

# A Contribution towards the Revision of the Passalidae of the World.

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(With Plate I.)

WHEN preparing my "Account of the Oriental Passalidae" (1914c) the lack of a representative collection of American and African forms prevented me from considering the relationship to other groups, borne by the Indo-Australian groups to which the Oriental forms belong. Shortly after the publication of that paper, however, the Passalidae collected by Mynheer J. R. H. N. Van de Poll were offered for sale. These were bought by the Trustees of the Indian Museum, who thereby added a particularly fine set of Indo-Australian species to their collection, together with much material for comparison from America and Africa. My thanks are due to them for the encouragement which they have thus given me to extend my investigations, so that they may include a study of the classification of the whole family.

I have further to thank Mr. G. J. Arrow for assistance in various forms, including the loan of specimens from the British Museum ; Mr. C. Holman-Hunt for material from the Malay Peninsula ; M. R. Vitalis de Salvaza for material from French Indo-China ; Mr. C. F. Baker for material from the Philippines ; and M. Guy Babault and Mr. G. E. Bryant for material from various localities.

## *Morphology of the Head.*

The study of a general collection of Passalidae, from parts of the world other than the Oriental Region, at once throws light on the question of the morphology of the anterior part of the head, a question which seemed most difficult before. It confirms as true for most species of Passalidae the suggestion, made on p. 337 of my "Account of the Oriental Passalidae," that "the whole of the upper surface of the anterior part of the head between the supra-orbital ridges and in front of the frontal ridges is frons, the whole of the clypeus being doubled beneath this out of sight ;" but it shows that this is not true of all species, and that the groove which I supposed to represent the suture between the clypeus and frons is probably situated beyond the lateral extremities of the former plate.

The most primitive surviving forms of Passalidae appear to be included in the genera *Oileoides* and *Popilius*, as these are defined below ; and *Oileoides subrecticornis* (see fig. i, 1 on next page) may conveniently be taken as an example of them.

In this species the clypeus is not hidden, but is exposed as an extensive transverse plate above the labrum. The labrum is attached by a well developed membrane, which extends beneath it to the lower posterior margin of the clypeus, and not to its anterior margin.

Thus two parts of the clypeus may be recognised, namely, a dorsal free part and a ventral part closely opposed to the membrane uniting it to the labrum. The posterior part of the free surface of the clypeus is sunk in the anterior margin of the frons, the two plates being, however, separated by a well marked suture; and the posterior angles are united with the adjoining portions of the frons to form a pair of small tubercles. These tubercles are those to which the name "outer tubercles" was given in my previous paper, a name which may conveniently be retained for them.

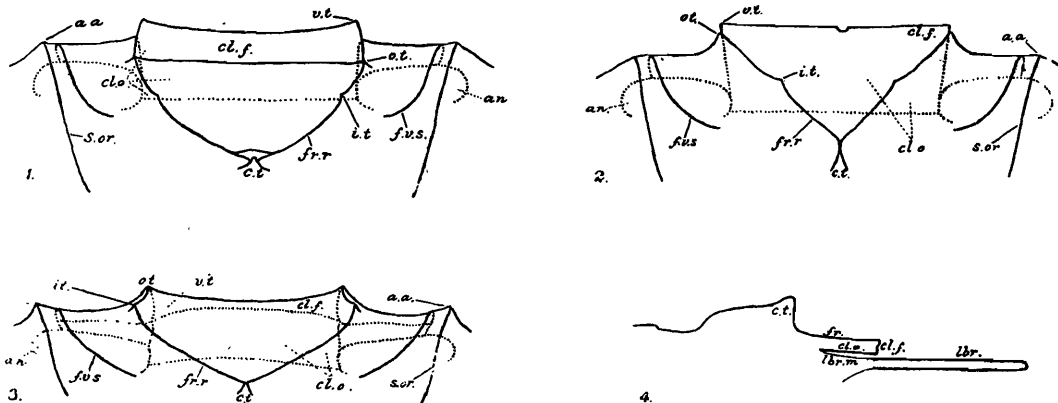


FIG. I.

1. *Oileoides subrecticornis* (Kuwert).  
 2. *Chondrocephalus granulifrons* (Bates).  
 3. *Passalus affinis*, Percheron.  
 4. *Passalus affinis*, Percheron. Median section of upper and anterior parts of head.
- } Anterior part of head. The outlines of the plates of the upper surface indicated by continuous, and those of the lower surface by dotted, lines.

a.a.—anterior angles of head.  
 an.—cavity for insertion of antenna.  
 cl.f.—free surface of clypeus.  
 cl.o.—opposed surface of clypeus.  
 c.t.—central tubercle.  
 fr.—frons.  
 fr. r.—frontal ridge.

f.v.s.—frontoververtical suture.  
 i.t.—inner tubercle.  
 lbr.—labrum.  
 lbr.m.—membrane between labrum and clypeus.  
 o.t.—outer tubercle.  
 s.or.—supraorbital ridge.  
 v.t.—ventral tubercle.

Having identified the clypeus in forms such as *Oileoides subrecticornis*, in which no doubt with regard to it can arise, the fate of the free surface of this plate in other forms can readily be followed.

In species belonging to the subfamily Pseudacanthinae (of this paper) the clypeus is always separated from the frons by a definite suture, though this varies greatly in shape and in some species the inner tubercles are situated so as to interfere somewhat with its continuity. In the Proculinae, in a few species of Passalinae, and perhaps also in the Aulacocyclinae, the clypeus has the same structure as in the Pseudacanthinae, but the suture is absent. In all other species the free surface of the clypeus is reduced to (at most) a narrow transverse band, situated below the anterior margin of the head, and terminated laterally by a pair of small downwardly directed tubercles, the "ventral tubercles" of my previous paper (1914c, text fig. i, p. 181). These "ventral tubercles"—really the anterior angles of the reduced free surface of the clypeus—are extremely persistent, and their presence or absence almost always enables one to determine whether the anterior margin of the head really conceals this surface of the clypeus or includes it. To see them clearly, however, it is often necessary to remove the labrum. The outer tubercles are normally situated immediately above or a little to the outer side of them; but in some forms these tubercles tend to come nearer together and may

be situated on the inner side of them. That they still mark the lateral extremities of the free surface of the clypeus in these cases is shown by the fact that they are joined by the sides of the opposed surface of the clypeus. The accompanying diagrams (fig. i) will help to illustrate the various stages in the suppression of the clypeus. With them may be compared figs. v, 11-15 and vi, 6-11 on pp. 34 and 45, illustrating in a less diagrammatic fashion its suppression in *Verres* and *Platyverres* and in *Paxillus* respectively.

The presence, in most American and African as well as Indo-Australian Passalidae, of definite frontal ridges and of central, inner and outer tubercles is sufficient indication of the morphological importance of these structures. The outer tubercles, as has just been shown, are formed in the more primitive species by a fusion of the frons and clypeus about the posterior angles of the latter. The central tubercle is normally situated at the angle formed by the union of the two frontal ridges which appear, from the evidence afforded by certain Indo-Australian species, to mark the position of part of the line separating the frons from the vertex. The inner tubercles appear to mark the point at which this line, usually quite imaginary for a short distance beyond this point, bends more or less backwards towards a suture a little to the inner side of the supraorbital ridges, in which it commonly ends (see Gravelly, 1914c, p. 184). This suture is easily seen in imperfectly hardened specimens of various groups, but is less distinct in those which have become thoroughly hard and black.

The homologies of the tubercles found in genera such as *Leptaulax* and *Tarquinius*, in which more than one pair of tubercles is situated on the anterior margin of the head, with those found in genera with only one pair so situated, are more difficult to determine than appeared to be the case when Indo-Australian forms only were under consideration.

A comparison of *Tarquinius* with *Pseudepisphenus* leaves little room for doubt that the more medially situated pair of tubercles in the former is homologous with the pair of inner tubercles of the latter (see Gravelly, 1914c, pp. 328-329), and in the absence of any evidence to the contrary it would be natural to assume the same homologies for the tubercles of *Leptaulax*, and of genera from the Ethiopian Region with similarly arranged tubercles.

But in the case of Ethiopian genera there is strong evidence in favour of different homologies. This is best illustrated by reference to the group characteristic of Madagascar, a group which is separated from the group found on the mainland of Africa by the possession of a pair of tubercles situated on the frons in the angle made by the fronto-vertical suture with the anterior margin of the head (see below pp. 68-69).

The most primitive of the Malagasy genera appears to be a new one described below (pp. 69-70, fig. viii, 1) under the name *Malagasalus*. In this genus the free surface of the clypeus, though almost vertical, is fully exposed. The outer tubercles, with a pair of well developed inner tubercles close behind them, project above it and are separated by a space equal to scarcely as much as two-thirds of its breadth. In *Solenocyclus*, the next genus of the series, the inner tubercles are also well developed and are situated further back from the outer tubercles; and an additional pair of marginal tubercles is present immediately above the ends of the clypeus. The outer tubercles, as pointed out above (p. 2), are formed in the first instance about the posterior angles of the clypeus; and their closer approximation one towards the other in forms such as *Malagasalus* leaves space in which the tendency towards tubercle-formation at this point can manifest itself over again. Presumably, therefore,

this additional pair of marginal tubercles is formed as a result of this tendency. *Solenocychus* is too closely allied to *Pentalobus* and *Erionomus* to admit of any doubt as to the identity of the homologies of their cephalic tubercles. The cephalic tubercles of certain species of these however, bear the closest possible resemblance to those of the Indo-Australian genus *Leptaulax*; and there does not appear to be any conclusive evidence to show whether the homologies of *Leptaulax* are the same as those of *Tarquinius*, as previously suggested, or may not really be the same as those of *Erionomus*. In the former case the inner and outer pairs of marginal tubercles will be the true inner and outer tubercles respectively, and the rudimentary tubercles sometimes formed on the frontal ridges at the point where these bend forwards will be secondary structures. In the latter case these rudimentary tubercles will represent the true inner tubercles, the inner pair of marginal tubercles will be the true outer tubercles, and the outer pair of marginal tubercles will be secondary structures.

It was suggested in my "Account of the Oriental Passalidae" (p. 330) that the Leptaulacinae were of comparatively recent origin, and were still spreading from some distributional centre towards the middle of the Indo-Australian area, into the outlying parts of this area, such as the Indian Peninsula and Ceylon. If this is so—as all available evidence regarding their distribution seems to indicate—it is most unlikely that they are at all closely related to any but Indo-Australian groups, a suggestion whose correctness is confirmed by the fact that the anterior lower tooth in the Leptaulacinae is of a form found only in Indo-Australian groups (see below, p. 9). Presumably, therefore, the origin of the Leptaulacinae is to be sought among Indo-Australian forms. But there is no definite evidence to show that they are in any way related to *Tarquinius*, the only known Indo-Australian Passalid to which they bear even a superficial resemblance. The fact, moreover, that in most Indo-Australian forms the outer tubercles tend to be separated by a distance which is less than the width of the clypeus, makes it easy to suppose that the evolution of the Leptaulacinae may have been on lines parallel to those of the evolution of Ethiopian forms.

In view of this uncertainty as to the homologies of the cephalic tubercles in the Leptaulacinae it seems best to continue to use the terms "inner" and "outer" tubercles in the connection in which they were used in my previous paper; but in addition to insert the word "marginal," when speaking of the Leptaulacinae, in order to show that in this case the terms are used in a descriptive sense which is not necessarily in accordance with morphology.

#### *Flightless Species.*

In several groups of American and Indo-Australian Passalidae there are species which have lost the habit of flight. This tends in all cases to produce certain modifications of structure:—

1. The union of the lateral and intermediate areas of the metasternum.
2. The union of the elytra in the middle line.
3. The shortening of the elytra and the rounding of all their contours.
4. The reduction of the wings, which appear to become thereby more efficient stridulating organs.

Flightless species consequently tend to bear a strong resemblance to one another, especially as regards the general shape of the body, and Bates (1886, pp. 2-3) divided the American Passalidae into two sections on this character alone (see below, p. 6).

The extent of the modifications differs greatly in different species, and the relation which they bear one to another is not always the same. Thus in American species the union of the elytra tends to precede the modification of the metasternum, while in Indo-Australian species the reverse is the case. Similarly, reduction of the dentition, which seems to be to some extent associated in American groups with loss of the habit of flight (see below, p. 9) is only found in Indo-Australian forms (where it reaches its maximum development) among species which show no indication of this.

In the Indian *Pleurarius brachyphyllus*, in which the wings are fully developed, the union of the elytra is not indicated in the pupa and is imperfect or absent in the newly hatched adult. This appears to be the case in some other species also, and it seems likely that the elytra may remain separate throughout life in certain individuals. I have not seen pupae of any of the more highly modified species.

#### *Genitalia and Sexual Distinctions.*

Very little appears to be known of the genitalia of the Passalidae. Sharp and Muir (1912, pp. 579-580, pl. xlv, figs. 11-13a) found two forms of male genitalia to exist, one in which "the basal piece and the lateral lobes form one piece, either by consolidation or the suppression of the basal piece" and one in which "the tegmen consists of two distinct pieces, the basal piece and the lateral lobes." The former they found in the genus *Aulacocyclus*, the latter in all the other genera they examined; but their observations were very restricted. I have been able to add to these observations to some extent; but the results were not such as to warrant any extensive investigation, since all the genitalia examined proved to be very much alike, except in the Aulacocyclinae. Here both the types described by Sharp and Muir occur, one in one group of the subfamily and the other in the other, showing that the difference they found in *Aulacocyclus* is not a distinctive character of the Aulacocyclinae as a whole, as suggested in my previous paper (p. 191). The only other positive result of my investigations was a curious fact which emerged in connection with species in which the central tubercle varies greatly in size. In these it was found that the specimens in which it was largest and best developed were females, and not males as would be expected by analogy with other groups.

#### *Classification, etc., including notes on the structure of the mandibles.*

Although the Van de Poll collection is a remarkably fine one, it is by no means complete. There can, I think, be little doubt that a considerable number of described genera and species have no separate existence; but the absence from the collection of such distinctive forms as *Platyverres intermedius*, and of other well-known species, affords sufficient proof that the names of the missing forms are not all to be lightly relegated to synonymy. The number of new species in so incomplete a collection, on the other hand, seems clearly to indicate that the Passalidae of the world as a whole are less fully known than are those of the Oriental Region dealt with in my previous paper.

In order to prevent subsequent confusion I have redescribed, or have at least directed attention to the distinctive characters of, every species that I have seen, excepting only the Oriental ones described in my previous paper; and I have figured a large proportion of them. This is made essential by the unsatisfactory condition of most of the existing descriptions, a condition which has united with the incompleteness of the collection before me to make the compilation of a satisfactory synonymy of the species very difficult, if not impossible. No attempt has been made to deal with the synonymy of species, the references given being in all cases to original descriptions or to others on which I may have relied in making my determinations.

The forms dealt with in my "Account of the Oriental Passalidae" naturally receive less detailed treatment than the others. The keys to the determination of genera published in that work are, however, repeated with such alterations as further study has shown to be desirable; and, except in some of the smaller genera, keys have been given to the identification of all species known to me, although in a few cases these are practically identical with those already published.

The first serious attempts made to divide the Passalidae up into genera were those of Kaup in 1868-9 and 1871, respectively. In his "Monographie der Passaliden," published in the latter year, he set forth a remarkable conception of the Animal Kingdom, which led him to postulate a series of subdivisions into co-ordinated series of fives. Believing, as he did, that none of his five sub-families of Passalidae could contain more than five groups, that no group could be composed of more than five genera, and no genus of more than five species, and believing that corresponding species, genera and groups were to be found respectively in all or almost all genera, groups and sub-families, his system of classification inevitably led to a considerable amount of wide separation of closely related genera and species.

In 1886 Bates introduced a number of changes into Kaup's classification of the American species. He brought together in one section all those in which the elytra are relatively short, and more or less protuberant in the middle of the base, and into another all the rest—*i.e.*, those in which the elytra are moderately long with broadly emarginate base—subdividing each of these sections primarily according to the lengths of the antennal lamellae. Unfortunately for this classification the shape of the elytra is correlated with the modification of the wings for stridulation and the loss of the power of flight, changes which not only appear to have taken place in some of the most highly specialized forms of several different American groups, but are also found among widely separated Indo-Australian genera (see below, p. 125); and the lengths of the antennal lamellae rarely seem to have much phylogenetic importance, being more or less variable in a number of genera, perhaps in all (see also Gravely, 1914c, pp. 180 and 182).

Kuwert's elaborate "Passaliden dichotomisch bearbeitet" is still more lacking in any sense of phylogenetic values, and disregards in addition the facts of geographical distribution.

Zang and Arrow have done much useful work in the direction of clearing up various items of the confusion thus produced, and my "Account of the Oriental Passalidae" has, I hope, helped to reduce the classification of the forms with which it deals to order; but Kuwert's remains the most recent monograph of the Passalidae of the world. In my "Account of the Oriental Passalidae" I have recorded all references known to me relating to Oriental genera.

and species. The following appear to be the only forms not referred to either in Kuwert's work or there :—

A.—AMERICAN FORMS.

- Coniger*, n. gen. with *Rimor ridiculus*, Kuwert, as type, Zang, 1905c, p. 232.  
*Epiphoroneus*, n. gen. with *Passalus occipitalis*, Eschscholtz, as type (Phoroneinae of Kuwert), Arrow, 1907, pp. 459–460.  
*Eumelus nasutus*, Arrow, 1907, p. 459.  
*Nasoproculus*, n. gen. with *Passalus heros*, Truqui, as type, Zang, 1905c, p. 226.  
 ,, *bifidus*, Zang, 1905c, p. 232, = *Oileus heros*, part, Kaup, nec *Passalus heros*, Truqui.  
*Neleides antillarum*, Arrow, 1907, p. 452.  
*Neleus camerani*, Pangella, 1905b, pp. 9–11.  
 ,, *cognettii*, Pangella, 1905b, pp. 13–15.  
 ,, *festae*, Rosmini, 1902, p. 8.  
*Ninus honduræ* var. *rosminiae*, Pangella, 1905a, pp. 11–12.  
 ,, *nobilii*, Pangella, 1905b, pp. 5–7.  
*Paxillosomus alfari*, Pangella, 1905a, pp. 9–11.  
 ,, *borellii*, Pangella, 1905b, pp. 3–4.  
 ,, *camerani*, Rosmini, 1902, pp. 4–5.  
*Paxillus parvus*, Casey, 1897, pp. 644–645.  
*Petrejus archidonæ*, Arrow, 1907, p. 456.  
 ,, *henrici*, Rosmini, 1902, pp. 6–7.  
 ,, *peruvianus*, Arrow, 1907, pp. 456–457.  
 ,, *spinus*, Arrow, 1907, p. 457.  
*Proculejoides crassulus*, Casey, 1897, pp. 642–643.  
 ,, *granulipennis*, Zang, 1905a, pp. 229–231.  
*Proculejus nudicostis*,<sup>1</sup> Bates, 1886–1890, p. 383.  
*Procululus*, n. gen. with *P. inca*, n. sp. as type (Petrejinæ of Kuwert), Zang, 1905a, pp. 225–227.  
*Proculus beckeri*, Zang, 1905a, p. 315.  
 ,, *densipennis*, Casey, 1914, p. 374  
 ,, *mandibularis*, Casey, 1914, p. 374.  
 ,, *magister*, Casey, 1897, pp. 641–642.  
*Ptichopus borellii*, Rosmini, 1902, p. 10.  
*Publius spinipes*, Zang, 1905a, pp. 231–232.  
*Rhodocanthopus biolleyi*, Pangella, 1905a, pp. 3–4.  
*Rimor munitus*, Casey, 1897, pp. 643–644.  
*Soranus depressifrons*, Bates, 1886–1890, pp. 384–385  
 ,, *imbellis*, Casey, 1897, pp. 645–646.  
*Spurius conradi*, Rosmini, 1902, p. 2.  
 ,, *dichotomus*, Zang, 1905a, pp. 227–229.  
*Tetraracus centralis*, Arrow, 1907, p. 458.  
 ,, *nobilii*, Rosmini, 1902, pp. 5–6.  
*Triaenurgus solidus*, Arrow, 1907, pp. 452–453.  
*Verres camerani*, Pangella, 1905a, pp. 7–9, text fig.

<sup>1</sup> Zang, who knew it from the description only, placed this species in the genus *Proculejoides* (1905a, p. 229). According to Arrow this is incorrect (1907, p. 450). I have not seen a specimen, but the description shows it to have the tridentate mandibles and hairless elytra of the genus *Pseudacanthus* as this is defined below.

- Verres cavilabris*, Casey, 1897, pp. 646-647.  
 „ *sternbergianus*, Zang, 1905a, p. 315.  
 „ *verniscatus*, Casey, pp. 647-648.  
*Veturius isthmicus*, Arrow, 1907, pp. 453-454.  
 „ *peruvianus*, Arrow, 1907, p. 455.  
 „ *punctatostriatus*, Arrow, 1907, pp. 454-455.

## B.—ETHIOPIAN FORMS.

- Didymus congoensis*, Arrow, 1907, p. 463.  
 „ *crassus*, Arrow, 1907, p. 465.  
 „ *curvilineatus*, Arrow, 1907, pp. 462-463.  
 „ *laevisternus*, Arrow, 1907, pp. 463-464.  
 „ *latipunctus*, Zang, 1905a, pp. 315-316.  
 „ *ruenzoricus*, Arrow, 1907, pp. 464-465.  
*Erionomus platypleura*, Arrow, 1907, p. 461.  
*Eumelosomus affinis*, Arrow, 1907, pp. 465-466.  
 „ *aloyisii sabaudiae*, Pangella, 1906, p. 1.

## C.—INDO-AUSTRALIAN FORMS.

- Analaches bicavis*, Zang, 1905a, pp. 241-242.  
 „ *brachymetopus*,<sup>1</sup> Zang, 1905a, pp. 30-31.  
 „ *dubius*, Heller, 1910, pp. 20-21.  
 „ *infestus*, Heller, 1910, p. 20.  
 „ *laevigatus*,<sup>2</sup> Zang, 1903a, p. 339 ; and 1905a, pp. 29-30.  
 „ *laticauda*, Zang, 1905a, pp. 240-241.  
 „ *paraplesius*, Zang, 1905a, pp. 238-240.  
 „ *punctithorax*,<sup>2</sup> Zang, 1903a, p. 339 ; and 1905a, pp. 28-29.  
*Aulacocyclus rouxi*, Heller, 1916, pp. 352-35.  
*Cetejus acutangulus*, Heller, 1910, pp. 18-19.  
 „ *infans*, Heller, 1910, p. 18.  
 „ *schenklingi*, Heller, 1910, pp. 19-20, text-fig. B.  
 „ *sodalicus*, Zang, 1906b, p. 25.  
*Episphenoides pectiniger*, Heller, 1910, pp. 17-18, text-fig. A.  
*Gonatas cetioides*, Zang, 1905a, p. 316.  
*Hyperplesthenus glaber*, Gravely, 1913, pp. 106-107, text-fig. 2A.  
*Kaupioloides*, n. gen. with *Kaupiolus trigonophorus*, Zang as type, Gravely, 1913, pp. 103-105, text-fig. 1.  
*Kaupiolus trigonophorus*, Zang, 1905a, p. 316.  
*Labiennus* (?) *gracilis*, Heller, 1910, pp. 16-17.

<sup>1</sup> Subsequently transferred to the genus *Cetejus* (Zang, 1905a, p. 238, footnote).

<sup>2</sup> Originally named *Epilaches* owing to Kuwert's confusion of the two generic names (Zang, 1905a, p. 24) ; subsequently transferred to the genus *Cetejus* (Zang, 1905a, p. 238, footnote).



*Mastochilus capitalis*,<sup>1</sup> Blackburn, 1900, pp. 209-210.

„ *subobliquus*, Tryon, 1892.

*Pelops triumphator*, Zang, 1904b, pp. 182-184.

*Plesthenus mandibularis*, Heller, 1900, p. 11, pl. fig. 5.

„ *scutellopunctatus*, Zang, 1903a, p. 339.

*Protomocoelus sternbergi*, Zang, 1905a, pp. 236-238.

*Tristorthus papuanus*, Heller, 1910, p. 15, pl. figs. 15-15a.

*Tristorthus puncticollis*, Heller, 1916, p. 353.

In view of the striking correlation which has been shown to exist, in certain Indo-Australian Passalidae, between classification and distribution (Gravely, 1914b), it is natural, when seeking for sound principles on which to base the classification of the family as a whole, to consider first whether it may not be possible on purely morphological grounds to regard the American and Ethiopian Passalidae respectively as series independent both of one another and of Indo-Australian forms.

It will be remembered that among the Indo-Australian Passalidae the Aulacocyclinae stand by themselves, widely separated from all other forms (Gravely, 1914c, pp. 191-192). They are also widely separated from American and Ethiopian forms and need not be further considered in this connection. In all other Indo-Australian Passalidae, except certain highly asymmetrical ones with reduced dentition, the lowest terminal tooth is directed inwards and is situated beside the anterior lower tooth, which is broadly triangular as seen from above and tends to be flattened above and below. In American and Ethiopian forms, on the other hand, none of which are asymmetrical, either the terminal teeth are situated in a line one above another; or the anterior lower tooth (on the right side at least) is more columnar and tends to be flattened in front and behind, or may be concave behind much as in the Aulacocyclinae, or both characters may be present. These characters are more marked in some species than in others, but in greater or less degree they are of universal application; and they are associated with various other, often more striking, differences of more limited application.

The reduction of the dentition takes place mainly in highly specialized genera of the Indo-Australian and American series, genera whose relationships are, as a rule, clearly indicated by other characters. Among the former it is confined to the more highly asymmetrical genera, and among the latter it is found chiefly in genera composed wholly or in part of flightless species. It is easy to follow the manner in which the reduction is carried out in the former; but in the latter it is often more difficult, the reduction being more abrupt. In the Indo-Australian series it is always due to the fusion of the anterior lower tooth with the lowest terminal tooth (see Gravely, 1914c, text-fig. 7, p. 314). In the American and Ethiopian series, with the possible exception of the genus *Proculus*, it seems always to be due to the fusion of the two lowest terminal teeth, though this is apt to be accompanied by a dorsoventral flattening of the anterior lower tooth, which thus loses its distinctive shape.

The reduction of the dentition in the American and Ethiopian series may most conveniently be illustrated by reference to the genera of the *Proculejoides* group of Passalinae

<sup>1</sup> *Mastochilus capitalis*, Blackburn = *Episphenoides quaestioni*s, Kuwert. See Zang, 1905c, p. 223.

(fig. ii, 1-3). In *Chondrocephalus* the dentition is normal, though the right anterior lower tooth is less distinctly columnar than usual. In *Vindex* the dentition is reduced, but the double origin of the lower of the two remaining terminal teeth may often be seen, especially in the right mandible of unworn specimens of *V. agnoscendus*. The anterior lower tooth of the left side is more conical in this genus, with dorso-ventral rather than antero-lateral compression, though that of the left side is still much broader than that of the right; and there is a more or less indistinct tubercle at the base of this tooth on both mandibles. In *Proculejoides* all trace of the double nature of the two remaining terminal teeth is lost, the anterior lower teeth of the two sides become still more alike, and the tubercles at their base become more conspicuous.

Of the genera with modified dentition in other families, *Proculejus* has teeth exactly like those of *Proculejoides*, and the only species of *Publius* known to me has teeth not unlike

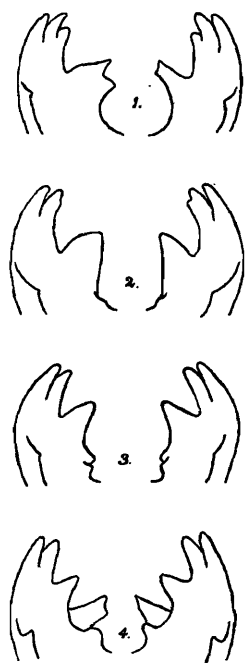


FIG. II.

1. *Chondrocephalus granulifrons* (Bates).
2. *Vindex agnoscendus* (Percheron).
3. *Proculejoides championi* (Bates).
4. *Proculus mnischechi*, Kaup.

The parts of the mandibles in front of and excluding the movable tooth, illustrating modifications in the dentition of American Passalidae.

those of *Vindex*, but has no trace on either side of the third terminal tooth and has more markedly asymmetrical anterior lower teeth. The teeth of *Proculus*, the most striking of all these genera, are, however, more puzzling. Superficially they usually resemble those of *Proculejoides*; but between what would be the anterior lower tooth in that genus and the large tubercle at its base there is ordinarily a scar, left by the breaking away of a columnar tooth which seems only to persist in imperfectly hardened specimens. This columnar tooth (see fig. ii, 4) has the form of the type of anterior lower tooth characteristic of the American series; and it is impossible to be sure whether the tooth in front of it forms the most anterior part of a single but highly complex anterior lower tooth, or is a lowest terminal tooth, reduced in size and situated behind and on the inner side of the middle and upper terminal teeth as in the Indo-Australian series.

The more typical American and Ethiopian forms can be distinguished from each other by the presence of one or more pairs, respectively, of marginal tubercles between the anterior angles of the head; but this distinction does not at first sight appear to be of universal application, since at least two genera, *Mitrorhinus* and *Stephanocephalus*, which have been accepted as American, have the additional tubercles characteristic of African genera. Zang, moreover, notes records of the American genus "*Passalus*" (= *Popilius* of the present paper) from the Congo, Senegal and Madagascar; and in the Van de Poll collection several specimens of *Pentalobus sansibaricus* bear the record "Bolivia"; while of two specimens of a new species of *Erionomus*, described below under the name *E. trichostigmoides*, one bears

the record "Dar-es-Salaam" and the other "S. Catherina, S. O. Brazil (Staudinger)." If these records are correct, and the species to which they refer really do occur both in America and in Africa or Madagascar, the occurrence in America of genera belonging to the group typical of Africa would be very natural. But in the absence of direct personal evidence by a collector I find it easier to believe them to be due to mistakes in labelling, numerous though they are. The position of *Mitorhinus* and *Stephanocephalus* therefore requires special consideration.

Judging from Kaup's figure (1871, pl. vi, fig. 3) *Passalus punctifrons*, Dejean, the type of the genus *Mitorhinus*, would seem to be from America and to belong in all probability, to the genus *Passalus* as this is defined below; but Kaup identifies the species with Percheron's *Passalus cayor*, a species the type of which is recorded as coming either from Senegal or from Brazil. As Percheron's figure (1835, pl. v, fig. 2) shows this to be an insect of the African type, the former is doubtless the correct locality. There can, I think, be little doubt that *cayor* belongs in reality to the African genus *Pentalobus*; and I suspect that both Kaup and Kuwert have confused prolongations of the anterior angles of the head with the tubercles on the inner side of these angles characteristic of African forms. Probably this has also been the case with the genus *Stephanocephalus*, the only species figured, Percheron's *Passalus hostilis* (1841, pl. lxxvii, fig. 4), whose locality was not known to its author, being in all probability African, although Kaup and Kuwert have applied the name to an American species, and have placed other American species in the same genus with it. For the present, then, the form of the anterior margin of the head may be regarded as separating American from Ethiopian groups; but further evidence on the point is much to be desired, especially as the aberrant genus *Ptichopus* is to some extent transitional between the two.<sup>1</sup>

Another character by which the American and Ethiopian groups may be separated is afforded by the posterior plate of the prosternum. In the former this is usually more or less narrowed behind, and is often pointed; whereas in the latter it is always more or less parallel sided and broadly truncate. This plate has the African character in most species of the American genus *Paxillus*, but I know of no other exceptions to the rule, although the distinction is not equally well marked in all species.

The Ethiopian genera fall conveniently into a single subfamily Solenocyclinae. The American genera, on the other hand, fall into three groups, each in my opinion of sufficient size and distinctness for recognition as a separate sub-family.

The first of these, to which the name Pseudacanthinae may be given, is distinguished chiefly by the presence of a well marked clypeo-frontal suture. Traces of this suture are found also in the species described below under the name *Chondrocephalus quinquecornutus*, and it is more or less complete in *Vindex agnosendus*. The former of these species may be regarded as in this character transitional between the two most primitive genera of the Pseudacanthinae and Passalinae respectively; and the latter agrees in every other character with the Passaline genus *Vindex* and not with any Pseudacanthine genus. In spite of these exceptions the presence of the suture in question remains the most distinctive single

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<sup>1</sup> See also below, p. 13, footnote <sup>1</sup>.

character running through the Pseudacanthinae. The second American sub-family may be called the Proculinae. It includes forms in which the outer tubercles are rudimentary or absent; the clypeus is almost always exposed, though never separated from the frons by a distinct suture. The third and last American sub-family, the Passalinae, includes forms in which the outer tubercles are well developed and usually very widely separated, the clypeus being hidden in almost all species.

The classification of the Indo-Australian Passalidae was recently revised (Gravely, 1914c, pp. 191-204, 316-318 and 328-330). They fall into two distinct sections, of which one forms the sub-family Aulacocyclusinae. The results of my previous work on the classification of the other section have been summarized as follows (1914c, pp. 336-337):—  
 “The second section has been sub-divided into the *Pleurarius*, *Aceraius*, *Macrolinus*, *Kaupioloides*, *Protomocoelus*, *Hyperplesthenus*, *Gnaphalocnemis*, *Plesthenus*, *Gonatas*, *Tarquinius* and *Leptaulax* groups. Of these groups the first three and the last two appear to be of most importance, and have been provisionally ranked as subfamilies, the remainder being put together into a single subfamily which takes its name from the genus *Gnaphalocnemis*. Their rank cannot be finally settled without reference to American and African species.”

The number of subfamilies thus recognized is undoubtedly too great in comparison with the classification of American and African forms outlined above, and may advantageously be reduced to two. One of these, the Leptaulacinae, remains as defined in my previous paper. The second, which may be called the Macrolininae, includes all the rest.

The above enumerated subfamilies of Passalidae may now be defined thus:—

- |   |  |         |                                  |
|---|--|---------|----------------------------------|
| 1 | The distal ends of the anterior coxae projecting beyond the surface of the intercoxal portion of the prosternum, which is entirely hidden except in aberrant Chinese and Japanese forms, where it is exceptionally strongly keeled; the usual paired cephalic tubercles absent, the middle lower tooth almost always fixed | .. .. . | <i>Aulacocyclusinae</i> , p. 13. |
|   | The distal ends of the anterior coxae about on a level with the general surface of the intercoxal portion of the prosternum, which is visible between them; at least one pair of the usual paired cephalic tubercles present in most species; the middle lower tooth always jointed on to the mandible                     | .. .. . | 2.                               |
| 2 | The anterior lower tooth more or less columnar, at least on the right side, being compressed before and behind or even concave behind; or all three terminal teeth directed forwards, and arranged in a line one above another; or the dentition incomplete; the head always symmetrical (American and African forms)      | .. .. . | 3.                               |
|   | The anterior lower tooth conical, compressed above and below; the lowest terminal tooth directed inwards and set a little behind the other two; the head often asymmetrical—always so in forms with reduced dentition (Indo-Australian forms)  | .. .. . | 6.                               |

- |                |   |   |                                |
|----------------|---|---|--------------------------------|
| 3 <sup>1</sup> | { | No secondary tubercles or angular processes present on the anterior margin of the head (or behind the clypeus when this is exposed) between the outer tubercles and anterior angles; the posterior plate of the prosternum almost always much narrowed, often pointed, behind (American forms) .. | 4.                             |
|                |   | At least one pair of secondary tubercles or angular processes present on the anterior margin of the head between the outer tubercles and the anterior angles; the posterior plate of the prosternum more or less parallel sided, broadly truncate behind (African forms) ..                       | <i>Solenocyclinae</i> , p. 68. |
| 4              | { | The clypeus exposed and separated from the frons by a distinct suture ..  | <i>Pseudacathinae</i> , p. 22. |
|                |   | The clypeus fused with the frons <sup>2</sup> and usually hidden ..   | 5.                             |
| 5              | { | The outer tubercles obsolete or absent, the clypeus almost always exposed <sup>3</sup> ..   | <i>Proculinae</i> , p. 32.     |
|                |   | The outer tubercles distinct, the clypeus rarely exposed ..   | <i>Passalinae</i> , p. 43.     |
| 6              | { | The anterior margin of the head rarely with more than one pair of tubercles, <sup>4</sup> though these may be compound in structure; the antennae rarely with less than four well developed lamellae; never with both these characters ..   | <i>Macrolininae</i> , p. 76.   |
|                |   | The anterior margin of the head always with two pairs of simple tubercles; the antennae always with three well developed lamellae only ..   | <i>Leptaulacinae</i> , p. 111. |

#### Subfamily *AULACOCYCLINAE*.

Three of the genera defined in my previous account of this subfamily (1914c, pp. 192-3) appear, in the light of further material, to be unnecessary. Two of these—*Caulifer* and *Auritululus*—are monospecific, and may advantageously be merged in *Aulacocyclus* and *Cylindrocaryulus*, respectively. The third, *Tristorthus*, may also be merged in *Aulacocyclus*. The best known species of *Tristorthus* is *T. tricuspis*, Kaup, from New Caledonia, a species shown by its short antennal lamellae to be most nearly allied to the Australian species of *Aulacocyclus*. With this are associated firstly, two other New Caledonian species, apparently distinguished largely by differences in size, and in my opinion doubtfully

<sup>1</sup> The processes especially characteristic of the *Solenocyclinae* are situated immediately above the ventral tubercles. Others may also, however, be present, and in all Malagasy forms a pair is more or less distinctly developed immediately on the inner side of the fronto-vertical suture. The most primitive Malagasy genus, *Malagasalus*, lacks the former pair of processes, and the above definition is applicable only by reason of its possession of the latter. The African and Malagasy groups are composed, broadly speaking, of parallel series of genera separated largely by the presence or absence of the latter pair of processes. I do not know of any African genus paralleling *Malagasalus*; but if one exists the above definition can hardly be expected to apply to it. See also above, pp. 10-11.

<sup>2</sup> Except in one species of *Vindex* (below, pp. 43 & 47); imperfectly fused in one species of *Chondrocephalus* (below pp. 43-45, fig. vi, 1). See also above p. 11.

<sup>3</sup> The clypeus is completely hidden only in the genus *Platyverres*, though in the transitional species *Verres corticola* it is hardly apparent. In both these species the inner tubercles are situated on the anterior margin of the head and may readily be mistaken for outer tubercles, though a comparison with other species of *Verres*, and especially with *V. cavicollis*, at once settles their true homology. The heads of the species in question are shown in fig. v, p. 34.

<sup>4</sup> Only in the genus *Tarquinius*, which has six well developed antennal lamellae.

distinct; secondly, a species which Zang (1905c, p. 226) has shown not to be the Malaysian species for which Kuwert took it, but probably also a form of *tricuspis*; and thirdly, a species *felderi*, Stoliczka, from Amboina and Ceram, with a simply pointed central tubercle and long antennal leaflets like those of the Moluccan species of *Aulacocyclus*. The genus *Tristorthus* is thus seen to consist only of a New Caledonian species (or group of species) and a Moluccan species, allied respectively to different groups of the genus *Aulacocyclus*, in which I therefore propose to place them.

The genera of Aulacocyclinae may now be redefined thus:—

1	{	The middle lower tooth fixed; the aedagus composed of two consecutive pieces, the tegmen and median lobe; <sup>1</sup> the central tubercle always present near the middle of the upper surface of the head .. .. .	2.
		The middle lower tooth moveable; the aedagus composed of three consecutive pieces, the tegmen being composed of a basal piece and lateral lobes; the central tubercle absent or occupying the whole of the antero-median part of the upper surface of the head .. .. .	4.
2	{	The mentum with a strong median keel .. .. .	<i>Comacupes</i> , p. 14.
		The mentum not keeled .. .. .	3.
3	{	The scars on the pronotum large, more or less ramified or S-shaped; the central tubercle broad and low, never pedunculate (Oriental forms only) .. .. .	<i>Taeniocerus</i> , p. 16.
		The scars on the pronotum not very large, crescentic or circular; the central tubercle taller, usually pedunculate (mostly not Oriental) .. .. .	<i>Aulacocyclus</i> , p. 17.
4	{	The central tubercle present, often very strongly elevated, its apex fused with the anterior margin of the head; the elytra separate .. .. .	<i>Ceracupes</i> , p. 21.
		The central tubercle absent; the elytra united .. .. .	<i>Cylindrocaryus</i> , p. 21.

Genus **COMACUPES**, Kaup, 1871, p. 17.

Type, *Passalus cylindraceus*, Perty, 1831, p. 36, fig. 3.

### **Comacupes cylindraceus** (Perty).

*Passalus cylindraceus*, Perty, 1831, p. 36, fig. 3.

*Comacupes cylindraceus*, Gravely, 1914c, p. 207, text-fig. 2, pl. xi, figs. 5-6a.

Specimens from the Malay Peninsula (Pahang), Singapore, North Nias (many from Hili Madjedja and one from G. Madjeja), Middle Nias (Dyma and Kalim Bungo), Sumatra (Bedagei interior, ca. 600 ft.), Java and Borneo (Mt. Marapok). Mr. C. Holman-Hunt has sent me for examination a specimen from Rawang in the Malay Peninsula. Length 24.5–27.5 mm.

<sup>1</sup> These names for parts of the male genital tube are those adopted by Sharp and Muir (1912, pp. 481–483 and 484–485).

**Comacupes masoni**, Stoliczka.

*Comacupes masoni*, Stoliczka, 1873, pp. 151-2.

*Comacupes masoni*, Gravelly, 1914c, p. 207, pl. xi, figs. 4-4a.

One specimen from an altitude of about 600 ft. in the interior of Bedagei, Sumatra, and three without locality label. They all resemble the Sumatran specimen referred to in footnote 2 of p. 269 of my "Account of the Oriental Passalidae." Without further specimens from the Malay Peninsula, however, it is impossible to say whether the Malay and Sumatran races of the species are distinct. Length 29-30 mm.

**Comacupes stoliczkae**, Gravelly.

*Comacupes stoliczkae*, Gravelly, 1914c, p. 206, pl. xi, figs. 3-3a.

Two specimens from Djember, Besoek, Java; two from Mt. Marapol<sup>t</sup> Borneo; and two without locality label. M. Babault has sent a specimen 24.5 mm. long from Medan, Sumatra, for identification. Length 23.7-25.0 mm.

**Comacupes basalis** (Smith).

*Passalus basalis*, Smith, 1852, p. 18, pl. i, fig. 5.

Five specimens from Mindoro and other parts of the Philippine Islands. Length 33.7-36.3 mm.

**Comacupes cavicornis**, Kaup.

*Aulacocyclus cavicornis* + *laevicornis*, Kaup, 1868a, p. 6.

*Comacupes cavicornis*, Kaup, 1871, p. 19.

*Comacupes cavicornis*, Gravelly, 1914c, pp. 204-205, pl. xi, figs. 1-2b.

Several specimens from Singapore, Java (Tjibodas, Telaga Bodas in Garoet, Preanger) and Borneo (Pontianak). Length 24.5-26.0 mm.

These additional specimens show that the local races described in my "Account of the Oriental Passalidae" (pp. 204-206) are not constant, and must be treated as one.

The species of *Comacupes* may be identified thus:—

- |   |   |  |                                 |
|---|---|--|---------------------------------|
| 1 | { The mesosternum strongly punctured all over; the abdominal sterna with at least a few hair-bearing punctures in fresh specimens .. .. .   | .. .. .  | 2.                              |
|   |   | { The mesosternum unpunctured except at the sides, the abdomen unpunctured and hairless .. .. .  | <i>C. foveicollis</i> , Kuwert. |
| 2 | { The lower margin of the overhanging portion of the central tubercle short, or ascending obliquely to meet the upper margin, which is always horizontal; the tubercle usually truncate or concave anteriorly, not sharply pointed, narrower, keeled or rounded above .. .. . | .. .. .  | 3.                              |
|   |   | { The lower margin of the overhanging portion of the central tubercle usually rather long, always horizontal, the anterior part of the upper margin descending obliquely to meet it in a more or less acute angle; the upper surface usually more or less distinctly grooved longitudinally, or excavate .. .. . | 4.                              |

- |   |   |   |                                 |
|---|---|---|---------------------------------|
| 3 | } | The central tubercle not strongly elevated, truncate or concave in front, very variable .. .. .                               | <i>C. cylindraceus</i> , p. 14. |
|   |   | The whole anterior end of the central tubercle raised well above the supraorbital ridges, not truncate or concave in front .. | <i>C. masoni</i> , p. 15.       |
| 4 | } | The central tubercle marked above with, at most, a more or less distinct longitudinal groove .. .. .                          | 5.                              |
|   |   | The central tubercle strongly excavate above ..   | <i>C. cavicornis</i> , p. 15.   |
| 5 | } | The central tubercle broad above, pedunculate ..  | <i>C. basalis</i> , p. 15.      |
|   |   | The central tubercle narrow, not pedunculate ..   | <i>C. stoliczkae</i> , p. 15.   |

Genus **TAENIOCERUS**, Kaup, 1871, p. 20.

Type, *Passalus bicanthatus*, Percheron, 1841, pp. 41-2, pl. lxxix, fig. 5.

### **Taeniocerus bicanthatus** (Percheron).

*Passalus bicanthatus*, Percheron, 1841, pp. 41-42, pl. lxxix, fig. 5.

*Taeniocerus bicanthatus*, Gravely, 1914c, pp. 208-209, pl. xi, figs. 7-7b.

One specimen said, probably erroneously, to come from Ceylon; others from Penang, Singapore, Bintam Island, and Borneo (a number of specimens from Mt. Marapok in Dent Province, northern spurs of Mt. Kina-Balu, Labuan and Pontianak). Mr. C. Holman-Hunt has sent a specimen from Rawang, Malay Peninsula, for examination. Length 26.0-29.5 mm.

### **Taeniocerus platypus**, Kaup.

*Aulacocyclus platypus*, Kaup, 1868a, p. 5.

*Taeniocerus platypus*, Kaup, 1871, p. 21.

Numerous specimens from Sumatra (Bedagei Interior, ca. 600 ft.), Java (Boeloe Lawang in Pasoeroean) and Borneo (Mt. Kina-Balu). M. Babault has presented us with specimens from Medan, Sumatra. Length 16.3-19.5 mm.

### **Taeniocerus pygmaeus**, Kaup.

*Aulacocyclus pygmaeus*, Kaup, 1868a, p. 5.

*Taeniocerus pygmaeus*, Kaup, 1871, p. 20.

*Taeniocerus pygmaeus*, Gravely, 1914c, pp. 209-210, pl. xi, figs. 8-8a.

One specimen each from the Malay Peninsula and Sumatra (Bedagei Interior, ca. 600 ft.) and several from Borneo (two from Mt. Marapok, Dent Province). Mr. C. Holman-Hunt has sent specimens from Kuala Kansar, Malay Peninsula, for examination. Length 14.2-15.9 mm.

### **Taeniocerus bicuspis**, Kaup.

*Aulacocyclus bicuspis*, Kaup, 1838a, p. 5.

*Taeniocerus bicuspis*, Kaup, 1871, pp. 21-22.

*Taeniocerus bicuspis*, Gravely, 1914c, pp. 210-211, pl. xi, figs. 9-9a.

Four specimens from Tukvar, Darjiling District, and one from "India." Length 18.5-21.1 mm.



The species of *Taeniocerus* may be identified thus:—

1	{	The upper surface of the central tubercle about twice as long as broad, flat, punctured, bordered by a very distinct horse-shoe-shaped ridge which is open in front	<i>T. bicanthatus</i> , p. 16.	
		The upper surface of the central tubercle relatively broader as a rule, less flattened, unpunctured, the marginal ridge often indistinct or absent across the middle-line behind as well as in front	.. .. .	2.
2	{	The anterior tibiae very broad	.. .. .	<i>T. platypus</i> , p. 16.
		The anterior tibiae slenderer	.. .. .	3.
3	{	The anterior margin of the canthus meeting the side of the head at a considerable distance behind the anterior angle; the external angle of the canthus obtuse	.. .. .	<i>T. pygmaeus</i> , p. 16.
		The anterior margin of the canthus meeting the side of the head at a very short distance behind the anterior angle; the external angle of the canthus sharper	.. .. .	<i>T. bicuspis</i> , p. 16.

Genus **AULACOCYCLUS**, Kaup, 1868a, p. 4.

Incl. *Taeniocerus* [part] + *Caulifer*, Kaup, 1871 + *Tristorthus*, Kuwert, 1896, p. 220.

Type, *Passalus edentulus*, MacLeay, 1826, p. 439.

**Aulacocyclus glabriusculus**, Kuwert.

*Aulacocyclus glabriusculus*; Kuwert, 1897, pp. 280 and 282.

A number of specimens from Aru Island. Length 25.4–27.3 mm.

The antennal lamellae are long and slender; the central tubercle, which closely resembles that of *A. edentulus* (fig. iii, 7), is erect at base, oblique or almost horizontal above, where it is medially grooved, the apex scarcely or not at all bent downwards. The elytral grooves are shallow, and are scarcely punctured either above or below.

**Aulacocyclus perlatus**, Kaup.

Fig. III, 1, p. 18.

*Aulacocyclus perlatus*, Kaup, 1868a, p. 7.

Four specimens from New Guinea, three of them being from Stephansort, Astrolabe Bay. Length 19.5–21.6 mm.

The antennal lamellae are long and slender, as in the preceding species. The central tubercle is decumbent, and more or less distinctly bent downwards at the apex. All the grooves of the elytra are strongly punctured.

**Aulacocyclus parryi**, Kaup.

*Aulacocyclus parryi*, Kaup, 1868a, p. 8.

Represented by specimens from Ceram, Halmaheira (Dodinga), Ternate and Singapore. Length 23.2–25.3 mm.

The antennae and elytra resemble those of the preceding species. The central tubercle resembles that of *A. glabriusculus* and *A. edentulus*, but is inclined to be slightly thickened on the under side just at the apex, giving it a somewhat more hooked appearance.

**Aulacocyclus aruensis**, Kuwert.

Fig. III, 2.

*Aulacocyclus aruensis*, Kuwert, 1897, p. 282.

Two specimens from each of the following localities :—New Guinea, Jobi, Aru, Ceram. Length 21–25 mm.

The antennae and elytra resemble those of the two preceding species. The central tubercle somewhat resembles that of *A. deyrollei*, but is stouter and less elevated in front, and has the apex perhaps a little more distinctly overhanging than is usual in that species.

**Aulacocyclus felderi** (Stoliczka).

Fig. III, 3.

*Comacupes felderi*, Stoliczka, 1873, p. 152, footnote.*Comacupes felderi*, Arrow, 1907, p. 447.

One specimen from Amboina, and one from Honitetoe, West Seran<sup>1</sup> (? Ceram). Length 21 mm.

This species differs from all others that are known in having the central tubercle ungrooved, erect, laterally compressed and simply pointed. The antennal lamellae are long

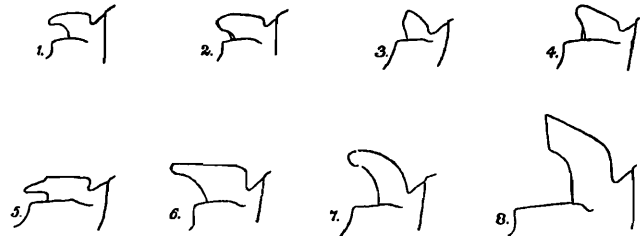


FIG. III.

The central tubercle and supraorbital ridge of species of *Aulacocyclus*, from the left side  $\times 4$ .

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| 1. <i>A. perlatus</i> , Kaup.     | 5. <i>A. tricuspis</i> , Kaup.    |
| 2. <i>A. aruensis</i> , Kuwert.   | 6. <i>A. errans</i> , Blackburn.  |
| 3. <i>A. felderi</i> (Stoliczka). | 7. <i>A. edentulus</i> (MacLeay). |
| 4. <i>A. mastersi</i> , MacLeay.  | 8. <i>A. teres</i> (Percheron).   |

and slender. The elytral grooves are scarcely punctured either above or at the sides, but are decidedly stronger than in *A. glabriusculus*.

**Aulacocyclus mastersi**, MacLeay.

Fig. III, 4.

*Aulacocyclus mastersi*, MacLeay, 1871, p. 174.*Taeniocerus mastersi*, Kuwert, 1897, p. 275.

Several specimens from Queensland (Port Denison and Clarence River), N. S. Wales (Richmond River) and Victoria. Length 21.7–27.5 mm.

The antennal lamellae are somewhat stout but moderately long. The central tubercle is laterally compressed and comparatively low. It is somewhat variable, and may be scarcely more elevated than in *Taeniocerus bicuspis*; usually, however, it is somewhat higher and the apex may even be faintly overhanging. The fine puncturing on the head is usually inconspicuous or absent. All the elytral grooves, except perhaps the first pair, are very finely punctured; none of them are very deep.

<sup>1</sup> "Exp. Martin III 92." Concerning the distribution of this species see Arrow, 1907, p. 447.

**Aulacocyclus deyrollei**, Kaup.*Aulacocyclus deyrollei*, Kaup, 1868a, pp. 7-8.*Taeniocerus deyrollei*, Kuwert, 1897, p. 275.

One specimen 25.5 mm. long, in the Indian Museum collection. I have also examined specimens in the British Museum.

*A. deyrollei* differs from *A. mastersi* only in the much greater breadth of the central tubercle and in the more conspicuous puncturing of the anterior part of the head.

**Aulacocyclus tricuspis**, Kaup.

Fig. III, 5.

*Aulacocyclus tricuspis*, Kaup, 1868a, p. 7.

Several specimens from New Caledonia and one from Woodlark Island. Length 22-25 mm.

This species is easily recognised by the tridentate form of the central tubercle, which resembles that of *Comapcupes cavicornis*, except that it is always broadest between the paired dorsal denticles. The antennal lamellae are much shorter than in *A. deyrollei*. The punctures in the grooves of the elytra are almost uniformly coarse.

**Aulacocyclus errans**, Blackburn.

Fig. III, 6.

*Aulacocyclus collaris*, Blackburn, 1896, p. 233.

Both sexes of this species appear to occur in two forms distinguishable from each other only by their size.

Large form.—Several specimens from Queensland. Mr. H. Schroder has presented us with specimens from the New England District of New South Wales. Length 27-30 mm.

Small form.—Numerous specimens from Queensland, including four from Cooktown, three from the McIvor River and one from Cardwell. Length 19.6-23.0 mm.

The antennal lamellae are somewhat shorter than in *A. deyrollei*. The central tubercle rises almost vertically and is then bent over forwards, the antero-ventral surface gradually and the postero-dorsal abruptly, the dorsal surface being straight and more or less horizontal. The anterior enlargements of the pronotal marginal grooves are somewhat more pronounced than in other species of the genus. The grooves of the elytra are even more coarsely punctured than in *A. tricuspis*.

**Aulacocyclus edentulus** (MacLeay).

Fig. III, 7.

*Passalus edentulus*, MacLeay, 1826, p. 439.

A number of specimens from Queensland (Brisbane), New South Wales (Sidney) and Victoria. Length 23-30 mm.

The central tubercle is more strongly elevated than in *A. errans* and less abruptly bent forwards. The anterior enlargements of the pronotal marginal groove are not very pronounced. The elytral grooves are less strongly punctured, especially dorsally.

**Aulacocyclus teres** (Percheron).

Fig. III, 8.

*Passalus teres*, Percheron, 1841, pp. 39-40.

A number of specimens from Queensland, New South Wales and Victoria (Melbourne). Length 30.8-40.0 mm.

*A. teres* is much larger than *A. edentulus*; its central tubercle is even more elevated, and is somewhat more abruptly bent forwards—scarcely as abruptly, however, as in *A. collaris*. The elytral grooves are very shallow and are obscurely punctured at the sides only.

The above-mentioned species of *Aulacocyclus* may be separated thus:—

1	{	The antennal lamellae long and slender; Papuan and Moluccan species .. .. . 2.
		The antennal lamellae shorter, at most moderately long and slender; Australian and New Caledonian species (? also from Woodlark island) .. .. . 6.
2	{	The central tubercle grooved above, its apex more or less overhanging .. .. . 3.
		The central tubercle not grooved above, its apex erect, laterally compressed and simply pointed .. .. . <i>A. felderi</i> , p. 18.
3	{	The grooves of the elytra shallow and scarcely punctured .. .. . <i>A. glabriusculus</i> , p. 17.
		The grooves of the elytra deeper and more or less strongly punctured .. .. . 4.
4	{	The central tubercle depressed, with slender overhanging apex .. .. . <i>A. perlatus</i> , p. 17.
		The central tubercle less depressed, with stouter or scarcely overhanging apex .. .. . 5.
5	{	The apex of the central tubercle well developed, usually more or less hook-like .. .. . <i>A. parryi</i> , p. 17.
		The apex of the central tubercle short and stout, scarcely overhanging .. .. . <i>A. aruensis</i> , p. 18.
6	{	The central tubercle very short, its apex scarcely or not overhanging .. .. . 7.
		The central tubercle more strongly elevated, with overhanging apex .. .. . 8.
7	{	The central tubercle laterally compressed; the anterior part of the head not conspicuously punctured .. .. . <i>A. mastersi</i> , p. 18.
		The central tubercle very broad; the anterior part of the head somewhat strongly punctured .. .. . <i>A. deyrollei</i> , p. 19.
8	{	The central tubercle pointed at apex as seen from above, with a pair of small tubercles beside the mid-dorsal groove behind .. .. . <i>A. tricuspis</i> , p. 19.
		The central tubercle normal, bifid at apex as seen from above .. .. . 9.
9	{	The central tubercle moderately elevated and somewhat abruptly bent forwards; the elytral grooves very coarsely punctured .. .. . <i>A. errans</i> , p. 19.
		The central tubercle more strongly elevated and less abruptly bent forwards; the elytral grooves not very strongly punctured .. .. . 10.
10	{	The central tubercle gradually curved forwards; the elytral grooves strongly impressed and distinctly punctured .. .. . <i>A. edentulus</i> , p. 19.
		The central tubercle somewhat abruptly bent forwards; the elytral grooves shallow and indistinctly punctured .. .. . <i>A. teres</i> , p. 19.

Genus **CERACUPES**, Kaup, 1871, p. 16.

Type, *Passalus fronticornis*, Westwood, 1842, pp. 124-125.

**Ceracupes fronticornis** (Westwood).

*Passalus fronticornis*, Westwood, 1842, pp. 124-125.

*Ceracupes fronticornis*, Gravelly, 1914c, p. 212, pl. xi, fig. 12.

Three specimens from 5,000-7,000 ft., Ruby Mines District of Upper Burma ; two from Renong, Siam, and several without recorded locality. M. Vitalis de Salvaza has sent for examination a specimen from ca. 4,000 ft., Chapa, near Lao Kay, Ht. Tonkin ; and Mr. J. Coggin Brown has presented us with a specimen from Loi Tawng Kyaw, Tawng Peng State, N. Shan States, Upper Burma, 5,500-7,000 ft. ; and one from Man Pat, Mongmit State, 5,200 ft., Ruby Mines District, Upper Burma.

Length 20-23 mm.

This species is less distinct from *C. austeni* and *C. arrowi* than I supposed when drawing up the key to the species (1914c, p. 319), the shape of the central tubercle being very variable. The distinction given in that key between *C. austeni* and the present species appears to hold good, though the distal bifurcation of the central tubercle of the latter is sometimes very weak. The most distinctive difference between *C. arrowi* and the present species is found in the elytra, whose grooves are deeply impressed and coarsely punctured in the latter, but shallow and less strongly punctured in the former.

The species of *Ceracupes* may be identified thus :—

1	{	The grooves of the elytra, and their punctures, somewhat shallow .. ..	<i>C. arrowi</i> , Heller.
		The grooves of the elytra, and their punctures, very deep .. ..	2.
2	{	The apex of the horn formed by the fusion of the central tubercle with the anterior margin of the head more or less distinctly bifid .. ..	<i>C. fronticornis</i> , p. 21.
		The apex of this horn acute .. ..	<i>C. austeni</i> , Stoliczka.

Genus **CYLINDROCAULUS**, Fairmaire, 1880, p. 164.

Incl. *Auritulus*, Zang, 1905.

Type, *Cylindrocaulus bucerus*, Fairmaire, 1880, p. 164.

The species of this genus may be identified thus :—

{	The front coxae almost contiguous ; the canthus extending about half way across the eye ; the supra-orbital tubercles flattened, expanded at the apex, truncate .. ..	<i>C. palalis</i> (Lewis).
	The front coxae widely separated ; the canthus extending all the way across the eye ; the supra-orbital tubercles slender and pointed .. ..	<i>C. bucerus</i> , Fairmaire.

Subfamily *PSEUDACANTHINAE*.

The most extensive genus of this subfamily, and one of the most primitive, appears to be *Popilius*, a genus which, as limited by previous authors, has proved most difficult to define satisfactorily. None of the characters hitherto used for this purpose appear really to have more than specific value. Especially variable and untrustworthy, in many cases even as a specific character, is the shape and size of the central tubercle. Some of the most definite characters are found in the clypeus, but even these do not as a rule afford satisfactory generic distinctions. It seems necessary, therefore, to sink the names *Heliscus* (= *Soranus*), *Odontotaenius* (= *Passalus*, auct. nec Fabricius) and *Passalotaenius* as synonyms of *Popilius*. Similarly *Coniger*, *Rimor* and *Rimoricus* may be sunk as synonyms of *Oileus*. And both *Popilius* and *Oileus* must be redefined.

The plastic and primitive genus *Popilius* forms a starting point to which the remaining genera of American Passalidae may be traced back, the more primitive species of all the remaining subfamilies having the clypeus similarly exposed, although there is usually no clypeofrontal suture, and the more highly specialized having it hidden.

In the subfamily Pseudacanthinae itself three separate lines of evolution may be recognized. In one, which includes a new genus *Oileoides*, and the genera *Oileus* and *Undulifer*, the sides of the metasternum are broadly hairy. In another, which is represented only by the genus *Spurius*, the central tubercle is absent. In the third the elytra are united and the wings are of use for stridulation but not for flight.

The more primitive members of the third group have the three terminal teeth of the mandibles distinct as in *Popilius*. I have only seen three such species; these belong to the genera *Pseudacanthus*, *Triaenurgus* and *Nasoproculus*, in none of which are the sides of the elytra hairy. It will be convenient to unite these three genera, and with them should probably go the genera *Ogyges*, *Prosoclitus* and *Truquius*, which have hairless elytra — unfortunately their mandibles have not been described. *Petrejoides* should perhaps come here also, but Kuwert's definition is inconclusive, and I have nothing else to go by. The name may equally well be synonymous with *Proculejus* or even with *Proculejoides*.

The genera *Proculejus*,<sup>1</sup> *Prosoclitus*, and *Eriopterus* should likewise, in all probability, be united into one genus *Proculejus*, differing from *Pseudacanthus* in having only two teeth at the apex of the mandible instead of three and in having hairy sided elytra. The reduction in the number of teeth on the mandible probably takes place by the union of the two lowest terminal teeth. The anterior lower tooth appears broad and bidentate in this genus on both mandibles, instead of bidentate on the left and unidentate on the right as in allied forms of the preceding genus.

The genera of Pseudacanthinae may be defined thus:—

1 {	The elytra separate, their vertical anterior part lightly concave	2.
{	The elytra united along the middle line, their vertical anterior part lightly convex	6.

<sup>1</sup> Except *P. quitensis*, Kaup (see below p. 51).

- |   |   |   |                               |
|---|---|---|-------------------------------|
| 2 | { | The sides of the metasternum broadly hairy and punctured throughout   | 3.                            |
|   |   | The hair-bearing punctures of the metasternum confined to the lateral areas and extreme anterior parts of the anterior intermediate areas   | 5.                            |
| 3 | { | The clypeus transversely trapezoidal  | <i>Oileoides</i> , p. 23.     |
|   |   | The clypeus transversely linear, straight or undulating   | 4.                            |
| 4 | { | The clypeus straight or lightly concave in the middle line  | <i>Oileus</i> , p. 25.        |
|   |   | The clypeus strongly convex in the middle and on either side, strongly produced backwards at the two points uniting the three curves thus formed  | <i>Undulifer</i> , p. 25.     |
| 5 | { | The central tubercle absent   | <i>Spurius</i> , p. 26.       |
|   |   | The central tubercle present  | <i>Popilius</i> , p. 26.      |
| 6 | { | The mandibles tridentate at apex, the left one with a broadly bifid tooth between the apex and the movable tooth, the right one with a unidentate tooth in this position (fig. iv, 13, p. 24); the sides of the elytra hairless | <i>Pseudacanthus</i> , p. 30. |
|   |   | The mandibles bidentate at apex, both of them with a broadly bifid tooth between the apex and the moveable tooth (fig. iv, 16, p. 24); the sides of the elytra hairy  | <i>Proculejus</i> , p. 31.    |

Genus **OILEOIDES**, n. gen.

Metasternum with a broad band of hair-bearing punctures on each side; clypeus expanded as in the more primitive species of *Popilius*. Otherwise like *Popilius*.

Type, *O. parvicornis*, n. sp.

**Oileoides parvicornis**, n. sp.

Fig. IV, 1, p. 24.

Two specimens from the Cauca Valley, Columbia. Length 27-28.5 mm.

The antennae have moderately long lamellae. The labrum is punctured and hairy, with distinctly concave anterior margin and convex sides, the latter somewhat convergent behind. Both mandibles have well developed upper, terminal and anterior lower teeth. The last-mentioned tooth is simple on the right side; on the left it is double, sometimes with the anterior of the two parts into which it is (vertically) divided itself divided to a less extent horizontally. The mentum is smooth in the middle, hairy and punctured laterally; its scars are not very strongly marked. The clypeus is extensive and flat like that of *Spurius bicornis* and *dichotomus*; it is lightly procurved as in the latter species. The frontal ridges are obsolete, and the central tubercle, though situated on the crest of a straight transverse ungrooved ridge formed by the union of the two parietal ridges, is very small. Between the central tubercle and the obsolete frontal ridges is a triangular area which is somewhat dull and strongly roughened, all the rest of the surface of the head being smooth and glossy.

The pronotum is transverse. The anterior margin is practically straight, the sides lightly and the posterior margin more distinctly convex. The scars are a little uneven, but are not definitely punctured. The prosternum is pointed behind.

The scutellum is smooth or distinctly but sparsely punctured. In the specimen in which the scutellum is unpunctured there is a strongly marked median groove; in the other this groove is much broken. The mesothoracic episterna are glossy and coarsely punctured all over, except in the posterior angles, which are matt and have less distinct or no punctures but may be more or less rugose. The mesosternum is more or less smooth and glossy all over—less so at the sides than in the middle.

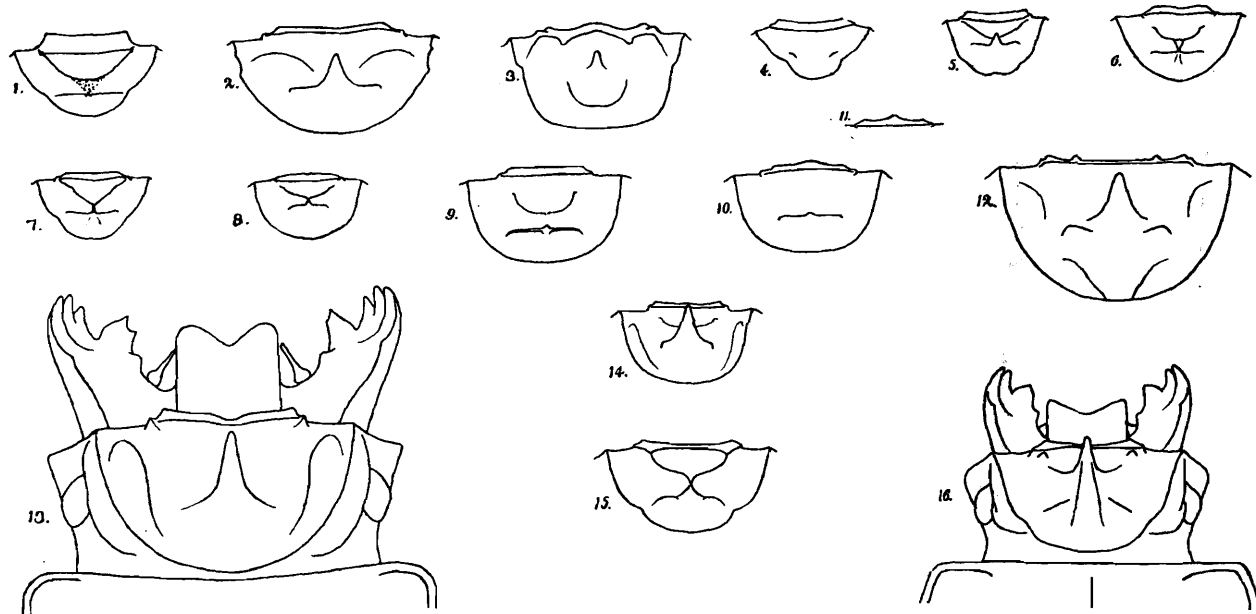


FIG. IV.

Pseudacanthinae; specific characters in the upper surface of the head  $\times 4$ .

- |  |  |
|--|--|
| 1. <i>Oileoides parvicornis</i> , Gravely.   | 9. <i>Popilius guatemalae</i> , Gravely.     |
| 2. <i>Oileus ridiculus</i> (Kuwert).         | 10. <i>Popilius tropicus</i> (Percheron).    |
| 3. <i>Undulifer incisus</i> (Truqui).        | 11. <i>Popilius brevioripennis</i> (Kuwert). |
| 4. <i>Spurius dichotomus</i> , Zang.         | 12. <i>Pseudacanthus solidus</i> (Arrow).    |
| 5. <i>Popilius recticornis</i> (Burmeister). | 13. <i>Pseudacanthus bifidus</i> (Zang).     |
| 6. <i>Popilius marginatus</i> (Percheron).   | 14. <i>Pseudacanthus jalapensis</i> , Bates. |
| 7. <i>Popilius amazonicus</i> , Gravely.     | 15. <i>Proculejus sartori</i> , Kaup.        |
| 8. <i>Popilius intergeneus</i> (Bates).      | 16. <i>Proculejus pubicostis</i> , Bates.    |

The lateral areas of the metasternum are narrow. These, the anterior intermediate areas, and the outer margins of the posterior intermediate areas are punctured and hairy. The rest of the plate is smooth, hairless and glossy, as are also the posterior coxae and the abdominal sterna. The grooves of the elytra are somewhat strongly punctured, especially laterally, but the punctures are small and round. The middle and hind tibiae are without spines except at the apex.

### *Oileoides subrecticornis* (Kuwert).

*Soranus subrecticornis*, Kuwert, 1897, p. 296.

Three specimens from the Cauca Valley, Columbia. Length 22-24 mm.

*O. subrecticornis* differs from *O. parvicornis* in its somewhat smaller size, its shorter antennal lamellae, its straighter clypeus, its somewhat more strongly developed central



tubercle and frontal ridges, which may be united and never have a roughened area between them, and its prothorax which is strongly punctured in and close round the scars.

Genus **OILEUS**, Kaup, 1869, p. 3.

Incl. *Coniger*, Zang, 1905 c; *Rimor*, Kaup, 1871; *Rimoricus*, Kuwert, 1897.

Type, *Passalus rimator*, Truqui, 1857, p. 266 (see Arrow, 1907, pp. 447-449.)

Species of this genus appear to be much larger than are those of the last, and further have always, so far as is known, a large decumbent central tubercle with free apex, instead of a feebly developed one, as well as a linear instead of an expanded clypeus.

**Oileus ridiculus** (Kuwert).

Fig. IV, 2.

*Rimoricus ridiculus*, Kuwert, 1897, p. 287.

Three specimens from Guatemala. Length 34-35 mm.

The lamellae of the antennae are extremely short, being equal to not more than two of the immediately preceding joints in length; the pronotum is punctured in and around the scars; the scutellum is roughened all over with obsolete punctures; the mesosternal scars are hairy; and the grooves of the elytra are very finely punctured. In one specimen the mesosternum is coarsely punctured.

**Oileus sargi** (Kaup).

*Rimor sargi*, Kaup, 1871, pp. 119-120.

One specimen from Guatemala. Length 30 mm.

The antennal lamellae are very long, being as long as about four of the immediately preceding joints; the pronotum is unpunctured; the scutellum is strongly punctured in the middle; and the mesosternal scars are not hairy.

**Oileus rimator** (Truqui).

*Passalus rimator*, Truqui, 1857, p. 266.

One specimen from Omilteme, Guerrero, 8,000 ft., lent by the British Museum. Length 37.8 mm.

This species is closely allied to *O. sargi*, from which it differs in having the clypeus lightly biconvex, the anterior margin of the pronotum biconcave and the mesosternal scars hairy.

Genus **UNDULIFER**, Kaup, 1869, p. 6.

Type, *Passalus incisus*, Truqui, 1857, pp. 266-267.

**Undulifer incisus** (Truqui).

Fig. IV, 3.

*Passalus incisus*, Truqui, 1857, pp. 266-267.

One specimen from Cordova, Mexico, presented by the British Museum. Length 29 mm.

*Undulifer incisus* is closely related to *Oileus ridiculus* and *sargi*. The antennae of the single specimen before me are broken, but from the one remaining lamella I conclude that

the lamellae were very long and slender as in the latter of these species. The clypeus has the form characteristic of the genus. The central tubercle is narrower and less separated from the surface of the head than in *O. ridiculus* and *O. sargi*. The pronotum is more extensively punctured round the scars than in either of these species. The mesothoracic episterna are polished throughout. The meso- and metasterna are extensively covered with hair-bearing punctures, especially laterally. The grooves of the elytra are quite as strongly punctured as in *O. ridiculus*.

Genus **SPURIUS**, Kaup, 1871, p. 75.

Type, *Passalus bicornis*, Truqui, 1857, p. 317.

**Spurius bicornis** (Truqui).

*Passalus bicornis*, Truqui, 1857, p. 317.

One specimen from Mexico and two from Guatemala. Length 17.5-18.0 mm.

**Spurius dichotomus**, Zang.

Fig. IV, 4, p. 24.

*Spurius dichotomus* Zang, 1905a, pp. 227-229.

One specimen from Guatemala, and one unlabelled preparation of the head and appendages. Length 21 mm.

This species may readily be distinguished from the preceding by its somewhat larger size; by the smaller size of the conical processes representing the parietal ridges, which are oblique instead of transverse; and by the shape of the clypeus, which is procurved instead of straight.

Genus **POPILIUS**, Kaup, 1871, p. 75.

Incl. *Heliscus*, Zang, 1905 (= *Soranus*, Kaup, 1871, preoccupied); *Odontotaenius*, Kuwert, 1896 (= *Passalus*, auct. nec Fabricius, see Zang, 1905c, pp. 224-225); *Passalotaenius*, Kuwert, 1896.

Type; *Passalus marginatus*, Percheron, 1835, pp. 89-90, pl. vii, fig. 1.

**Popilius recticornis** (Burmeister).

Fig. IV, 5, p. 24.

*Passalus recticornis*, Burmeister, 1847, pp. 508-509.

Four specimens from Mexico. Length 18-20 mm.

*P. recticornis* is the smallest species of its genus known to me. The antennal lamellae are short. The clypeus is strongly procurved. The frontal ridges are obsolete, but the central tubercle, which is directed forward, is very strongly developed, the apex being free. Apart from some of these characters, and the smoothness of the metasternum characteristic of the genus, *P. recticornis* closely resembles the above described species of the genus *Oileoides*. The mesothoracic episterna are, however, less extensively punctured and uniformly glossy, and the prosternum is truncate behind. The punctures round the scars on the pronotum are usually more numerous even than in *O. subrecticornis*.

**Popilius marginatus** (Percheron).

Fig. IV, 6, p. 24.

*Passalus marginatus*, Percheron, 1835, pp. 89-90, pl. vii, fig. 1.

Three specimens from Farinas, Bolivia. Length 21-22 mm.

*Popilius marginatus* is of about the same size as *Oileoides subrecticornis* or a little smaller, but it has longer antennal lamellae, its straight clypeus is less extensive antero-posteriorly and consequently less flat, there is a strong median keel or pair of keels between the small central tubercle and the obsolete frontal ridges, the pronotum is more thickly punctured above the scars and its median groove is complete, the scutellum is strongly punctured at least near the middle line in front. The metasternum resembles that of *P. recticornis* and other species of *Popilius*; it may have a few punctures in the posterior intermediate areas. The abdominal sterna are punctured in the angles of the scars. In other respects *P. marginatus* resembles *O. subrecticornis*.

**Popilius amazonicus**, n. sp.

Fig. IV, 7, p. 24.

One specimen from the Amazon, Peru. Length 20 mm.

*P. amazonicus* resembles *P. marginatus* in general appearance, but the tubercles and ridges of the head resemble rather those of *P. intergeneus*, the pronotum is very sparsely punctured near the scars, the pointed posterior extremity of the prosternum is very slender, and the scars of the abdominal sterna are more extensively punctured.

**Popilius intergeneus** (Bates).

Fig. IV, 8, p. 24.

*Soranus (?) intergeneus*, Bates, 1886, p. 21.

Numerous specimens from Guatemala. I am indebted to Mr. Arrow for their identification by comparison with Bates' type. Length 20.0-21.5 mm.

This species is intermediate in size between the two preceding. From *P. marginatus* it differs in having the antennal lamellae short, the anterior margin of the clypeus slightly convex and often indented in the middle line, the frontal ridges stronger and on an average more directly united with the central tubercle, the pronotum punctured in the anterior angles as well as above the scars, the prosternum truncate instead of pointed behind, the mesothoracic episterna uniformly glossy except for an unpunctured matt oval patch a little below and in front of the unpunctured posterior angles, the scars of the abdominal sterna more extensively punctured and the grooves of the elytra more strongly punctured.

**Popilius guatemalae** n. sp.

Fig. IV, 9, p. 24.

One specimen from Guatemala. Length 28.5 mm.

This species differs from *P. intergeneus* in its much larger size, straight margined clypeus, smaller and more arcuate frontal ridges, grooved parietal ridges, incomplete pronotal median groove, much less extensively punctured pronotum (the punctures being confined to the neighbourhood of the scars), pointed posterior end of prosternum, almost

unpunctured scutellum (the punctures being confined to a pair of longitudinal lines), normal mesothoracic episterna with matt and indistinctly punctured posterior angles, smoother abdominal sterna, and more finely punctured elytral grooves.

**Popilius tropicus** (Percheron).

Fig. IV, 10, p. 24.

*Passalus tropicus*, Percheron, 1835, pp. 97-99, pl. vii, fig. 4.

Five specimens from Mexico, and one without locality record. Length 25(♂)-28(♀) mm.

Kaup recognizes three varieties of this species, based on the sculpture of the upper surface of the head, and quotes Truqui to the effect that the central tubercle is very variable. One of the specimens before me has a much more strongly developed central tubercle than the others. It is a female and all the others are males<sup>1</sup>.

The clypeus appears always to be distinctly recurved, and I doubt whether the frontal ridges, which are often absent, are ever very strongly developed. They are straighter than in *P. guatemalae*. The parietal ridges are not grooved, and the scutellum may be irregularly punctured. In other respects this species resembles *P. guatemalae*.

**Popilius brevioripennis** (Kuwert).

Fig. IV, 11, p. 24.

*Odontotaenius brevioripennis*, Kuwert, 1897, p. 290.

One specimen from Mexico, distinctly smaller than the type (23 instead of 26 mm. long) and with numerous punctures above the scars. The number of these punctures is, however, very variable in the closely allied species, *P. striatopunctatus*, and the difference in size is within the usual limits of variability. The specimen of *P. brevioripennis* differs from the single female specimen of *P. tropicus* before me in having longer antennal lamellae, a strong median convexity of the anterior margin of the clypeus, a slightly truncate posterior prosternal plate, mesothoracic episterna like those of *P. intergeneus*, and more strongly punctured elytral grooves.

**Popilius striato-punctatus** (Percheron).

*Passalus striato-punctatus*, Percheron, 1835, pp. 101-102, pl. vii, fig. 7.

Numerous specimens from Mexico, one from British Honduras and two from Nicaragua. Length 25-28 mm.

The size of the central tubercle is variable; it is smaller in males than in females, but the difference is not a sharp one. *P. striatopunctatus* differs from *T. brevioripennis* in its larger size, its more strongly developed central tubercle and slightly less indistinct frontal ridges. The posterior end of the prosternum is variable.

**Popilius cornutus** (Fabricius).

*Passalus cornutus*, Fabricius, 1801, p. 256.

Numerous specimens from Florida, two from Mexico and one from each of the following places:—New York, Illinois, Delaware (Wilmington), Ohio and Haiti. Length 29-37 mm.

<sup>1</sup> In one the genitalia were found to be damaged, and I was unable to determine the sex with certainty.

The central tubercle is very variable in shape and size, and is larger in females than in males. *P. cornutus* differs from *P. striatopunctatus* in its larger size, somewhat shorter antennal lamellae, evenly arched anterior margin of clypeus, pedunculate and larger central tubercle, unpunctured pronotum, prosternum usually more broadly truncate behind, mesothoracic episterna with a broad matt band parallel to but not in contact with the lower margin, unpunctured posterior intermediate areas of metasternum, and more finely punctured elytral grooves.

The above species of *Popilius* may be distinguished from one another thus :—

- |   |   |  |                                      |
|---|---|--|--------------------------------------|
| 1 | { | The clypeus more or less broadly flattened and trapezoidal   | 2.                                   |
|   |   | The clypeus transversely linear or distinctly prominent in the middle line .. .. .   | 7.                                   |
| 2 | { | The central tubercle elongate, with free forwardly directed apex   | <i>P. recticornis</i> , p. 26.       |
|   |   | The central tubercle small, its apex not free .. .. .  | 3.                                   |
| 3 | { | The antennal lamellae long, equal to about four of the immediately preceding joints in length .. .. .  | 4.                                   |
|   |   | The antennal lamellae short, equal to about two of the immediately preceding joints in length .. .. .  | 5.                                   |
| 4 | { | The frontal ridges short and curved, together forming almost a semi-circle   | <i>P. marginatus</i> , p. 27.        |
|   |   | The frontal ridges long and approximately straight, meeting in a slightly obtuse angle .. .. .   | <i>P. amazonicus</i> , p. 27.        |
| 5 | { | The central tubercle situated in, or a little in front of, the middle of the head; the frontal ridges well developed, long and approximately straight, meeting in an obtuse angle  | <i>P. intergeneus</i> , p. 27.       |
|   |   | The central tubercle situated a little behind the middle of the head; the frontal ridges weaker or absent  | 6.                                   |
| 6 | { | The clypeus straight; the frontal ridges forming a semi-circle in front of the central tubercle; the parietal ridges grooved   | <i>P. guatemalae</i> , p. 27.        |
|   |   | The clypeus lightly recurved; the frontal ridges absent, or extending straight to the obsolete frontal tubercles from either side of the base of the central tubercle at about a right-angle to each other; the parietal ridges keeled | } <i>P. tropicus</i> , p. 28.        |
| 7 | { | The clypeus linear, parallel-sided, lightly recurved; the central tubercle sometimes with free apex, but never pedunculate   |                                      |
|   |   | The clypeus with at least the posterior margin straight; or the central tubercle pedunculate .. .. .   | 8.                                   |
| 8 | { | The anterior margin of the clypeus with a strongly developed median convexity, the central tubercle not pedunculate  | 9.                                   |
|   |   | The anterior margin of the clypeus at most lightly convex medially, the central tubercle pedunculate .. .. .   | <i>P. cornutus</i> , p. 28.          |
| 9 | { | The central tubercle of moderate size, its apex scarcely free .. .. .  | <i>P. brevioripennis</i> , p. 28.    |
|   |   | The central tubercle large in both sexes (especially the female), its apex entirely free .. .. .   | <i>P. striato-punctatus</i> , p. 28. |

Genus **PSEUDACANTHUS**, Kaup, 1869, p. 9.

Incl. *Nasoproculus*, Zang, 1905c.; ? *Ogyges*, Kaup, 1871; ? *Petrejoides*, Kuwert, 1896; *Triaenurgus*, Bates, 1886; ? *Truquius*, Bates, 1886.

Type, *Passalus mexicanus* Truqui, 1857, pp. 315-316.

**Pseudacanthus bifidus** (Zang).

Fig. IV, 13, p. 24.

*Nasoproculus bifidus*, Zang, 1905c, p. 232.

Six specimens from Mexico. Length 37-41 mm.

The antennal lamellae are long, being equal to three or four of the immediately preceding joints. The anterior margin of the labrum is deeply cleft; the sides of the labrum are straight and parallel. The clypeus is strongly arched on either side of a still stronger median concavity. The central tubercle resembles that of the genus *Oileus* in general form. There are no frontal tubercles or ridges. The parietal ridges are obsolete. The pronotum is unpunctured; its median groove is very strong, but does not quite reach the anterior margin. The scutellum is strongly punctured on either side of the middle line. The mesothoracic episterna are punctured above and near the anterior margin only; they are glossy, except for a matt oval patch behind the lower margin and a matt streak in the posterior angle. The mesosternum is glossy except in the scars, which are matt; it is unpunctured. The metasternum is hairless, and is unpunctured except in the posterior intermediate areas; the lateral areas are linear and smooth. The abdominal sterna are smooth. The grooves on the elytra are finely punctured laterally.

**Pseudacanthus solidus** (Arrow).

Fig. IV, 12, p. 24.

*Triaenurgus solidus*, Arrow, 1907, pp. 452-453.

Described from a (damaged) cotype, 39 mm. long, from Chuipache, Quezaltenango, Guatemala, lent by the British Museum.

The anterior margin of the labrum is lightly concave. The clypeus is straight, and bears a pair of small tubercles, each situated about half way from the middle line to the tubercle in which it terminates laterally. The parietal ridges, though somewhat small, are quite distinct. There are two or three punctures in or near the scars on each side of the pronotum. The matt areas of the mesothoracic episterna are even more restricted than in *P. bifidus*. The mesosternum is punctured and hairy laterally behind. The lateral areas of the metasternum are broad; both these areas, and the intermediate areas in front of and behind the usual group of coarse hairless punctures on the posterior intermediate areas, are covered with hair-bearing punctures. The abdominal sterna are smooth. In other respects this species resembles *P. bifidus*.

**Pseudacanthus jalapensis**, Bates.

Fig. IV, 14, p. 24.

*Pseudacanthus jalapensis*, Bates, 1886, p. 9, pl. i, figs. 10-10a.

One specimen from Oajaca, S. Mexico. Also a cotype from Jalapa lent by the British Museum. Length 22.0-23.5 mm.

*P. jalapensis* is very much smaller than either of the preceding species of the genus, and its antennal lamellae are much shorter in proportion than in those species. The clypeus is very lightly concave (practically straight) and has no tubercles except at its lateral extremities. A pair of small frontal tubercles is situated a little behind it, each about a third of the way from the end to the middle line. The frontal and parietal ridges are obsolete. The central tubercle is very large and resembles in form that of the two preceding species. The pronotum resembles that of *P. solidus*. The scutellum is strongly punctured near the middle line, especially behind. The mesothoracic episterna have one or two matt areas close to the lower margin, the rest of the surface being glossy; they are punctured above and along the anterior margin. The mesosternum is polished except along the lateral margins where it is dull. The metasternum has hair-bearing punctures only beside the middle coxae; the lateral areas are linear and somewhat rough; the general surface is glossy and unpunctured. The abdominal sterna are slightly roughened in the broad outermost parts of the scars only. The elytra are somewhat coarsely punctured in the grooves.

Genus **PROCULEJUS**, Kaup 1868b, p. 13.

Incl. ? *Eriopterus*, Kuwert, 1896; ? *Prosoclitus*, Bates, 1886.

Type, *Proculejus truquii*, Kaup, 1868b, pp. 16-17.

**Proculejus pubicostis**, Bates.

Fig. IV, 16, p. 24.

*Proculejus pubicostis*, Bates, 1886, p. 5, pl. i, figs. 4-4a.

Two specimens from Mexico, 30-31 mm. long.

The antennal lamellae are moderately long, being about equal to three of the immediately preceding joints in length. The labrum is parallel-sided, and is strongly concave in front. The clypeus is very lightly convex (practically straight); it bears an obscure tubercle at either end, and just behind and on the inner side of these tubercles is a pair of small frontal tubercles, which the obsolete frontal ridges do not clearly reach. The central tubercle is very large, it is massive and rounded at the base, but the long forwardly directed apex is somewhat slender. The parietal ridges are obsolete. The pronotum bears only a few fine hair-bearing punctures below the scars; the strongly impressed median groove scarcely reaches the anterior margin. The scutellum is strongly punctured on either side of the middle line, especially behind. The mesothoracic episterna are punctured above and in front; they are glossy except for an extensive matt band, which extends downwards from a little above the posterior angle of each towards the ventral angle. The mesosternum is polished except in the scars, which are deep and narrow. The metasternum resembles that of *Pseudacanthus jalapensis*. The abdominal sterna are smooth. The elytra are somewhat coarsely punctured above, very coarsely punctured at the sides; the last three ribs above the margin are finely punctured and hairy.

**Proculejus sartori**, Kaup.

Fig. IV, 15, p. 24.

*Proculejus Sartorii*, Kaup, 1868b, p. 17.

One specimen without locality record. Length 12.5 mm.

The labrum is concave in front, but not so strongly as in *P. pubicostis*. The clypeus is straight or lightly concave, and is united with the well developed frontal tubercles a little distance from each end. The frontal tubercles are united by well developed frontal ridges to the central tubercle, which is situated a little in front of the middle of the head; this tubercle is small and upwardly directed, and has no free apex. The scutellum is sparsely and somewhat finely punctured, especially in front. The mesothoracic episterna are punctured except in the posterior angles, and are glossy except for an oval patch behind the lower margin. In all other respects this species resembles the last, except that the mesosternal scars are shallower and that the elytral grooves are if anything even more coarsely punctured.

**Proculejus truquii**, Kaup.*Proculejus Truquii*, Kaup, 1868b, pp. 16-17.

One specimen from Mexico, 31 mm. long.

*Proculejus truquii* is much broader in proportion to its length than is either of the two preceding members of the genus. The head is ornamented much as in *P. sartori*, but the frontal area is somewhat narrower and the central tubercle is situated more in the middle. The pronotum resembles that of the two preceding species. The scutellum bears a few obscure punctures. The grooves of the elytra are very much broader and more coarsely punctured than in either of the preceding species, being about as wide as the ribs at the sides, and about half as wide above, the punctures in each groove being much broader than the spaces between them. In all other respects *P. truquii* resembles *P. sartori*.

Subfamily *PROCULINAE*.

Almost all members of this subfamily have the clypeus exposed as in the Pseudacanthinae; but it is fused with the frons instead of separated from it by a distinct suture. Faint traces of this suture, as of the outer tubercles, may perhaps be recognized in the genus *Arrox*, which is probably the most primitive genus of the family. From this genus the extensive genus *Veturius* may easily be derived; and this appears to have given rise to two divergent lines of descent, culminating respectively in the flightless genera *Platyverres* and *Proculus*. The former, in which the clypeus is completely hidden, is connected to *Veturius* through the genus *Verres*, in which all stages of the disappearance of the clypeus may be traced (compare fig. v, 11-15, p. 34). The latter, in which the specialized features associated with flightless species<sup>1</sup> reach their highest development, has the clypeus exposed, and is connected to *Veturius* by the genus *Publius*, a genus which only differs from species of *Veturius* with the two lowest terminal teeth fused by its fused elytra and reduced wings.

<sup>1</sup> See above pp. 4-5.



The genus *Procululus*, Zang (1905a, pp. 225-227, type, *P. inca*) is probably allied to *Publius* and *Proculus*, though in no other genus of Proculinae are the lateral areas of the metasternum known to be hairless—a character suggesting possible affinities with *Proculejoides*, in the subfamily Passalinae. It resembles *Publius* in having normal antennae, and *Proculus* in having egg-shaped elytra. The mandibles appear to resemble those of the last named genus.

The genera of Proculinae known to me may be defined thus:—

- |   |   |   |                             |
|---|---|---|-----------------------------|
| 1 | } | The elytra separate, their vertical anterior part lightly concave .. .. .   | 2.                          |
|   |   | The elytra united along the middle line, their vertical anterior part more or less distinctly convex .. .. .  | 4.                          |
| 2 | } | The anterior lower tooth of the left mandible bidentate as seen from above; the clypeus always exposed and more or less horizontal; the anterior margin of the pronotum usually biconcave .. .. .   | 3.                          |
|   |   | The anterior lower tooth of the left mandible tridentate as seen from above; the clypeus steeper, or hidden and rudimentary; the anterior margin of the pronotum straight, or lightly biconvex .. .. .  | <i>Verres</i> , p. 40.      |
| 3 | } | Rudimentary outer tubercles present; the anterior margin of the pronotum straight .. .. .   | <i>Arrox</i> , p. 33.       |
|   |   | The outer tubercles absent; the anterior margin of the pronotum more or less sinuous or with a strongly sinuous marginal groove .. .. .   | <i>Veturius</i> , p. 35.    |
| 4 | } | The clypeus entirely hidden; the mandibles tridentate distally .. .. .  | <i>Platyverres</i> , p. 41. |
|   |   | The clypeus broadly exposed; the mandibles usually bidentate distally .. .. .   | 5.                          |
| 5 | } | The lamellae of the antennae of moderate length; the anterior lower tooth of the left mandible broader than that of the right; the sides of the elytra approximately straight and parallel; the metasternum with distinct lateral areas .. .. .       | <i>Publius</i> , p. 42.     |
|   |   | The lamellae of the antennae abnormally long and slender, the three together being narrower than any one of them is long; the mandibles symmetrical; the sides of the elytra strongly rounded; the metasternum without distinct lateral areas .. .. . | <i>Proculus</i> , p. 42.    |

Genus **ARROX**, Zang, 1905b, p. 155.

=*Sertorius*, Kaup, 1871, preoccupied.

Type, *Sertorius agassizi*, Kaup, 1871, p. 114.

**Arrox agassizi** (Kaup).

Fig. V, 1.

*Sertorius Agassizi*, Kaup, 1871, p. 114.

One specimen from Nicaragua, 30 mm. long. Both mandibles have three well developed terminal teeth; the anterior lower tooth of the right side is more or less columnar, that of the left is broadly bidentate as seen from above, but the anterior denticle is itself divided into two horizontally. The upper surface of the head though glossy is irregular, not smooth

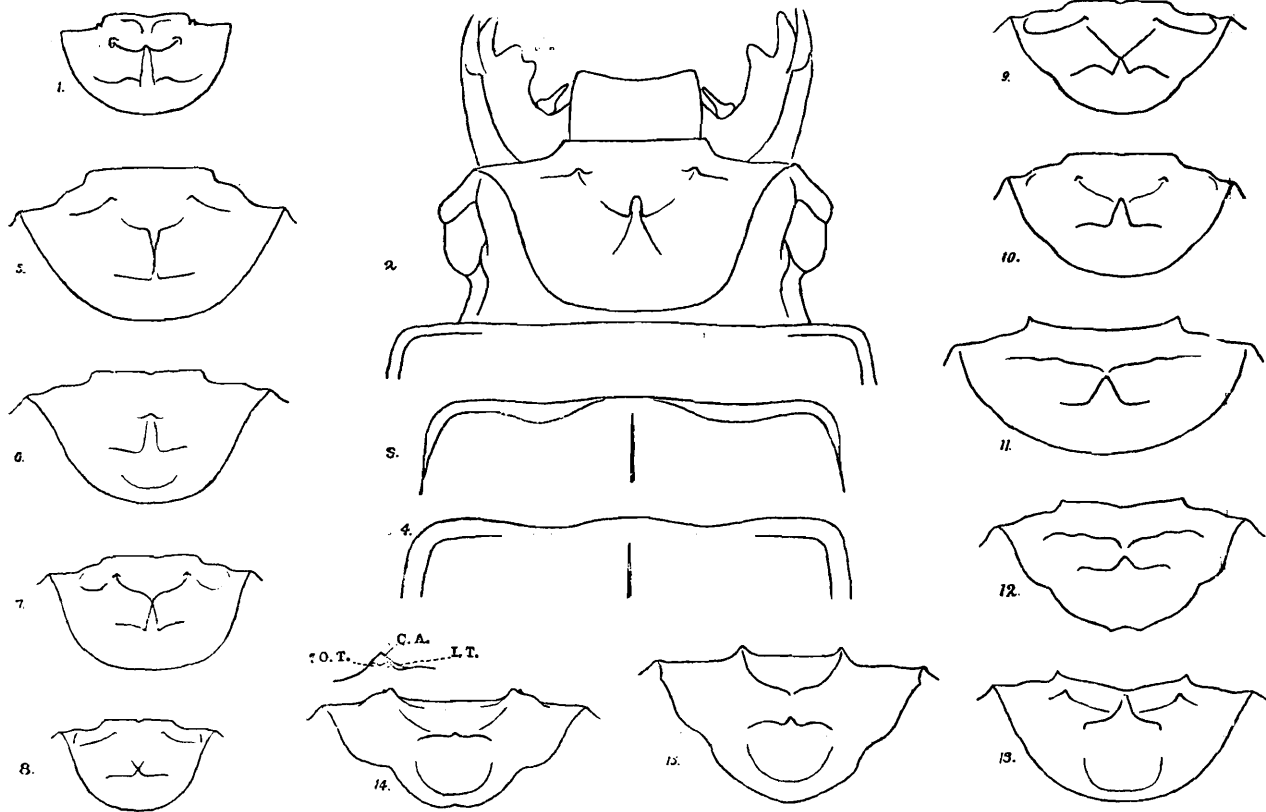


FIG. V.

Proculinae; specific characters in the head and prothorax  $\times 4$ .

C.A., clypeus angles; I.T., inner tubercles; O.T., outer tubercles.

- |   |   |
|---|---|
| 1. <i>Arrox agassizi</i> (Kaup).              | 9. <i>Veturius boliviae</i> , Gravely.      |
| 2. <i>Publius crassus</i> (Smith).            | 10. <i>Veturius heydeni</i> , Kaup.         |
| 3. <i>Veturius sinuatosulcatus</i> , Gravely. | 11. <i>Verres furcibris</i> (Eschscholtz).  |
| 4. <i>Veturius spinifer</i> , Gravely.        | 12. <i>Verres sternipunctitus</i> , Kuwert. |
| 5. <i>Veturius sinuatosulcatus</i> Gravely.   | 13. <i>Verres cavicollis</i> , Bates.       |
| 6. <i>Veturius unicornis</i> , Gravely.       | 14. <i>Verres corticola</i> (Truqui).       |
| 7. <i>Veturius criniceps</i> , Kuwert.        | 15. <i>Platyverres intermedius</i> (Kaup).  |
| 8. <i>Veturius assimilis</i> (Weber).         |   |

as in species of the allied genera *Veturius* and *Verres*; and the clypeus is somewhat convex above. On either side of the clypeus is a rudimentary outer tubercle, but there is no ridge between these tubercles and the larger inner tubercles. The pronotum has a very few coarse punctures only in the slightly enlarged anterior extremities of the narrow marginal groove; its median groove scarcely reaches the anterior margin. The scutellum is thickly punctured on either side of a smooth middle line. The mesothoracic episterna are glossy and closely covered with strong coarse punctures above, matt and more faintly and sparsely

punctured and hairy below. The mesosternum is dull, unpunctured and hairless all over. The metasternum is punctured and hairy in the lateral and anterior intermediate areas only; the lateral areas are slightly broadened behind. The abdominal sterna are smooth and glossy, except the first pair of scars which are somewhat rough. The elytra are sparsely hairy between the shoulders; their grooves are somewhat strongly punctured. The middle tibiae each have a small spine before the end.

Genus **VETURIUS**, Kaup, 1871, p. 110.

Incl. *Pleurostylus*, Kaup, 1871 (see Arrow, 1907, pp. 449-450).

Type, *Passalus heydeni*, Kaup, 1868b, p. 27.

**Veturius sinuatosulcatus**, n. sp.

Fig. V, 3 & 5.

One specimen from Chaco, 40 mm. long.

The labrum is lightly concave in front, lightly convex at the sides. The mandibles (which are somewhat worn) appear to have been very like those of *Arrox agassizi*, but the two lowest terminal teeth have been fused, probably at the base only, and somewhat widely separated from the uppermost terminal tooth, especially on the left side. The head is smooth, with a strongly elevated central tubercle flanked by straight and somewhat forwardly directed parietal ridges. The central tubercle unites in front with a slender, finely pointed, V-shaped ridge or pair of ridges from which the obsolete frontal ridges arise at an obtuse angle to each other. The inner tubercles are well developed, but the frontal ridges do not reach them.

The sides of the pronotum are strongly concave, but are overhung by the strongly convex upper borders of the marginal grooves. The anterior margin is practically straight, but is bordered by a strongly sinuous marginal groove which, though much narrowed near the middle line, is scarcely broken. The pronotum is highly convex behind the median curve of this groove, which is enlarged on either side of the convexity. At the sides the groove is broad behind as well as in front, not narrow behind as in *V. sinuato-collis*, Kuwert. The median groove is deeply impressed and practically complete.

The scutellum is coarsely punctured in the anterior angles and on either side of all but the extreme posterior part of the middle line, bands meeting in the posterior angle to form an ↓-shaped figure being left unpunctured. The mesothoracic episterna are glossy and punctured above and along the anterior margin, matt and unpunctured behind. The mesosternum bears matt bands in the middle line and along the sides, meeting in a broad matt area in the anterior angle to form an ↑-shaped figure. Between these bands it is glossy. It is unpunctured and hairless throughout. The metasternum is punctured and hairy only in the anterior parts of the anterior intermediate areas and in the lateral areas; the lateral areas are moderately broad behind. The abdominal sterna are glossy. The grooves of the elytra are distinctly punctured, especially laterally; the shoulders are without hair. There is a strong spine a little beyond the middle of the middle and hind tibiae.

**Veturius spinifer**, n. sp.

Fig. V, 4, p. 34.

? *Veturius sinuatus*, Kuwert, 1898, p. 172 (*nec* Eschscholtz).

One specimen from Columbia ; two from Venezuela ; and three from Santa Catherina, S. E. Brazil. I have selected one of the Brazilian specimens as the type of the species. Length 42-45 mm.

*Veturius spinifer* agrees closely with Kuwert's description of *V sinuatus*, but lacks the hairy shoulders of Eschscholtz's species. It is closely allied to *V sinuatosulcatus* but differs in having more distinct frontal ridges, which proceed almost direct from the central to the inner tubercles at about a right angle to one another ; in having a normal pronotum with practically straight sides, sinuous anterior margin, marginal groove broadly incomplete and not enlarged in front, and no anterior median convexity ; in having the scutellum somewhat less regularly punctured ; and in having the mesosternum more or less matt all over. There are (? always) some hair-bearing punctures in the anterior angle of the mesosternum. The anterior intermediate areas of the metasternum are almost covered with hair-bearing punctures. The two lowest terminal teeth are smaller than the upper one and are fused at the base, but free distally.

**Veturius platyrhinus** (Hope).*Passalus platyrhinus*, Hope, 1845, p. 28.*Veturius platyrhinus*, Kaup, 1871, pp. 111-112.

Three specimens from Chiriqui, Panama, and one from Brazil. Length 48 mm.

This species differs from the last only in its larger size, and in the absence of spines from the middle and hind tibiae.

**Veturius unicornis**, n. sp.

Fig. V, 6, p. 34.

Two specimens from the Peruvian Amazon and one from the Upper Amazon. Length 34-37 mm.

The two lowest terminal teeth of both mandibles are completely fused. The inner tubercles and frontal ridges, as well as the outer tubercles, are entirely absent ; the central tubercle is distinct, but is less strongly elevated than in the three preceding species. The anterior margin of the pronotum is almost straight, and the marginal groove is narrow throughout. The scutellum is almost or quite unpunctured. The mesosternum is glossy except for a narrow band along each side and across the middle behind the anterior angle. The hairy portions of the anterior intermediate areas of the metasternum are very restricted. The grooves of the elytra are somewhat more distinctly punctured than in any of the three preceding species. In other respects this species resembles *V spinifer*.

**Veturius simillimus**, Kuwert.*Veturius simillimus*, Kuwert, 1898, p. 167.

Eight specimens from Bahia, Brazil, 35-40 mm. long.

The mandibles resemble those of *V unicornis*. The head resembles that of *V spinifer*, or may be somewhat more slender, in which case the frontal ridges meet in a more acute

angle. A well-marked tubercle is sometimes present between the frontal tubercles. The scutellum is strongly punctured, except over a more or less well developed posterior median band and in the lateral angles. The whole of the mesothoracic episterna are punctured; in the matt areas the punctures bear hairs, but not elsewhere. The mesosternum bears a pair of glossy patches in an  $\uparrow$ -shaped matt figure as in *V sinuatosulcatus*; these patches bear a number of hair-bearing punctures, which become thicker on the matt surface anterior and lateral to them, but the median matt band is hairless and unpunctured. The metasternum is almost as extensively smooth as in *V unicornis*. In all other respects *V simillimus* resembles *V spinifer*.

**Veturius cephalotus** (Saint-Fargeau and Serville).

*Passalus cephalotus*, Saint-Fargeau and Serville, 1825, p. 20 (*nec* Kuwert).

One specimen from Cayenne, one from Surinam, and five from the Peruvian Amazon. Length 35-40 mm.

*Veturius cephalotus* was first described from Cayenne, and our specimen from that locality bears a label showing that it was identified by Kaup. The species in our collection which most closely resembles Kuwert's *V cephalotus* appears to me to be *V sinuatus*, and one of these has been determined as *V cephalotus* by Kaup, who regarded the two as identical. Kuwert's *V sinuatus* is probably the species described above as *V spinifer* although this lacks the hairy shoulders of the true *sinuatus* of Eschscholtz.

*V cephalotus* differs from *V simillimus* chiefly in the absence of the spines above the ends of the middle and hind tibiae, and in the uniformly punctured and hairy anterior intermediate areas of the metasternum. In addition, the two lowest terminal teeth are usually distinct at the apex on the right mandible and sometimes also on the left; the marginal grooves of the pronotum are inclined to be narrower in the anterior angles and more strongly punctured behind them; and the median matt band of the mesosternum is inclined to be broader, and the hair-bearing punctures to be more definitely concentrated into marginal bands.

**Veturius sinuatus** (Eschscholtz).

*Passalus sinuatus*, Eschscholtz, 1829, pp. 25-26.

?*Veturius cephalotus* (*nec sinuatus*), Kuwert 1898, p. 168.

Seven specimens from Brazil, including one from Rio Grande do Sul, one from Bahia, and two from Blumenau. Length 37-44 mm.

*V sinuatus* is closely allied to *V cephalotus*, but the two lowest terminal teeth, though fused at the base, are distinct distally on both mandibles; the frontal ridges are often obsolete; the matt posterior angles of the mesothoracic episterna are hairless and unpunctured; the metasternum resembles that of *V simillimus*; and the elytra have a tuft of hair on the shoulders.

**Veturius criniceps**, Kuwert

Fig. V, 7, p. 34.

*Veturius criniceps*, Kuwert, 1898, p. 170.

Two specimens from Chiriqui, Panama, 32 mm. long.

The head differs from that of *V. simillimus* in having the central tubercle less elevated and set further forward, with the result that the frontal ridges meet in a very obtuse angle.

The mesosternum bears matt bands arranged as in *V. sinuatosulcatus*, but has in addition a band of hair-bearing punctures on either side of the whole length of the middle-line. The anterior lateral and intermediate areas of the metasternum are entirely covered with hair-bearing punctures. The elytra have a tuft of hair on the shoulders; they are less glossy than in other species, although the head and pronotum are normal in this respect. The middle but not the hind tibiae have a spine before the end. Otherwise *V. criniceps* resembles the much larger *V. simillimus* in structure.

**Veturius assimilis** (Weber).

Fig. V, 8, p. 34.

*Passalus assimilis*, Weber, 1801, p. 81.

One specimen from Rio de Janeiro, 26 mm. long.

The mandibles resemble those of *V. simillimus* and *V. criniceps*, but the head is much narrower than in these species, and the central tubercle is set much further back than in the latter, being if anything somewhat further from the inner tubercles than these are from each other. The frontal ridges are absent except close to the central tubercle, where they are directed straight towards the inner tubercles. The scutellum is strongly punctured on either side of a broad median band. The mesosternum resembles that of *V. simillimus*, but has fewer punctures. The grooves of the elytra are very strongly punctured. The middle and posterior tibiae have no spines before the end. In other respects this species resembles *V. simillimus*.

**Veturius boliviae** n. sp.

Fig. V, 9, p. 34.

Five specimens from Chaco, Bolivia, 31-34 mm. long.

*Veturius boliviae* is very like *V. cephalotus*, but is smaller, has three well developed terminal teeth on both mandibles, has very few punctures on the scutellum and the matt parts of the mesothoracic episterna, has hair-bearing punctures on either side of the middle line of the mesosternum as well as in front and at the sides and sometimes diffused over other parts, the middle line being matt narrowly or not at all, and has more or less impunctate grooves on the elytra.

**Veturius heydeni**, Kaup.

Fig. V, 10, p. 34.

*Passalus Heydenii*, Kaup, 1868b, p. 27.

? *Nec. Veturius heydeni*, Kuwert, 1898, p. 169.

One specimen from Mexico, 33 mm. long and very broad in proportion; determined by Kaup.

The frontal ridges and inner tubercles of this species are obsolete, and the short parietal ridges are dwarfed by the large central tubercle. In other respects the structure of this species resembles that of *V. boliviae*, except that the marginal grooves of the pronotum are narrower, that there is scarcely any hair near the middle line of the mesosternum and none between this and the marginal bands, which alone are matt, and that the elytra are more distinctly punctured.

The abovementioned species of *Veturius* may be recognized thus :—

- |    |   |   |                                    |     |
|----|---|---|------------------------------------|-----|
| 1  | { | The mesosternum hairless and unpunctured except, as a rule,<br>in the anterior angle .. .. .  | ..                                 | 2.  |
|    |   | The mesosternum with hair-bearing punctures behind or at the<br>side , as well as in front  |                                    | 5.  |
| 2  | { | The anterior margin of the pronotum practically straight, only<br>the anterior marginal groove sinuous ; this groove almost<br>complete across the middle line, where the pronotum is some-<br>what strongly convex immediately behind it | <i>V. sinuatosulcatus</i> , p. 35. |     |
|    |   | The pronotum normal, its anterior margin sinuous with widely<br>broken marginal groove  |                                    | 3.  |
| 3  | { | The frontal ridges and inner tubercles present ; the two lowest<br>terminal teeth of both mandibles fused at base only  |                                    | 4.  |
|    |   | The fronta <sup>l</sup> ridges and inner tubercles absent ; the two lowest<br>terminal teeth of both mandibles completely fused   | <i>V. unicornis</i> , p. 36.       |     |
| 4  | { | The middle tibiae with spines above their ends  | <i>V. spinifer</i> , p. 36.        |     |
|    |   | The middle tibiae without spines above their ends   | <i>V. platyrhinus</i> , p. 36.     |     |
| 5  | { | The two lowest terminal teeth of both mandibles completely<br>fused (spines present above the ends of the middle tibiae ; the<br>elytra hairless at the shoulders)  | <i>V. simillimus</i> , p. 36.      |     |
|    |   | The two lowest terminal teeth fused at base only, in unworn<br>specimens, on the right and usually also on the left mandible  |                                    | 6.  |
| 6  | { | The two lowest terminal teeth of the left mandible completely<br>fused (no spines above the ends of the middle tibiae ; the<br>elytra hairless at the shoulders)  | <i>V. cephalotus</i> , p. 37.      |     |
|    |   | The two lowest terminal teeth distinct at apex in unworn speci-<br>mens on both mandibles. .. .. .  | .. .. .                            | 7.  |
| 7  | { | The elytra with a tuft of hair on each shoulder   |                                    | 8.  |
|    |   | The elytra without any such tufts, (the middle tibiae without<br>spines above the end) .  |                                    | 9.  |
| 8  | { | The central tubercle normally situated, at least as far from the<br>inner tubercles as these are from one another ; the elytra<br>normal ; the middle tibiae without spines above the end   | <i>V. sinuatus</i> , p. 37.        |     |
|    |   | The central tubercle set unusually far forwards, being nearer to<br>the inner tubercles than they are to each other ; the elytra<br>less glossy than the head and thorax ; the middle tibiae with<br>spines above the end                 | <i>V. criniceps</i> , p. 37.       |     |
| 9  | { | The central tubercle situated at least as far from the inner<br>tubercles as these are from one another ; the obsolete frontal<br>ridges meeting in an acute angle  | <i>V. assimilis</i> , p. 38.       |     |
|    |   | The central tubercle situated nearer to the inner tubercles than<br>these are to each other ; the frontal ridges meeting in an<br>obtuse angle  |                                    | 10. |
| 10 | { | The central tubercle normal, not free at apex ; the frontal<br>ridges moderately distinct   | <i>V. boliviana</i> , p. 38.       |     |
|    |   | The central tubercle slender, with free apex ; the frontal ridges<br>obsolete   | <i>V. heydeni</i> , p. 38.         |     |

Genus **VERRES**, Kaup, 1871, p. 114.

Type, *Passalus corticola*, Truqui, 1857, p. 310.

**Verres furcylabris** (Eschscholtz).

Fig. V, 11, p. 34.

*Passalus furcylabris*, Eschscholtz, 1829, p. 25.

Three specimens, of which two are from Para, Brazil. Length 40-44 mm.

The anterior margin of the labrum is very deeply incised. The mandibles each have three well developed terminal teeth. The central tubercle is massive, the inner tubercles and parietal ridges are obsolete. The median groove of the pronotum is practically complete. The marginal grooves are abruptly terminated and deeply impressed near the anterior angles. The scutellum is more or less densely punctured, except in the middle line and the anterior angles. The mesothoracic episterna are glossy and densely punctured, except in the posterior angles, which are extensively matt. The mesosternum is unpunctured and hairless (except in the anterior angle); it may be wholly matt or partially glossy. The metasternum is covered with hair-bearing punctures only in the anterior parts of the anterior intermediate areas and in the lateral areas, but there are some larger hairless punctures near the posterior margin. The abdominal sterna are smooth. The elytra are hairless; their grooves are strongly punctured, especially laterally. The middle and hind tibiae are without spines before the end.

**Verres sternipunctatus**, Kuwert.

Fig. V, 12, p. 34

*Verres sternipunctus*, Kuwert, 1898, p. 174.

Three specimens from Nicaragua, 33-38 mm. long.

I am doubtful whether this species is really distinct from *V. hageni*, Kaup; if not, the name *hageni* must stand.

The labrum is less deeply incised than in the preceding species, and the parietal ridges are distinct. The scutellum may be entirely covered with punctures. The mesosternum is entirely matt, with a few hair-bearing punctures on either side of the middle line and along the outer margins. The anterior intermediate areas of the metasternum are entirely covered with hair-bearing punctures. The grooves of the elytra are less strongly punctured than in the preceding species, which this one resembles in characters not mentioned.

**Verres cavicollis**, Bates.

Fig. V, 13, p. 34.

*Verres cavicollis*, Bates, 1886, p. 24, pl. i, figs. 20-20a, nec. Kuwert (see Arrow, 1907, p. 455).

One specimen from Guatemala, 37 mm. long.

The labrum is deeply incised, as in *V. furcylabris*, and is very strongly depressed behind the incision. The mandibles resemble those of other members of the genus. The inner tubercles are well developed, and the part of the head in front of them is short and almost vertical. The central tubercle has a slender free apex, and the parietal ridges, though small, are complete. The median groove of the pronotum does not nearly reach the anterior



margin. The marginal grooves are rudimentary, except in the anterior angles where they form a pair of large circular pits punctured on the inner side. The scutellum is almost entirely covered with punctures. The mesothoracic episterna resemble those of other members of the genus. The mesosternum is matt and is entirely covered with hair-bearing punctures except near the middle line behind. The metasternum is covered with hair-bearing punctures, except the central area and the inner parts of the posterior intermediate areas, which bear a number of hairless punctures behind. The abdominal sterna are smooth. The elytra and legs resemble those of *V sternipunctatus*.

**Verres corticola**, (Truqui).

Fig. V, 14, p. 24.

*Passalus corticola*, Truqui, 1857, p. 310.

Numerous specimens from Guatemala and one from Mexico. Length 31-36 mm.

The labrum is slightly concave in front. The mandibles resemble those of other members of the genus. The central tubercle is fused with the pair of short parietal ridges to form a massive protuberance, in front of which the more or less distinct frontal ridges extend towards the inner tubercles at a somewhat obtuse angle to one another. The inner tubercles are distinct as in *V cavicollis*, but are situated on the anterior margin of the head with only the angles of the clypeus visible in front of, or rather below, them. The angles of the clypeus are somewhat more widely separated than the inner tubercles, and a pair of rudimentary outer tubercles may perhaps be recognized in a pair of more or less tumid areas connecting them. The addition to fig. v, 14, illustrates these tubercles and the clypeus angle on the left side, being drawn on a larger scale than the main figure, and from a more anterior position. The prothorax and mesothorax resemble those of *V furcilabris*, except that the scutellum is more sparsely punctured. The metasternum and elytra resemble those of *V sternipunctatus*. The abdominal sterna and legs resemble those of other members of the genus.

The above mentioned species of *Verres* may be recognized as follows:—

- |   |   |   |                                       |
|---|---|---|---------------------------------------|
| 1 | { | The clypeus extensive, oblique; the inner tubercles obsolete  | 2.                                    |
|   |   | The clypeus smaller, almost vertical, or rudimentary; the inner tubercles distinct  | 3.                                    |
| 2 | { | The labrum very deeply cleft; the parietal ridges obsolete  | <i>V. furcilabris</i> , p. 40.        |
|   |   | The labrum less deeply cleft; the parietal ridges short but distinct  | .. <i>V. sternipunctatus</i> , p. 40. |
| 3 | { | The labrum very deeply cleft; the clypeus distinct; the apex of the central tubercle free; a pair of large circular pits in the anterior angles of the pronotum | <i>V. cavicollis</i> , p. 40.         |
|   |   | The labrum not deeply cleft; the clypeus hidden and rudimentary; the apex of the central tubercle not free; the pronotum normal                                 | <i>V. corticola</i> , p. 4.           |

Genus **PLATYVERRES**, Bates, 1886, p. 9.

Type, *Verres intermedius*, Kaup, 1871, p. 115.

**Platyverres intermedius** (Kaup).

Fig. V, 15, p. 34.

*Verres intermedius*, Kaup, 1871, p. 115.

One specimen (with worn mandibles) from Omilteme, Guerrero, lent by the British Museum. Length 42.5 mm.

*Platyverres intermedius* is closely allied to *Verres corticola*. The labrum is, however, somewhat more deeply excavate; the clypeus is entirely hidden even at the angles; the frontal ridges are broadly arched and are more or less confluent half way between the central tubercle and the anterior margin of the head; the anterior ends of the marginal grooves of the prothorax are less deeply impressed; the lateral areas of the metasternum, though punctured and hairy, are narrow throughout; the elytra are united and are more coarsely punctured in the grooves.

Genus **PUBLIUS**, Kaup, 1871, p. 70.? Incl. *Procululus*, Zang, 1905a.Type, *Passalus crassus*, Smith, 1852, p. 14.**Publius crassus** (Smith).

Fig. V, 2, p. 34.

*Passalus crassus*, Smith, 1852, p. 14.

One specimen from Bogota, Columbia, 43.5 mm. long.

The antennal lamellae are short, being equal to about two of the immediately preceding joints in length. The labrum is broader behind than in front; its anterior margin is lightly concave, its sides are lightly convex. Both mandibles are bidentate distally; the left one has a broad bifid tooth between these teeth and the moveable tooth; the right one has a simple conical tooth in this position. The frontal ridges are obsolete; the frontal tubercles are broad and short and somewhat rounded; the central tubercle has a slender but not very long free apex, which is less depressed than that of *Proculejus pubicostis*. The pronotum is unpunctured, and its scars are indistinct; its median groove does not nearly reach the anterior margin. The scutellum bears a few large punctures near the middle line in front. The mesothoracic episterna are extensively matt and unpunctured in the posterior angles, being glossy and punctured elsewhere. The mesosternum is glossy, except in the scars, which become very large and almost meet in the middle line in front. The metasternum is glossy, unpunctured and hairless except beside the middle coxae and in the linear lateral areas. The abdominal sterna are smooth. The grooves on the elytra are very faintly punctured.

Genus **PROCULUS**, Kaup, 1868b, p. 8.Incl. *Cyphoproculus*, Kuwert, 1896.Type, *Passalus goryi*, Melly, 1833, pl. lvi.

**Proculus goryi** (Melly).

*Passalus goryi*, Melly, 1833, pl. lvi.

Two specimens from Vera Paz, Guatemala, 67-72 mm. in length.

*Proculus goryi* may readily be distinguished from the other two species before me by the obsolete upper tooth of the mandibles, normally flattened mentum, and glossy elytra.

**Proculus opacipennis** (Thomson).

*Passalus opacipennis*, Thomson, 1857, pp. 420-421, pl. xxi, fig. 4.

Three specimens from Ecuador and two from Guatemala, 51-56 mm. in length.

*Proculus opacipennis* has a long and slightly curved upper tooth on each mandible, a normally flattened mentum, and matt elytra.

**Proculus mniszehi**, Kaup, 1868.

*Proculus mniszehi*, Kaup, 1868b, pp. 11-13.

Eight specimens from Guatemala (mostly from Vera Paz), one from Ecuador, and one from San Pedro Sula, Honduras. They vary from 53-69 mm. in length.

*Proculus mniszehi* has an acute and well developed upper tooth on each mandible, glossy elytra, and a mentum with the inner margin of the forwardly directed lateral processes turned almost at right angles to the rest of the plate in a ventral direction to form a pair of smoothly rounded lobes.

Subfamily *PASSALINAE*.

The subfamily Passalinae as represented in the collection before me includes five clearly defined genera, and a large assemblage of species separated from one another by various combinations and modifications of characters so graded as thoroughly to obscure their true relationships one to another.

In the first three genera the clypeus is always exposed and the antennae always have three lamellae. The first of them, *Chondrocephalus*, only differs from the primitive Pseudacanthine genus *Popilius* in having no suture between the clypeus and the frons and no hair on the lateral areas of the metasternum. *C. quinquecornutus* is to some extent transitional between the two genera, having definite traces of the suture; but as these are not very distinct and as the lateral areas of the metasternum are hairless it seems to me to make, on the whole, a better *Chondrocephalus* than *Popilius*.

The second genus, *Vindex*, contains one species, *V. agnoscendus*, in which the clypeo-frontal suture is distinct throughout as in the Pseudacanthinae; and but for its flattened form and separate elytra with hairless sides this species might have been held to indicate the relationship of its genus to *Proculejus* instead of to *Chondrocephalus*; for *Vindex* possesses the main peculiarities of the dentition characteristic of *Proculejus* (see above, p. 10).

One species of *Vindex*, described below for the first time, has the elytra united as they are in the next genus *Proculejoides*. But whereas this species retains the flattened form characteristic of other species of *Vindex*, *Proculejoides* has assumed the more massive form ordinarily assumed by flightless species of all groups.

The fourth genus, *Paxillus*, is distinguished from all others by having more than three well developed lamellae on each antenna. In some species the clypeus is exposed and in others it is hidden; but all are closely related to one another and as they are not very numerous all the genera which have been established for them may conveniently be united into one. It is probable that a considerable proportion of the species that have been described are invalid (see Arrow, 1907, p. 443).

The remaining species, though undoubtedly numerous, probably require proportionally still more drastic reduction of their numbers. It seems to be impossible to separate them into groups having the same value as the genera mentioned above. Consequently I propose to regard almost all of them as constituting a single large and plastic genus *Passalus*.

The only exception is the genus *Ptichopus*, the last and in some respects the most highly specialized genus of the subfamily. It may readily be recognized from all others by the remarkable structure of its mandibles.

The genera of Passalinae known to me may be separated thus:—

1	{	The clypeus clearly exposed; the antennae with not more than three well developed lamellae	2.
		The clypeus hidden <sup>1</sup> ; or, the antennae with more than three well developed lamellae	4.
2	{	The dentition normal; the clypeus more or less horizontal	<i>Chondrocephalus</i> , p. 44.
		The dentition reduced; the clypeus more or less vertical	3.
3	{	Much flattened insects with the inner and outer tubercles almost in a straight line on the upper part of the anterior margin of the head, and projecting forwards above the clypeus	<i>Vindex</i> , p. 46.
		Robust insects with the cephalic tubercles normally situated	<i>Proculejoides</i> , p. 47.
4	{	The antennae with more than three well developed lamellae; the clypeus exposed or hidden	<i>Paxillus</i> , p. 48.
		The antennae with not more than three well developed lamellae; the clypeus hidden <sup>1</sup>	5.
5	{	The dentition normal	<i>Passalus</i> , p. 51.
		The upper terminal tooth very large and acute, directed forwards; the middle one rudimentary or absent; the lowest one very small, directed inwards	<i>Ptichopus</i> , p. 68.

Genus **CHONDROCEPHALUS**, Kuwert, 1896, p. 221.

Type, *Popilius granulifrons*, Bates, 1886, p. 12, pl. i, figs. 13-13a.

**Chondrocephalus quinquecornutus**, n. sp.

Fig. VI, 1.

Two complete specimens from Guatemala and one dissected head. Length 17 mm.

The lamellae of the antennae are moderately long and slender. The anterior lower tooth of the left mandible is broad and more or less distinctly bidentate, that of the right

<sup>1</sup> Exposed to some extent in *Passalus guatemalensis*; see below, p. 57.

mandible slender and scarcely if at all bidentate. The anterior margin of the labrum is straight, the sides all lightly convex. The parietal ridges are somewhat short. The central tubercle is laterally compressed; its base extends forwards to the point at which the frontal ridges diverge towards the stout conical inner tubercles, from which tubercles they bend abruptly outwards to end in the similar outer tubercles—a character in which this species differs from *C. granulum*, Kuwert, to which it appears to be more nearly related than to any other species yet described. The transverse course of the ends of the frontal ridges, combined with the more irregular (though glossy) surface of the whole area in front of the inner and outer tubercles combine in some specimens to give this area an appearance of being definitely cut off from the rest of the head, as is the clypeus from the frons in the genus *Popilius*. The anterior margin of the clypeus is more or less distinctly notched.

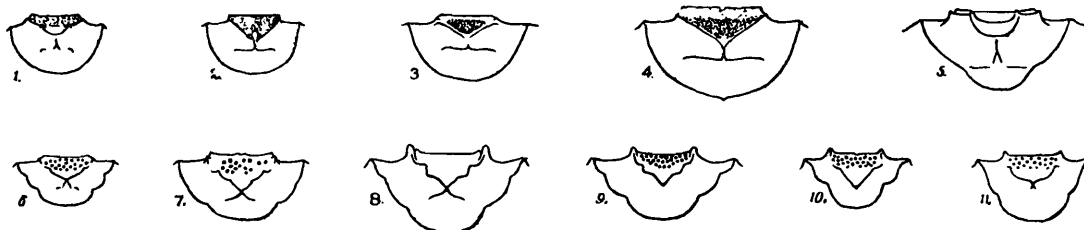


FIG. VI.

Passalinae (except *Passalus*); specific characters in the upper surface of the head  $\times 4$ .

- |   |  |
|---|--|
| 1. <i>Chondrocephalus quinquecornutus</i> , Gravelly. | 7. <i>Paxillus brasiliensis</i> (St. Farg. and Serv.). |
| 2. <i>Chondrocephalus cordiger</i> , Gravelly.        | 8. <i>Paxillus pentaphyllus</i> (Beauvois).            |
| 3. <i>Chondrocephalus purulenis</i> (Bates).          | 9. <i>Paxillus leachii</i> , MacLeay.                  |
| 4. <i>Chondrocephalus granulifrons</i> (Bates).       | 10. <i>Paxillus robustus</i> (Percheron).              |
| 5. <i>Vindex synelytris</i> , Gravelly.               | 11. <i>Paxillus crenotus</i> , MacLeay.                |
| 6. <i>Paxillus camerani</i> (Rosmini).                |  |

The angles of the pronotum are rounded, the posterior more so than the anterior. The sides and marginal grooves of the pronotum are coarsely and irregularly punctured; there are no distinct scars. The scutellum bears a few punctures near the middle. The mesothoracic episterna are glossy throughout, and are coarsely but somewhat sparsely punctured except in the posterior angles, which are smooth. The mesosternum is smooth and glossy, except the lateral margins which are matt. The metasternum is hairless; its lateral areas are narrow and slightly roughened throughout; there are a few large punctures on the posterior borders of the intermediate areas. The abdominal sterna are glossy. All the grooves of the elytra are coarsely punctured. The middle and posterior tibiae are armed with about two spines each before the apex.

### *Chondrocephalus cordiger*, n. sp.

Fig. VI, 2.

One specimen from Guatemala, 18.3 mm. long.

The antennae, mandibles and labrum resemble those of *C. quinquecornutus*. The parietal ridges are somewhat longer than in that species. The frontal ridges extend straight from the anterior extension of the central tubercle to the small outer tubercles. Not far from the central tubercle they are united by a curved groove, immediately beyond which is a pair of almost obsolete inner tubercles. The somewhat heart-shaped area enclosed between this groove and the frontal ridges is smooth and glossy, like the surface of the

head without and behind the ridges ; in front of this groove and between the ridges it is matt.

The marginal grooves of the pronotum are more finely and evenly punctured than in *P. quinquecornutus*. The coarse punctures on the sides of the pronotum are less numerous than in that species, and a pair of punctured scars are evident ; there are a few coarse punctures on the dorsal surface as well as at the sides.

The scutellum is without punctures. The mesothoracic episterna, mesosternum and abdominal sterna resemble those of *P. quinquecornutus* ; the metasternum is more extensively punctured in the posterior intermediate areas. The punctures in the grooves of the elytra, and the spines on the middle and posterior tibiae, are not quite so pronounced as in that species.

### **Chondrocephalus purulensis** (Bates).

Fig. VI, 3, p. 45.

*Popilius purulensis*, Bates, 1886, p. 13.

One specimen from Guatemala, 22·8 mm. long.

The anterior margin of the labrum is slightly concave, and the sides are slightly convergent behind. There are no inner tubercles. The frontal ridges, which are flattened above, are straight and meet in a more obtuse angle than in either of the preceding species ; they and the clypeus are glossy, the whole of the triangular area bounded by them being matt. In other respects the head resembles that of *C. cordiger*, as do also the antennae and mandibles.

The pronotum resembles that of *C. cordiger* in form, but the scars are more pronounced and there are no coarse punctures on the general surface, either at the sides or nearer the middle. The scutellum bears a group of punctures on either side of the middle line ; in other respects the mesothorax resembles that of the two preceding species. The metasternum bears a few punctures in the inner angles only of the posterior intermediate areas. The abdominal sterna, elytra and legs resemble those of *C. cordiger*.

### **Chondrocephalus granulifrons** (Bates).

Fig. VI, 4, p. 45.

*Popilius granulifrons*, Bates, 1886, p. 12.

Numerous specimens from Guatemala, 26·2–32·2 mm. long.

*C. granulifrons* differs from *C. purulensis* in having the frontal ridges (which meet in a right angle) less flattened above, with the inner tubercles more or less imperfectly developed and sometimes united. The small area behind and between the inner tubercles is glossy, that between the inner and outer tubercles matt, and the clypeus more or less rough and glossy. The puncturing on the scutellum is variable. The spines on the middle and hind tibiae are stronger.

Genus **VINDEX**, Kaup, 1871, p. 78.

Type, *Passalus agnoscendus*, Percheron, 1841, p. 22, pl. lxxviii, fig. 2.

**Vindex agnoscendus** (Percheron).

*Passalus agnoscendus*, Percheron, 1841, p. 22, pl. lxxviii, fig. 2.

Seven specimens from Mexico, 20–22.4 mm. long.

This species may readily be recognized from either of the other two members of the genus known to me by its free elytra, with coarsely, but not transversely punctured lateral grooves. It is also characterized by the presence of a distinct trace of the lowest terminal tooth of the right mandible, and of a distinct clypeofrontal suture. The inner tubercles are situated upon this suture as in certain species of *Pseudacanthus* and *Proculejus*, and the suture is most readily seen between them, where it replaces the ridge found in this position in other species.

**Vindex sculptilis**, Bates.

*Vindex sculptilis*, Bates, 1886, p. 13.

Numerous specimens from Guatemala, 20.3–23.0 mm. long.

In this species there is no definite trace of the lowest terminal tooth on either mandible, and there is no clypeofrontal suture. The elytra are free, and the punctures in their lateral grooves are very large and transverse.

**Vindex synelytris**, n. sp.

Fig. VI, 5, p. 45.

Three specimens from Guatemala, 23.8–25.0 mm. long.

The head and mandibles resemble those of *V sculptilis*. The elytra are united in the middle line, though their form is unmodified and the wings are well developed; the lateral grooves are coarsely but not transversely punctured; their dorsal grooves are more finely punctured than in either of the other two species.

Genus **PROCULEJOIDES**, Kuwert, 1896, p. 221.

Type, *Proculejus championi*, Bates, 1886, pp. 5-6, pl. i, figs. 5-5a.

**Proculejoides championi** (Bates).

*Proculejus championi*, Bates, 1886, pp. 5-6, pl. i, figs. 5-5a.

Numerous specimens from Guatemala, which show that the species is very variable in size (length 23.5–32.0 mm.), and that the ridges bounding the frontal area are variable, both as to form and distinctness.

The mandibles closely resemble those of *Proculejus*. The clypeus, though exposed, is bent downwards as in *Verres cavicollis* and is far from conspicuous, not even being prominent laterally as in that species. Both outer and inner tubercles are distinct, but the frontal ridges are obsolete in front of the latter. The prothorax resembles that of *Chondrocephalus granulifrons* except for its greater convexity. The scutellum is not distinctly punctured. The mesothoracic episterna and mesosternum resemble those of *C. granulifrons* except for a ventral matt patch on each of the former. The

metasternum is unpunctured and has smooth hairless narrow lateral areas. The abdominal sterna are glossy. The outermost grooves of the elytra are very indistinctly punctured; the dorsal grooves are unpunctured. The middle tibiae each bear two, and the posterior one, strong spine before the apex.

Genus **PAXILLUS**, MacLeay, 1819, p. 105.

Incl. *Paxilloides*, Kuwert, 1896; *Paxillosomus*, Kuwert, 1896; *Spasalus*, Kaup, 1863.

Type, *Paxillus leachii*, MacLeay, 1819, p. 106 (Paris edition, p. 20).

**Paxillus camerani** (Rosmini).

Fig. VI, 6, p. 45.

*Paxillosomus camerani*, Rosmini, 1902, pp. 4-5.

One specimen from the Upper Amazon; 16 mm. long.

The anterior margin of the labrum is straight; the sides are lightly convex. The last five joints of the antennae are lamellate, the middle lamella being distinctly the longest, though this scarcely exceeds the one immediately preceding it by as much as does the corresponding lamella of *P. pentaphyllus*. The mandibles each have three distinct terminal teeth, of which the middle one is perhaps slightly nearer to the one below it than to the one above it. The left anterior lower tooth is broader than the right and is probably bidentate when unworn as in other species. The central tubercle and parietal ridges are small. The frontal ridges extend from the central tubercle at a very obtuse angle to each other towards the outer tubercles, their course being slightly curved. The inner tubercles are distinct and are nearer to the outer than to the central tubercle. The outer tubercles, which are bluntly conical, are little larger than the inner; they do not overhang the angles of the clypeus, which project horizontally in front of them, terminating the lightly concave anterior margin of the clypeus. The area between the frontal ridges is punctured in front of the inner tubercles, and smooth behind them.

The pronotum is coarsely punctured laterally except (? always) in the neighbourhood of the scars. The sides and anterior margin of the pronotum are straight, with the angles between them slightly prominent. The posterior margin and angles are rounded; the latter are densely covered beneath with long yellowish hair. The marginal groove is fine; the median groove is almost complete. The posterior plate of the prosternum is broadly truncate behind, being little narrower behind than in front. There are a few indistinct scattered punctures on the scutellum. The mesothoracic episterna are glossy above, and matt, except beside the anterior margin, below; they are punctured except in the posterior angles. The mesosternum is glossy, with deep punctured scars. The lateral areas of the metasternum are narrow throughout, rugose, and very finely hairy; a row of punctures extends along the inner side of the posterior intermediate areas. The abdominal sterna are polished except in the scars, which are matt. The elytra are densely and somewhat extensively hairy at and below the shoulders; their lateral grooves are coarsely, their dorsal grooves more finely, punctured.



**Paxillus brasiliensis** (Saint-Fargeau and Serville).

Fig. VI, 7, p. 45.

*Passalus brasiliensis*, Saint-Fargeau and Serville, 1825, p. 21.*Paxilloides brasiliensis*, Kuwert, 1898, p. 181.

Three specimens from Bolivia, one from Bogota, one from Yucatan and two without locality labels. Length 18–21 mm.

I follow Kuwert with regard to this determination; the original description (quoted by Guérin, 1828, p. 90) being altogether inconclusive.

The anterior margin of the labrum is lightly concave as a rule. The ends of the five antennal lamellae form a straight line when furled, the middle lamella being scarcely if at all longer than the penultimate one. The anterior margin of the clypeus may be lightly concave, or may be lightly convex close to (but on either side of) the middle line, where in this case it is faintly notched. The frontal ridges arise at right angles to one another and are practically straight; the extent of the transverse anterior punctured area between them is variable. The posterior angles of the pronotum bear only a small patch of short hair beneath. The mesosternal scars may be smooth or rugulose, glossy or matt. The lateral areas of the metasternum are hairless. The strength of the puncturing of the dorsal grooves of the elytra is somewhat variable. The shoulders of the elytra are somewhat hairy, but are not densely covered with long pile as in the preceding species. In other respects the present species resembles the last.

**Paxillus pentaphyllus** (Beauvois).

Fig. VI, 8, p. 45.

*Passalus pentaphyllus*, Beauvois, 1805, p. 2, pl. i, fig. 2.

One specimen from Mosquito 26.3 mm. long.

The anterior margin of the labrum is somewhat more strongly convex than in the preceding species. The antennae resemble those of *P. camerani*, but the ends of their lamellae when furled form a somewhat more strongly curved line. The outer tubercles are long and slender, and are directed forwards above the angles of the clypeus which, however, are exposed beneath them. The area between the outer tubercles is glossy and unpunctured. In other respects this species resembles the preceding one, except that the posterior intermediate areas of the metasternum are more extensively and very coarsely punctured.

**Paxillus leachii**, MacLeay.

Fig. VI, 9, p. 45.

*Paxillus leachii*, MacLeay, 1819, p. 106 (Paris edition, p. 20).

Many specimens from Guatemala, Iquitas (Upper Amazon), Bahia, Rio de Janeiro, Para, Esperito-Santo (Brazil), Bolivia, Nicaragua, British Honduras, Mexico, and Montevideo. Length 16.0–21.5 mm.

This species differs from the last only in having the anterior margin of the labrum less strongly concave, in having the ends of the antennal lamellae in a straight line when the antennae are furled, in having coarse punctures between the outer tubercles of the head,

in having the lower side of the prothorax still less hairy, and in having the posterior intermediate areas of the metasternum more finely punctured.

**Paxillus robustus** (Percheron).

Fig. VI, 10, p. 45.

*Passalus robustus*, Percheron, 1835, pp. 35-36, pl. iii, fig. 1.

Several specimens from different localities in Brazil (Santa-Catherina, Bahia, Rio de Janeiro and Esperito-Santo). Length 15.2-18.0 mm.

This species and the next are less strongly flattened than any of the preceding members of the genus; they have the posterior plate of the prosternum strongly tapered behind and have the clypeus entirely hidden; the outer tubercles are variable in size, but are probably always somewhat long and slender in unworn specimens, and the frontal ridges are obsolete between them and the inner tubercles, though well developed between the inner tubercles and central tubercle. The anterior angles of the head are sometimes rather strongly produced and acute. The sides of the pronotum are more extensively, and the grooves of the elytra more coarsely punctured than in *P. leachii*, which this species resembles in other respects, except that the shoulders of the elytra are entirely hairless. The tibiae of the intermediate (and to a less extent the hind) legs often bear several strong spines on the outer side, especially in small specimens.

**Paxillus crenatus**, MacLeay.

Fig. VI, 11, p. 45.

*Paxillus crenatus*, MacLeay, 1819, p. 10; (Paris edition, p. 20).

Several specimens from the Upper Amazon, Guadaloupe, Surinam and Mosquito. Length 17.0-19.5 mm.

This species differs from the last only in having the frontal ridges broadly arcuate, instead of meeting abruptly, in having the anterior extremities of the marginal grooves of the pronotum broader and deeper, and in having the metasternum and elytra somewhat less strongly punctured.

The above mentioned species of *Paxillus* may be recognized from one another, as follows:—

- |   |   |   |                                 |
|---|---|---|---------------------------------|
| 1 | { | Much flattened insects, with the clypeus more or less exposed     | 2.                              |
|   |   | More robust insects, with the clypeus entirely hidden             | 5.                              |
| 2 | { | The outer tubercles short and blunt, not directed forwards        |                                 |
|   |   | above the clypeus .. .. .   | 3.                              |
|   |   | The outer tubercles long and slender in unworn specimens,         |                                 |
|   |   | directed forwards above the angles of the clypeus which           |                                 |
|   |   | they tend to obscure .. .. .                                      | 4.                              |
| 3 | { | The frontal ridges meeting in a strongly obtuse angle; the        |                                 |
|   |   | posterior angles of the pronotum, and the shoulders of the        |                                 |
|   |   | elytra, densely covered beneath with long yellowish hair          | <i>P. camerani</i> , p. 48.     |
|   |   | The frontal ridges meeting in a right angle; the posterior angles |                                 |
|   |   | of the pronotum, and the shoulders of the elytra, less hairy      |                                 |
|   |   | beneath .. .. .   | <i>P. brasiliensis</i> , p. 49. |

- |   |   |  |                                 |
|---|---|--|---------------------------------|
| 4 | } | The ends of the antennal lamellae in a strongly curved line when furled; the anterior margin of the head unpunctured                             | <i>P. pentaphyllus</i> , p. 49. |
|   |   | The ends of the antennal lamellae in a straight line when furled; the anterior margin of the head coarsely punctured between the outer tubercles | <i>P. leachii</i> , p. 49.      |
| 5 | } | The frontal ridges straight, arising at right angles to each other   | <i>P. robustus</i> , p. 50.     |
|   |   | The frontal ridges together forming a crescent   | <i>P. crenatus</i> , p. 50.     |

Genus **PASSALUS**, Fabricius, 1792, p. 240.

= *Neleus nec Passalus*, Kaup, etc. (see Zang, 1905c, pp. 224 and 226).

Incl. \**Epiphanus*+*Eumelus*+*Lucilius*+*Mitrorhinus*<sup>1</sup>+\**Neleides*+\**Ninus* (= *Scalmus*, Zang) + \**Pertinax*+\**Petrejus*+\**Phoroneus* (= *Macrolobus*, Zang) + *Rhagonocerus*+\**Rhodocanthopus* + *Stephanocephalus*<sup>1</sup> + \**Vatinius* (= *Zosterothrix*, Zang), Kaup. Also \**Aponeleides*+*Cassius*+*Epipertinax*+\**Flavius* (= *Lasioperix*, Zang), + *Lophocephalus*+*Manlius* + *Microthorax* (= *Phaulothorax*, Zang) + \**Morosophus*+\**Neleuops* + *Ninoides* + *Oeneus* + *Parapertinax* + \**Pertinacides* + *Phanocles* (= *Psilomus*, Zang) + \**Phoronaeosomus* + *Polyacanthopus*+\**Ptychotrichus* (= *Epipleurothrix*, Zang) + *Severus*+*Synesius*+\**Tetraracrus*+*Thryptocerus* (= *Alococerus*, Zang) + *Toxeutotaenius*+\**Trichopleurus*+*Valerius*, Kuwert. Also \**Epiphoroneus*, Arrow.

Type, *Lucanus interruptus*, Linnaeus, 1767, p. 560.<sup>2</sup>

It seems probable, and has been assumed in the above synonymy, that all genera belonging to Kuwert's subfamilies Rhodocanthopinae, Neleidinae, Pertinacinae, Pleurariinae (except *Pleurarius* which belongs to the Indo-Australian Series), Phoronaeinae, Petrejinae, Vatiniinae and Neleinae should be included in this complex and heterogeneous genus; but I have been able to confirm this by reference to specimens only in the case of the genera marked with an asterisk (\*). The genus *Prosoclitus*, Bates, has been omitted because I think, judging from Bates' description, which is all that Kuwert also had to go upon, that Bates was probably right in regarding the species for which he founded it as closely allied to the genus *Proculejus*.

One of Kaup's species of *Proculejus*, *P. quitensis*, was rightly removed by Kuwert to one of his subfamilies here included in the genus *Passalus*; but the genus *Prosoclitus*, in which he placed it, is probably allied to if not identical with *Proculejus*, not *Passalus*. *P. quitensis* differs from all other species of *Passalus* known to me in having the elytra united; but, if this character is to be regarded as in itself sufficient to warrant the separation of the species possessing it into special genera, new genera will be required for one of the four described species of *Vindex*, and for each of two species that otherwise fall into two widely separated divisions of the genus *Macrolinus*. This multiplication of small genera seems to me undesirable, although I have found it convenient to retain the already existing small flightless genera *Platyverres* and *Publius*, instead of uniting them

<sup>1</sup> See above, pp. 10-11.

<sup>2</sup> This is the reference usually given, but is not the earliest description. See below, p. 63, footnote.

with *Verres* and *Veturius* respectively, as would have been more consistent. *Proculejus quitensis* consequently becomes *Passalus quitensis*.

In spite of the complex manner in which various specific characters are intermingled, the species of *Passalus* can be arranged in a series leading up from forms with the margin of the head between the outer tubercles straight or faintly notched in the middle line, the inner and outer tubercles usually more or less widely separated, and the lateral areas of the metasternum usually narrow, smooth and hairless, to forms with the margin of the head abruptly emarginate in the middle line, the inner and outer tubercles in contact with one another, together forming an oblique edge, and the lateral areas of the metasternum broad, punctured and hairy. The following descriptions have been placed in this order.

### **Passalus nanus** (Kuwert).

*Rhodocanthopus nanus*, Kuwert, 1898, p. 139.

One or two specimens from each of the following localities—Guatemala, Ecuador, and the Cauca Valley in Columbia. Length 15.3–17.7 mm.

This species is very like *Paxillus robustus*, but its antennae have only three well developed lamellae, its frontal ridges are apt to be more denticulate (especially in Columbian specimens), its eyes are smaller and less prominent, its pronotum and elytra are much more coarsely punctured, the punctures in the lateral grooves of the elytra being more or less distinctly transverse, and its intermediate and hind tibiae are still more strongly spined. The epipleura are unpunctured and hairless as in *Paxillus robustus*.

### **Passalus rugosus**, n. sp.

Fig. VII, 1.

Three specimens from the Cauca Valley, Columbia. Length 21.0–21.8 mm.

The central tubercle is relatively nearer to the anterior margin of the head than in *P. nanus*, the frontal ridges consequently diverging in a more obtuse angle. The sides of the pronotum are very coarsely punctured, but there are no coarse punctures nearer the middle as in *C. nanus*, nor are there any on the central area of the metasternum as in that species. The grooves of the elytra are even more strongly punctured than in *C. nanus*, the punctures in the lateral grooves being distinctly transverse. The epipleura are punctured and hairy. In other respects this species resembles *P. nanus*.

### **Passalus punctato-striatus**, Percheron.

Fig. VII, 2.

*Passalus punctato striatus*, Percheron, 1835, pp. 78-79, pl. vi, fig. 1.

A large number of specimens from Guatemala and Mexico, some of the latter being from Oaxaca; a few from San Salvador, Honduras (San Pedro Sula), Nicaragua, Columbia and Surinam. Length 20.3–28.3 mm., relative breadth extremely variable; the distance between the inner and outer tubercles, and other characters, also variable to some extent.

This species differs from the last only in having the frontal area slightly larger, the pronotum and the grooves of the elytra less coarsely punctured, the epipleura unpunctured

and hairless, and the middle and hind tibiae usually unspined or nearly so.<sup>1</sup> The difference is most marked as regards the punctures in the dorsal grooves of the elytra, those in the pair of grooves nearest the suture being almost impunctate in most specimens of the present species.

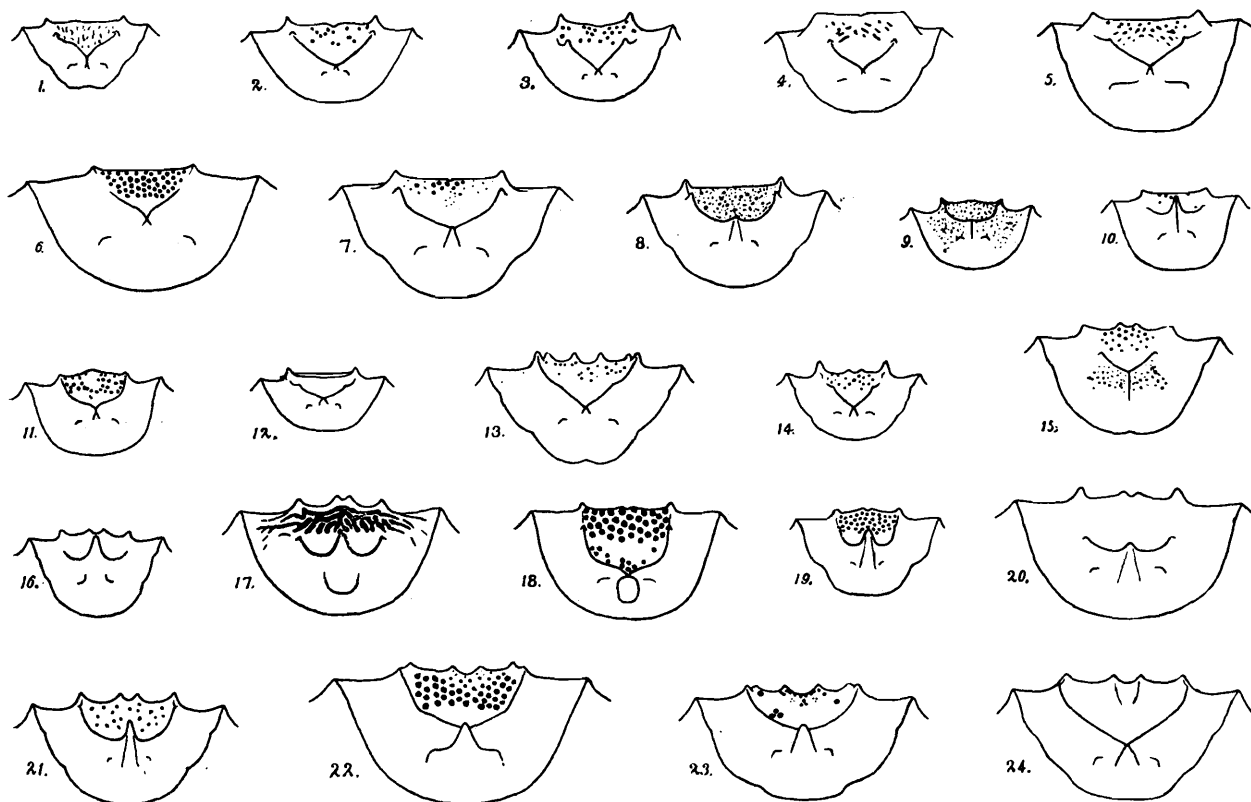


FIG. VII.

*Passalus* spp. ; specific characters in the upper surface of the head  $\times 4$ .

- |   |   |
|---|---|
| 1. <i>P. rugosus</i> , Gravelly.            | 13. <i>P. interstitialis</i> , Eschscholtz. |
| 2. <i>P. punctato-striatus</i> , Percheron. | 14. <i>P. spinipes</i> , Gravelly.          |
| 3. <i>P. rhodocanthopoides</i> (Kuwert).    | 15. <i>P. abortivus</i> , Percheron.        |
| 4. <i>P. morio</i> , Percheron.             | 16. <i>P. mucronatus</i> , Burmeister.      |
| 5. <i>P. latifrons</i> , Percheron.         | 17. <i>P. quadricollis</i> Eschscholtz.     |
| 6. <i>P. pertyi</i> (Kaup).                 | 18. <i>P. occipitalis</i> , Eschscholtz.    |
| 7. <i>P. quitensis</i> (Kaup).              | 19. <i>P. nasutus</i> , Percheron.          |
| 8. <i>P. catherinae</i> , Gravelly.         | 20. <i>P. polli</i> , Gravelly.             |
| 9. <i>P. eucadorensis</i> , Gravelly.       | 21. <i>P. punctatissimus</i> , Eschscholtz. |
| 10. <i>P. curtus</i> (Kaup).                | 22. <i>P. opacus</i> , Gravelly.            |
| 11. <i>P. prominens</i> , Gravelly.         | 23. <i>P. glaber</i> , Gravelly.            |
| 12. <i>P. guatemalensis</i> (Kaup).         | 24. <i>P. erosus</i> , Truqui.              |

### ***Passalus rhodocanthopoides* (Kuwert).**

Fig. VII. 3.

*Neleuops rhodocanthopoides*, Kuwert, 1898, pp. 142-143.

Several specimens from Peru (Cumbasa and the Amazon region). Length 24-25 mm.

A somewhat flatter insect than the preceding, with the inner tubercles situated almost vertically behind the outer tubercles but separated from them by a well marked concavity. The posterior intermediate areas of the metasternum are coarsely punctured,

<sup>1</sup> One of the Mexican specimens has numerous small spines on these tibiae, and the Columbian specimen has them numerous and very strong. The latter specimen has the elytra more coarsely punctured than any other that I have seen and may prove to belong to a different species.

the lateral areas are hairy and punctured, as are also the epipleura and the shoulders and anterior half of the lower margin of the elytra. In other respects this species resembles the preceding one.

**Passalus morio**, Percheron.

Fig. VII, 4, p. 53.

*Passalus morio*, Percheron, 1835, pp. 83-84, pl. vi, fig. 4.

Sixteen specimens from Brazil (Espirito-Santo, Bahia, Blumenau, Rio). Length 10-27.5 mm.

This species is somewhat more convex than either of the two preceding. The length of the antennal lamellae is somewhat variable.

The head is very like that of *P. rhodocanthopoides*, but the outer tubercles are very obtuse, the anterior margin is somewhat thickened, the frontal area behind this thickening is flat with no special depression between the inner and outer tubercles, and the inner tubercles are situated much nearer together than the outer. The punctures on the pronotum are usually confined to the scars and marginal grooves, but may be absent from the former or may extend beyond them. The mesosternal scars are represented only by triangular matt areas which are not sunk below the level of the surrounding surface. The posterior intermediate areas of the metasternum are as a rule strongly punctured; the lateral areas are more or less linear, smooth or slightly roughened, with or without hair-bearing punctures. The epipleura are hairless and unpunctured, the puncturing of the elytra in this and other respects resembling that of *P. punctato-striatus*. The armature of the middle and hind tibiae is variable, never as strong as in *P. rugosus*.

**Passalus latifrons**, Percheron.

Fig. VII, 5, p. 53.

*Passalus latifrons*, Percheron, 1841, pp. 32-33, pl. lxxix, fig. 1.

Three specimens from Surinam, length 30.6-32.1 mm.

*P. latifrons* is very like *P. morio*, and will perhaps prove to be no more than a local race of it. The outer tubercles are more prominent and consequently less obtuse; the inner tubercles are less distinct; the frontal ridges diverge at a more obtuse angle and extend more distinctly beyond the latter towards the former. The anterior angles of the pronotum are produced forwards to form a somewhat obscure but distinctly acute projection. The punctures in the pronotal scars and on the posterior intermediate areas of the metasternum are few in number in all our specimens, and the lateral areas of the metasternum are smooth and hairless. The mesosternal scars are entirely absent.

**Passalus pertyi** (Kaup).

Fig. VII, 6, p. 53.

*Pertinax pertyi*, Kaup, 1869, p. 22.

Two specimens without locality labels. Length 39.0-41.5 mm.

The frontal area is smaller in all directions than in *P. latifrons* and more densely punctured in front. The inner tubercles are obsolete and the frontal ridges do not reach the outer tubercles. The anterior angles of the pronotum are strongly rounded. The

posterior intermediate areas of the metasternum are more extensively punctured than in *P. latifrons*, which the present species resembles in other respects.

**Passalus convexus**, Schönherr.

*Passalus convexus*, Schönherr, 1817, p. 333, and appendix pp. 142-143.

Ten specimens from Cumbase (Peru), Tejuca, Upper Amazon, and Amazonas. Length 38.0-43.7 mm.

This species, like the last, is closely allied to *Passalus latifrons*, from which it differs only in its larger size, in not having the frontal ridges continued beyond the inner tubercles, in having less prominent outer tubercles, and in having the anterior angles of the pronotum more or less rounded.

**Passalus quitensis** (Kaup).

Fig. VII, 7, p. 53.

*Proculejus quitensis*, Kaup, 1871, pp. 63-64.

Described from a cotype from Quito, lent by the British Museum. Length 32 mm.

In addition to its rounded pronotum and fused and rounded elytra *Passalus quitensis* differs from *P. convexus* in having the inner tubercles directly behind and much nearer to the outer tubercles, in having curved instead of straight frontal ridges, in having well developed mesosternal scars, and in having the posterior intermediate areas of the metasternum strongly and extensively punctured.

**Passalus affinis**, Percheron.

*Passalus affinis*, Percheron, 1835, pp. 72-73, pl. v, fig. 5.

Several specimens from Cuba, three from St. Domingo and one from Haiti. Length 37.5-42.0 mm. Relative breadth very variable.

The frontal area resembles that of *P. quitensis*, but is more closely and extensively punctured in front, while the inner and outer tubercles are contiguous, together forming a pair of more or less oblique ridges on the anterior margin of the head, as in *P. interruptus*, etc. The mesosternal scars are well developed; the posterior intermediate areas of the metasternum are coarsely and extensively punctured. The lateral areas of the metasternum, the epipleura and the shoulders of the elytra are punctured and hairy. In other respects this species resembles *P. convexus*.

**Passalus catharinae**, n. sp.

Fig. VII, 8, p. 53.

One specimen from Santa Catharina and one from Chaco. Length 31-33 mm.

The head is very like that of *P. affinis*, but the frontal ridges and all the tubercles are more strongly elevated, the broad and rectangular or obtuse apex of the central tubercle slightly overhanging the frontal area, which is more or less sparsely punctured. There are a few strong punctures above the pronotal scars. The posterior intermediate areas of the metasternum bear a few coalescent punctures along the inner margin; the lateral areas are linear, hairless and unpunctured. The elytra resemble those of *P. affinis* except that the dorsal ridges are less and the lateral more coarsely punctured, the three grooves

nearest the suture being unpunctured, the fourth containing more or less obsolete punctures, the fifth and sixth containing strong round punctures, and the seventh, eighth and ninth containing larger and more or less transverse punctures. In other respects this species resembles *P. affinis*.

**Passalus recticlypeatus** (Kuwert).

*Petrejus recticlypeatus*, Kuwert, 1898, p. 202.

Four specimens, without locality record. Length 23.3–24.7 mm.

This species is very like the preceding one, but is smaller and has the apex of the central tubercle acute, free and directed forwards above the finely roughened but unpunctured frontal area, the inner tubercles being obsolete or absent. The posterior intermediate areas of the metasternum are almost or quite unpunctured; the lateral areas are more or less rugose and bear a few fine hairs. The lateral grooves of the elytra, though much more strongly punctured than the dorsal, are less strongly punctured than in *Passalus catherinae*, which this species resembles in other respects.

**Passalus eucadorensis**, n. sp.

Fig. VII, 9, p. 53.

One specimen from Ecuador, 20.4 mm. long.

In this species the cephalic tubercles and ridges resemble those of *P. catherinae*, except that the central tubercle is weaker; otherwise the insect resembles *P. recticlypeatus*, except that the anterior margin of the head is slightly prominent in the middle line, and that the metasternum and elytra are entirely hairless.

**Passalus curtus** (Kaup).

Fig. VII, 10, p. 53.

*Petrejus curtus*, Kaup, 1869, p. 38.

One specimen from the Cauca Valley, 23.3 mm. long.

The free apex of the central tubercle is longer than in *P. recticlypeatus*, but the frontal ridges are less strongly elevated and become obsolete in front. The frontal area is irregularly marked with coarse punctures. The sides of the pronotum and the posterior intermediate areas of the metasternum are somewhat more extensively punctured. The mesosternal scars and the lateral areas of the metasternum are finely punctured and hairy. The epipleura are without, and the shoulders of the elytra almost without, hair-bearing punctures. The puncturing of the dorsal grooves of the elytra is about as coarse as that of the lateral grooves. In other respects this species resembles *P. recticlypeatus*.

**Passalus gracilis** (Kaup).

*Petrejus gracilis*, Kaup, 1869, p. 38.

One specimen from Columbia, 16.5 mm. long.

A much smaller species than the preceding, with more flattened central tubercle, conical forwardly directed parietal ridges, somewhat more distinct frontal ridges, smooth



unpunctured frontal area, hairless mesosternal scars, metasternal lateral areas and elytra-shoulders, and less coarsely punctured dorsal grooves on the elytra.

***Passalus prominens*, n. sp.**

Fig. VII, 11, p. 53.

One specimen from the Peruvian Amazon, 22 mm. long, and somewhat convex.

The anterior margin of the head is slightly prominent as in *P. eucadorensis*, forming an obtuse angle in the middle line ; but the frontal area is larger, being quite half as long as it is wide in front, and its general surface is smooth and somewhat sparsely marked with large punctures instead of being finely roughened all over. The central tubercle is laterally compressed, with an antero-posteriorly obtuse apex situated behind the junction of the frontal ridges. The frontal tubercles are obsolete. In other respects this species resembles *P. gracilis*, except that the anterior angles of the pronotum are more acute and the posterior angles (like the hind part of the posterior intermediate areas of the metasternum) are somewhat densely punctured, the anterior ends of the marginal grooves being densely punctured and strongly enlarged.

***Passalus guatemalensis* (Kaup).**

Fig. VII, 12, p. 53.

*Oileus guatemalensis*, Kaup, 1869, p. 6.

Three specimens from Nicaragua, 19.6–20.3 mm. long.

*Passalus guatemalensis* differs from all other species of *Passalus* known to me in having a vertical and more or less conspicuously exposed clypeus. It should perhaps be regarded as the type of a distinct genus allied to *Vindex*, but such a course would hardly be justifiable at present.

*P. guatemalensis* is a somewhat flatter insect than the last, with a more or less punctured obtuse-angled frontal area, the frontal tubercles being situated about half way between the less prominent central and more prominent outer tubercles. The margin of the head between the outer tubercles is straight, with or without a median notch. The sides of the pronotum are somewhat rounded, and the anterior angles are not acute ; the median groove is complete, and the anterior ends of the marginal grooves are scarcely enlarged or punctured ; the scars are transverse and punctured, with a longitudinal band of punctures above them. In other respects this species resembles *P. prominens*, except that the punctures on the posterior intermediate areas of the metasternum are more widely dispersed.

***Passalus incertus*, Percheron.**

*Passalus incertus*, Percheron, 1841, pp. 27-28, pl. lxxviii, fig. 4.

Six specimens from the Cauca Valley, and one from Venezuela. Length 19.4–24.3 mm.

A slender and somewhat flattened insect, differing from the last only in having the clypeus entirely hidden, the median notch of the anterior margin of the head sometimes

very pronounced, the frontal area more or less rugose but unpunctured, the frontal ridges strongly arched, the inner and outer tubercles nearer together, the anterior ends of the marginal grooves of the pronotum more strongly dilated and punctured, the sides of the pronotum more extensively punctured in small and less in large specimens, the posterior intermediate areas of the metasternum less strongly and extensively punctured, the grooves of the elytra somewhat more strongly punctured, and the shoulders and epipleura punctured and hairy. The spines on the middle tibiae are variable in number; in none of our specimens are they very strong.

**Passalus interstitialis, Eschscholtz.**

Fig. VII, 13, p. 53.

*Passalus interstitialis*, Eschscholtz, 1829, pp. 18-19.

One or more (often numerous) specimens from each of the following localities:—Mexico, Guatemala, Honduras (San Pedro Sula), Panama (Chiriqui), Cuba, Surinam, Peru (Cumbase and Amazon), Brazil (Amazonas, Pernambuco, Bahia, Rio and Blumenau), Bolivia (Cordico and Farinas) and Paraguay. Length 24–34 mm.

The anterior margin of the head is much more extensively notched in the middle line than in the preceding species, and the notch is bounded by a pair of very prominent tubercles. These tubercles are fully as strong as the outer tubercles, which are somewhat small and are more or less obscured by the inner tubercles, the latter being very long and projecting from a point contiguous to and a little behind and on the outer side of them. From the inner tubercles the imperfectly denticulate frontal ridges extend in a straight line backwards and inwards to meet in a right or slightly obtuse angle. The anterior part of the frontal area is more or less punctured.

The pronotum resembles that of the preceding species in shape and is more or less extensively punctured at the sides, but the anterior ends of the marginal grooves are not expanded. The mesothorax is normal. The posterior intermediate areas of the metasternum are closely and coarsely punctured; the lateral areas are moderately broad and are covered with hair-bearing punctures. The dorsal grooves of the elytra are strongly but finely punctured, the lateral grooves are coarsely punctured. The epipleura shoulders and anterior half or two-thirds of the outermost rib of the elytra are thickly covered with hair-bearing punctures. The middle tibiae are armed with one stout spine.

**Passalus glaberrimus, Eschscholtz.**

*Passalus glaberrimus*, Eschscholtz, 1829, p. 20.

Four specimens, of which three are from Brazil (Blumenau and Rio), and one bears no record. Length 20 mm.

*Passalus glaberrimus* is very like *P. incertus*, but has the anterior margin of the head more definitely notched than is usual in that species, the sides of the pronotum usually more extensively punctured, the anterior angles of the pronotum somewhat more acute and the elytra devoid of hair-bearing punctures.

**Passalus spinosus** (Kuwert).

*Rhodocanthopus incertus*, Kuwert, 1898, p. 140.

Two specimens from Chiriqui, Panama, 20.3 mm. long. A somewhat more robust insect than the preceding.

The frontal ridges are straight and meet in a right angle; the inner tubercles are situated about half way from the central to the outer tubercles and there is a pair of small secondary tubercles between them and the latter; the anterior margin of the head is broadly notched in the middle; the anterior part of the frontal area is moderately strongly punctured. The pronotum resembles that of *P. incertus* in shape, but is only punctured in and close to the scars and in the marginal grooves, whose anterior ends are smaller. The mesothorax resembles that of *P. incertus*. The metasternum differs from that of *P. incertus* only in having the lateral areas somewhat broader and less smooth behind. The elytra are hairless; their four dorsal grooves are about as strongly punctured as in *P. incertus*; the next four are marked with very large transverse punctures, the transverse ridges between which tend to become obsolete behind. In the two remaining grooves these ridges are obsolete throughout, and at the extreme posterior end the longitudinal ridges become obsolete also, the remaining surface being matt. The middle and hind tibiae are armed with three or four strong spines.

**Passalus spinipes**, n. sp.

Fig. VII, 14, p. 53.

One specimen from Nicaragua, 22.7 mm. long.

This species is closely allied to *P. spinosus*, but the inner tubercles and the secondary tubercles in front of them are less pronounced, the sides of the pronotum bear a longitudinal band of punctures above the scars, the posterior intermediate areas of the metasternum are less extensively punctured, the lateral areas are extremely narrow throughout, the punctures in the grooves of the elytra are finer, those in the lateral grooves though moderately coarse not being transverse.

**Passalus spiniger** (Bates).

*Rhodocanthopus spiniger*, Bates, 1886, pp. 15-16, pl. 1, figs. 16-16a.

One specimen from Columbia, 22 mm. long.

This species is very like the last two, but the anterior margin of the head is less broadly and perhaps more sharply notched, the frontal area is scarcely as long or as distinctly punctured, there are no secondary tubercles between the inner and outer tubercles, the sides of the pronotum are more coarsely and extensively punctured, the lateral areas of the metasternum are intermediate between the two in width, and the puncturing of the grooves of the elytra is somewhat coarser than in *P. spinosus* above and less coarse (scarcely if at all transverse) at the sides, all the transverse ridges being distinct and broadly elevated as in *P. spinipes*.

**Passalus abortivus**, Percheron.

Fig. VII, 15, p. 53.

*Passalus abortivus*, Percheron, 1835, pp. 87-89, pl. vi, fig. 7.

Three specimens from the Amazon, of which at least two are from Peru. Length 28.0-28.3 mm. long. One specimen with deformed antennae.

This species differs from all other species of *Passalus* known to me in sometimes having a distinct lamella in front of the three ordinarily found on the antennae of species of this genus. This lamella, however, is not fully developed as are the additional lamellae found in the genus *Paxillus*, but is either much slenderer than those following it as well as only about half their length, or is quite short and inconspicuous.<sup>1</sup> The anterior margin of the head bears a pair of small but well developed tubercles on either side of the median notch, which is consequently much more pronounced than is ever the case in *Paxillus*. The cephalic tubercles and ridges closely resemble those of *Passalus spiniger*. The pronotum resembles that of *P. spiniger* in shape, but is unpunctured except in the scars and marginal grooves. An oval patch a little below the middle of the mesothoracic episterna, the mesosternal scars, the lateral areas of the metasternum, and the lower parts of the shoulders of the elytra (but not the epipleura) are covered with hair-bearing punctures. The posterior intermediate areas of the metasternum are coarsely punctured behind and on the inner side. The elytra are strongly and uniformly punctured. The middle and hind tibiae bear from one to three spines which are stronger on the former than on the latter.

**Passalus jansonii** (Bates).*Phoroneus jansonii*, Bates, 1886, p. 18, pl. i, figs. 17-17a.

One specimen from Nicaragua, 32 mm. long.

This species is very like the last, but the triconcave margin of the head between the outer tubercles is thickened and lightly convex as a whole; the frontal area and the pronotum (even in the scars and anteriorly weak marginal grooves) are unpunctured; the mesothoracic episterna, the mesosternal scars, the metasternum and the elytra are hairless, the second and third being entirely unpunctured, and the last being punctured in the lateral grooves only; and there are no very distinct spines on the middle and hind tibiae.

**Passalus mucronatus**, Burmeister.

Fig. VII, 16, p. 53.

*Passalus mucronatus*, Burmeister, 1847, pp. 488-489.

One specimen from Columbia and one from Guatemala. Length 24 mm.

The head and pronotum resemble those of the preceding species in outline, but the central tubercle is much elongated with free decumbent apex, the frontal ridges are feebly developed, the anterior margin of the head is not thickened, and the sides of the pronotum, including the scars and anteriorly enlarged marginal grooves, are strongly punctured. The

<sup>1</sup> In one of our two specimens in which the antennae are not deformed it is slender and about half the length of the others; in the other it is scarcely if at all different from the enlargement often found in the same position in other species.

mesothorax is normal. There are a number of coarse punctures on the posterior intermediate areas of the metasternum, the lateral areas being linear, smooth and hairless. The anterior intermediate areas of the metasternum, and the shoulders of the elytra with the anterior parts of the epipleura, are covered with hair-bearing punctures, the shoulders of the elytra being densely hairy. All the grooves of the elytra are distinctly punctured, the lateral scarcely more strongly than the dorsal. The middle and hind tibiae are without distinct spines.

***Passalus quadricollis*, Eschscholtz.**

Fig. VII, 17, p. 53.

*Passalus quadricollis*, Eschscholtz, 1892, pp. 21-22.

*Phoroneus quadricollis*, Kaup, 1871, p. 102.

Two specimens from Brazil, one of them in the collection of M. Guy Babault of Paris. Length 33 mm.

The central tubercle is set further back than in *P. mucronatus* and the free apex extends forwards horizontally at right angles to the massive base by which it is raised high above the large and coarsely rugose frontal area. The frontal ridges and inner tubercles are more strongly developed than in *P. mucronatus*. The pronotum resembles that of *P. mucronatus*, except that the punctures are confined to the scars and marginal grooves, those in the former being of very large size. The mesosternal scars are matt, but are not depressed. The inner angles of the posterior intermediate areas of the metasternum are marked with very large and more or less coalescent punctures; the anterior intermediate and lateral areas of the metasternum and the shoulders of the elytra are covered with hair-bearing punctures. The grooves of the elytra are marked with shallow punctures which are very broad in the lateral grooves. The middle tibiae bear a stout spine on the outer side.

***Passalus occipitalis*, Eschscholtz, 1829.**

Fig. VII, 18, p. 53.

*Passalus occipitalis*, Eschscholtz, 1829, p. 21.

One specimen 33 mm. long. Locality not recorded.

This species is closely related to the last, but the massive central tubercle is set still further back and has no free horizontal apex. The frontal ridges diverge at about a right angle and then bend forwards and run parallel to one another as far as the inner tubercles, which are situated not very far behind the outer. The anterior margin of the head, though straight as a whole, is a little irregular; it is not distinctly notched in our specimen;<sup>1</sup> the whole anterior part of the frontal area is thickly covered with large punctures. The whole of the thorax resembles that of *P. quadricollis*, except that the mesothoracic scars are to some extent depressed, and the punctures in the inner angles of the posterior intermediate areas of the metasternum are much smaller. The elytra are punctured as in that species in the lateral grooves, more finely or not at all in the dorsal ones. The legs resemble those of that species.

<sup>1</sup> See also, however, Arrow, 1907, pp. 459-460.

**Passalus nasutus**, Percheron.

Fig. VII, 19, p. 53.

*Passalus nasutus*, Percheron, 1835, pp. 90-91, pl. vi, fig. 8.

One specimen from Parana, 24.4 mm. long.

This species resembles the preceding, but is much smaller; the central tubercle is conical, free distally and directed forwards and a little upwards; the pronotum has less acute anterior angles and somewhat more numerous punctures in the scars; the epipleura and shoulders of the elytra are densely covered with hair-bearing punctures; the grooves of the elytra are punctured much as in *P. quadricollis*.

**Passalus polli**, n. sp.

Fig. VII, 20, p. 53.

One specimen from Joinville, 34.5 mm. long.

*Passalus polli* is much larger than *P. nasutus* and has a smaller central tubercle situated somewhat further forwards, whose apex is scarcely free. The frontal ridges are small and extend almost directly outwards, then arching slightly forwards to end in the inner tubercles, which are equidistant from the central and outer tubercles; the whole surface of the head in front of the inner tubercles is rugose and glossy. The anterior ends of the marginal grooves are somewhat curved but scarcely expanded. The mesosternal scars are depressed and covered with moderately large, indistinct, coalescent punctures. The posterior intermediate areas of the metasternum are closely covered with coarse punctures; the lateral areas are very broad, especially behind, and are covered with hair-bearing punctures. The puncturing of the grooves of the elytra resembles that of *P. quadricollis*, but is somewhat deeper laterally; the shoulders, epipleura and anterior half of the rib immediately above each of the thickened lateral margins are covered with hair-bearing punctures. The middle and hind tibiae are each armed with one stout spine.

**Passalus toriferus**, Eschscholtz.*Passalus toriferus*, Eschscholtz, 1829, pp. 17-18.

Three specimens from Brazil, one from Yucatan, and one said (no doubt incorrectly) to come from S. Australia. Length 28-34 mm.

This species differs from the last only in having the anterior part of the head less rugose (the frontal area sometimes punctured), the inner tubercles situated close behind and slightly on the outer side of the outer tubercles, the sides of the pronotum strongly and coarsely punctured at least near the scars, and the extreme anterior part of the eighth groove of the elytra hairy. The central tubercle is very variable and may be distinctly or not at all free distally.

**Passalus punctatissimus**, Eschscholtz.

Fig. VII, 21, p. 53.

*Passalus punctatissimus*, Eschscholtz, 1829, pp. 19-20.

A number of specimens from the Peruvian and Upper Amazon, two from Rio and one from Blumenau. Length 26.5-30.0 mm. Also one specimen 34.2 mm. long, said to

come from Queensland. This specimen has hairy mesosternal scars and may belong to a distinct species.

*Passalus punctatissimus* differs from *P. toriferus* chiefly in having all the cephalic tubercles longer and more acute, and in not having the eighth groove of the elytra hairy in front. The frontal area may be partially or not at all punctured. The anterior ends of the marginal grooves of the pronotum are not expanded but may be somewhat curved. The pronotum is sometimes wider in front than behind, with acutely produced anterior angles.<sup>1</sup> The outermost rib of the elytra is sometimes hairy throughout instead of only in its anterior half.<sup>2</sup> The last two variations may perhaps indicate a tendency for the species to split up into various local races, but more material is needed to settle this.

### **Passalus unicornis**, Saint-Fargeau and Serville.

*Passalus unicornis*, Saint-Fargeau and Serville, 1825, p. 20.

Six specimens from Guadeloupe, 38.5–42.0 mm. long.

The central tubercle is extremely long and slender, much more so than in the preceding species, but the other cephalic tubercles are much less prominent and more obtuse than in that species. The pronotum is unpunctured, except in the uniformly narrow marginal grooves, and in and close to the scars. The epipleura, shoulders, tips, and eighth and tenth (usually also the ninth to a less extent) ribs of the elytra are covered with hair-bearing punctures.

### **Passalus opacus**, n. sp.

Fig. VII, 22, p. 53.

One specimen from Farinas, Bolivia, 39.5 mm. long.

The whole surface of this insect is dull as in *P. languidus* (Kuwert, 1898, p. 275), from which it differs in having all the grooves of the elytra much more strongly punctured. Apart from its dulled surface *P. opacus* differs from *P. unicornis* in having the head more rugose with a much shorter central tubercle, the sides of the pronotum more extensively punctured, the marginal grooves of the pronotum very broad in front of the scars, the mesosternal scars indistinct, no hair on the ribs of the elytra above or behind the extreme anterior part of the tenth, and all the grooves of the elytra much more coarsely punctured, the punctures in the lateral grooves being transverse.

### **Passalus interruptus** (Linnaeus).

*Lucanus interruptus*, Linnaeus, 1767, p. 560.<sup>3</sup>

One or more (often numerous) specimens from each of the following localities:—Texas, Mexico, Guatemala (including one specimen from Escuintla), Honduras (San Pedro Sula), Nicaragua, Panama (Chiriqui), Columbia, Venezuela (Caracas), Guiana (Demerara, Surinam, Cayenne), Peruvian Amazon, Upper Amazon, Brazil (Amazonas, Pernambuco,

<sup>1</sup> This is most marked in the series from the Upper Amazon.

<sup>2</sup> This is so in the two specimens from the Peruvian Amazon.

<sup>3</sup> This is the reference usually given, but Linnaeus himself described the species at greater length in 1764 (p. 33) and refers there to yet earlier descriptions. I have been unable to consult these and cannot say in which or by whom the name *interruptus* was first introduced.

Bahia, Petropolis, Rio de Janeiro, Santa Catharina, Blumenau) and Bolivia (Farinas and S. Antonia). Length 17-51 mm.

This appears to be a very common, widely distributed and variable species. Large specimens may be as much as three times as long as small ones, are much more robust-looking, have the sides of the pronotum unpunctured except in the scars and marginal grooves instead of extensively punctured, have the dorsal grooves of the elytra smooth instead of distinctly punctured and have the lateral grooves moderately strongly instead of very coarsely punctured.<sup>1</sup> The mesosternal scars are usually deep, narrow and smooth as in *P. unicornis*, but may be larger and more irregular, with or without a few hair-bearing punctures, or the whole of the sides of the mesosternum may be densely covered with hair-bearing punctures. The hair on the elytra is usually distributed as in *P. opacus*, but may be more extensive as in *P. unicornis*.

*P. interruptus* differs from *P. opacus* in having the surface of the body glossy and the punctures in the grooves of the elytra much less coarse, the lateral ones not being transverse. In these characters it resembles *P. unicornis*, from which it differs in having a much shorter central tubercle.

**Passalus glaber**, n. sp.

Fig. VII, 23, p. 53.

One specimen without locality record. Length 37 mm.

This species is very like the last, but has only a few hair-bearing punctures on the elytra, these being confined to the lower parts of the shoulders immediately in front of the epipleura; it has the mesosternal scars replaced by broad matt areas which are not sunk below the general level of the plate; and it has the metasternum somewhat less extensively punctured.

**Passalus binominatus**, Percheron.

*Passalus binominatus*, Percheron, 1841, pp. 23-24.

One specimen from Santa Catharina, 32 mm. long.

The secondary tubercles on the anterior margin of the head are less widely separated, and although the frontal ridges are lightly arched the frontal area is more nearly triangular than semicircular. The central tubercle is obtuse and has no free forwardly directed apex. There are no coarse punctures on the general surface of the pronotum. The mesosternal scars are entirely absent. There are only a few coarse punctures on the inner side of the posterior intermediate areas of the metasternum. In all other respects this species resembles *P. glaber*.

**Passalus erosus**, Truqui.

Fig. VII, 24, p. 53.

*Passalus erosus*, Truqui, 1857, p. 268.

One specimen doubtfully recorded from Brazil, and one said (doubtless incorrectly) to have come from India. Length 35-36 mm.

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<sup>1</sup> The punctures in the lateral grooves are really of about the same size in all specimens; consequently they are proportionally larger and look much coarser in small than in big ones.



This species differs from the last only in the form of the frontal area, which is slightly longer in proportion to its width and is more or less distinctly grooved in continuation of the median notch on the anterior margin.

The species of *Passalus* known to me may be distinguished from one another thus:—

1	{	The punctures in the grooves of the elytra extremely coarse, transverse laterally; the anterior margin of the head straight between the outer tubercles; the lateral areas of the metasternum hairless (small insects only) .. .. .	2.
		The punctures in the grooves of the elytra less coarse, not transverse laterally; or, the anterior margin of the head strongly notched in the middle; or, the lateral areas of the metasternum hairy .. .. .	3.
2	{	The epipleura hairless	<i>P. nanus</i> , p. 52.
		The epipleura hairy	<i>P. rugosus</i> , p. 52.
3	{	The anterior margin of the head straight or simply notched in the middle, without secondary tubercles; the frontal area large, with the central tubercle about half as far from the anterior margin as the outer tubercles are from each other, and with the frontal ridges usually straight and diverging at about a right angle; the central tubercle small, without free apex; the outer tubercles prominent, the inner tubercles usually situated very near them, always nearer to them than to the central tubercle; the lateral areas of the metasternum, and the epipleura and shoulders of the elytra, hairless .. .. .	<i>P. punctato-striatus</i> , p. 52.
		Not as above .. .. .	4.
4	{	The anterior margin of the head straight between the outer tubercles; the clypeus entirely hidden; the central tubercle small with no trace of free apex; the inner tubercles usually much less widely separated than the outer, and when distinct always situated a considerable distance behind them; the frontal ridges straight, not arched, meeting in a distinct though sometimes more or less obtuse angle; the epipleura usually hairless, when hairy the lateral areas of the metasternum always hairy also .. .. .	5.
		Not as above .. .. .	9.
5	{	The inner and outer tubercles equally widely separated, the former situated at a considerable distance behind the latter; the epipleura densely hairy .. .. .	<i>P. rhodocanthopoides</i> , p. 53.
		Not as above .. .. .	6.
6	{	The anterior margin of the head usually somewhat thickened; the outer tubercles obsolete, obtuse; the frontal ridges ending in the inner tubercles, which are very pronounced and are situated about half way between the central and outer tubercles .. .. .	<i>P. morio</i> , p. 54.
		Not as above .. .. .	7.

7	{	The anterior angles of the pronotum produced to form a pair of small but distinctly acute forwardly-directed processes	<i>P. latifrons</i> , p. 54.	
		The anterior angles of the pronotum not so produced	.. ..	8.
8	{	The frontal area small, coarsely and closely punctured in front	<i>P. pertyi</i> , p. 54.	
		The frontal area large, smooth or rugose with a few large punctures in front	.. ..	<i>P. convexus</i> , p. 55.
9	{	The elytra fused, their vertical anterior part lightly convex	<i>P. quitensis</i> , p. 55.	
		The elytra separate, their vertical anterior part not convex	.. ..	10.
10	{	The anterior margin of the head straight between the outer tubercles or very faintly notched in the middle; the lateral areas of the metasternum hairy	<i>P. affinis</i> , p. 55.	
		The anterior margin of the head strongly notched or provided with secondary tubercles between the outer tubercles; or the lateral areas of the metasternum hairless		11.
11	{	The frontal area about three times as wide as long, broadly rounded and not angular behind; the anterior margin of the head straight or lightly convex between the outer tubercles	.. ..	12.
		The frontal area about twice as wide as long, or angular behind; the anterior margin of the head usually notched or provided with secondary tubercles between the outer tubercles	.. ..	16.
12	{	The central tubercle without very long and slender free apex; the frontal ridges strong	.. ..	13.
		The central tubercle with long and slender free apex; the frontal ridges weak	.. ..	15.
13	{	The epipleura hairy, the apex of the central tubercle more or less free	.. ..	14.
		The epipleura hairless; the apex of the central tubercle not free	<i>P. euacadorensis</i> , p. 56.	
14	{	The apex of the central tubercle scarcely free, somewhat blunt	<i>P. catherinae</i> , p. 55.	
		The apex of the central tubercle distinctly free, sharper	.. ..	<i>P. recticlypeatus</i> , p. 56.
15	{	The lateral areas of the metasternum hairy	.. ..	<i>P. curtus</i> , p. 56.
		The lateral areas of the metasternum hairless	.. ..	<i>P. gracilis</i> , p. 56.
16	{	The anterior margin of the head convex between the outer tubercles, but without median notch or secondary tubercles..	<i>P. prominens</i> , p. 57.	
		Not as above	.. ..	17.
17	{	The clypeus to some extent exposed as a more or less vertical (slightly overhanging) plate between the frons and the labrum	.. ..	<i>P. guatemalensis</i> , p. 57.
		The clypeus entirely hidden	.. ..	18.
18	{	The lateral areas of the metasternum hairless; the epipleura hairy throughout; the central tubercle without free apex..	<i>P. incertus</i> , p. 57.	
		Not as above	.. ..	19.

- |    |   |   |                                   |     |
|----|---|---|-----------------------------------|-----|
| 19 | { | The inner tubercles large, directed forwards above the somewhat smaller outer tubercles, close behind the outer side of which they are situated; a pair of well developed and somewhat widely separated secondary tubercles present between the outer tubercles; the frontal ridges straight, meeting in a right or slightly obtuse angle; the lateral areas of the metasternum, and the epipleura, shoulders and anterior parts of the sides of the elytra densely hairy | <i>P. interstitialis</i> , p. 58. |     |
|    |   | Not as above ..   |                                   | 20. |
| 20 | { | The central tubercle small, without free apex, normal; the anterior margin of the head not thickened; the lateral areas of the metasternum hairless   |                                   | 21. |
|    |   | Not as above ..   |                                   | 24. |
| 21 | { | The middle and hind tibiae armed with at most one small spine ..  | <i>P. glaberrimus</i> , p. 58.    |     |
|    |   | The middle and hind tibiae more extensively armed ..  | ..                                | 22. |
| 22 | { | The pronotum punctured only in the marginal grooves and in and immediately above the scars  | <i>P. spinosus</i> , p. 59.       |     |
|    |   | The sides of the pronotum with an extensive band of punctures above the scars   | .. ..                             | 23. |
| 23 | { | The grooves of the elytra somewhat finely punctured   | <i>P. spinipes</i> , p. 59.       |     |
|    |   | The grooves of the elytra very coarsely punctured ..  | <i>P. spiniger</i> , p. 59.       |     |
| 24 | { | The inner and outer tubercles clearly separate; the former never more distant from one another than the latter, sometimes more or less obsolete .. ..   | .. ..                             | 25. |
|    |   | The inner and outer tubercles situated close together, forming together a pair of small oblique ridges on the anterior margin of the head, with the former tubercles somewhat more distant from one another than the latter ..  | .. ..                             | 31. |
| 25 | { | The epipleura hairless, or the central tubercle with free apex  | .. ..                             | 26. |
|    |   | The epipleura densely hairy; the central tubercle without free apex ..  | <i>P. polli</i> , p. 62.          |     |
| 26 | { | The central tubercle without free apex, normal ..   | ..                                | 27. |
|    |   | The central tubercle with free apex, or more or less columnar   | .. ..                             | 28. |
| 27 | { | The lateral areas of the metasternum hairy; a more or less rudimentary fourth lamella often recognizable on the antennae  | <i>P. abortivus</i> , p. 60.      |     |
|    |   | The lateral areas of the metasternum hairless ..  | <i>P. jansoni</i> , p. 60.        |     |
| 28 | { | The frontal area fully twice as broad as long; the central tubercle decumbent throughout, with long slender free apex; the lateral areas of the metasternum hairless ..   | <i>P. macronatus</i> , p. 60.     |     |
|    |   | The frontal area less than twice as broad as long; the lateral areas of the metasternum more or less hairy ..   | .. ..                             | 29. |
| 29 | { | The central tubercle strongly elevated at base, massive, with small decumbent forwardly directed free apex ..   | <i>P. quadricollis</i> , p. 61.   |     |
|    |   | The central tubercle not having this form ..  | .. ..                             | 30. |

30	{	The central tubercle erect, more or less columnar, broadly rounded above .. .. .	<i>P. occipitalis</i> , p. 61.	
		The central tubercle decumbent throughout, with slender free apex .. .. .	<i>P. nasutus</i> , p. 62.	
31	{	The epipleura densely hairy .. .. .		32.
		The epipleura hairless .. .. .		36.
32	{	The general surface glossy; the punctures in the lateral grooves of the elytra coarse but scarcely transverse .. .. .		33.
		The general surface quite dull; the punctures in the lateral grooves of the elytra very coarse, more or less transverse .. .. .	<i>P. opacus</i> , p. 63.	
33	{	The frontal area less than twice as broad as long; the central tubercle without free apex .. .. .	<i>P. toriferus</i> , p. 62.	
		The frontal area more than twice as broad as long; or the central tubercle with free apex .. .. .		34.
34	{	The central tubercle with long and slender free apex .. .. .		35.
		The central tubercle not extensively free .. .. .	<i>P. interruptus</i> , p. 63.	
35	{	The eighth ribs of the elytra hairless and unpunctured throughout .. .. .	<i>P. punctatissimus</i> , p. 62.	
		The eighth ribs of the elytra punctured and hairy, especially in front .. .. .	<i>P. unicornis</i> , p. 63.	
36	{	The frontal area more than twice as broad as long .. .. .	<i>P. glaber</i> , p. 64.	
		The frontal area less than twice as broad as long .. .. .		37.
37	{	The frontal area not grooved in continuation of the median concavity between the secondary tubercles on the anterior margin .. .. .	<i>P. binominatus</i> , p. 64.	
		The frontal area grooved medially in front, in continuation with the concavity between the secondary tubercles on the anterior margin .. .. .	<i>P. erosus</i> , p. 64.	

Genus **PTICHOPUS**, Kaup, 1869, p. 27.

Type, *Passalus angulatus*, Percheron, 1835, pp. 84-86, pl. vi, fig. 5.

**Ptichopus angulatus** (Percheron).

*Passalus angulatus*, Percheron, 1835, pp. 84-86, pl. vi, fig. 5.

Several specimens from Mexico, Guatemala, Honduras (San Pedro Sula), and Nicaragua. Length 24-35 mm. These specimens show the species to be a somewhat variable one, even in the characters used by Kuwert to distinguish others from it; and the validity of species thus distinguished seems very doubtful. The generic definition, therefore will probably suffice for the identification of the present form, which is very unlike any other Passalid known to me.

Subfamily **SOLENOCYCLINAE**.

The characteristics of this subfamily have been discussed and defined above (pp. 10-13). Specimens from Madagascar are characterized by the presence of a pair of more or less pronounced marginal tubercles immediately on the inner side of the fronto-vertical

suture, no tubercles being developed in this position in specimens from Africa. Kuwert has, it is true, described from Madagascar one species of each of his otherwise purely African genera *Erionomus* and *Didimoides*; but it remains to be seen whether he was right. In the case of the former genus the sentence "Der ganze Clypeus in der Breite der ganzen Oberlippe scharf vorgezogen" suggests, for instance, that *studi* may belong in reality to the new genus *Malagasalus*, established below to receive the only species of Solenocyclinae known to me in which the clypeus is exposed, and the pair of marginal tubercles most characteristic of the family as a whole—*i.e.*, those immediately above the lateral extremities of the clypeus—are entirely absent.

None of the Malagasy genera hitherto described contain very many species; and the differences between them may advantageously I think be regarded as specific rather than generic. I propose, therefore, to unite all of them under the name *Solenocyclus*.

Some of the African genera appear to be decidedly larger; but in spite of this I am unable to find satisfactory characters by which to define more than two. I propose, therefore, to unite under the name *Pentalobus*, Kaup, all species with hairy sides to the metasternum and a more or less distinct tubercle or pair of tubercles or excavation in the middle of the anterior margin of the head; and to unite under the name *Erionomus*, Kaup, all species in which the sides of the metasternum are hairless and the middle of the anterior margin of the head is straight.

The genera of Solenocyclinae may now be defined as follows:—

1	{	A more or less distinct pair of marginal tubercles present immediately on the inner side of the fronto-vertical sutures (Malagasy forms)	..	2.
		Tubercles not present in this position (African forms)	..	3.
2	{	The clypeus exposed		<i>Malagasalus</i> , p. 69.
		The clypeus hidden		<i>Solenocyclus</i> , p. 70.
3	{	The sides of the metasternum hairless; the anterior margin of the head more or less distinctly notched in the middle line, or with a median tubercle		<i>Pentalobus</i> , p. 72.
		The sides of the metasternum hairy; the anterior margin of the head without any median notch or tubercle	..	<i>Erionomus</i> , p. 74.

Genus **MALAGASALUS**, n. gen.

Type, *Malagasalus clypeatus*, n. sp.

The clypeus exposed; a pair of marginal tubercles present immediately on the inner side of the fronto-vertical sutures; the sides of the metasternum hairless.

**Malagasalus clypeatus**, n. sp.

Fig. VIII, 1, p. 70.

Two specimens from Fenerive, Madagascar. Length 34 mm.

The antennae each have three well developed lamellae. The labrum is concave in front, convex at the sides, slightly narrower behind than in front. The central tubercle is strongly elevated above the short parietal ridges, but is somewhat obtuse. The frontal ridges diverge from it in an angle of about 90°; they extend to the strongly developed

inner tubercles, which are directed obliquely upwards and are in contact anteriorly with the still larger, but more forwardly directed outer tubercles. The outer tubercles are separated by a distance which is less than the width of the labrum; they are equidistant from each other and from the tubercles on the inner side of the fronto-vertical suture, which are almost equally large. The clypeus is exposed, but is directed almost vertically downwards.

The pronotum is slightly wider behind than in front, and its anterior angles are obtuse. Its anterior margin is straight, and its posterior margin lightly convex. The marginal groove is somewhat widely incomplete in front, and is strongly punctured. The median groove is strong and complete. The scars are punctured, and there may be a few punctures in the anterior angles. The surface of the prothorax is closely punctured and hairy, but the hair is not very long. The mesosternum is smooth and glossy, with large and deeply impressed roughened scars. The anterior intermediate areas of the metasternum are somewhat coarsely and sparsely, and the lateral areas more finely and densely punctured and hairy, the latter being, however, to some extent roughened and hairless behind. A somewhat extensive patch of close, coarse, hairless punctures is present beside the posterior margin of the posterior intermediate areas, and a band of finer hair-bearing punctures extends from behind this patch outwards along the posterior margin to the posterior angles. The elytra are hairless, with the lateral grooves strongly and the dorsal somewhat more weakly punctured.

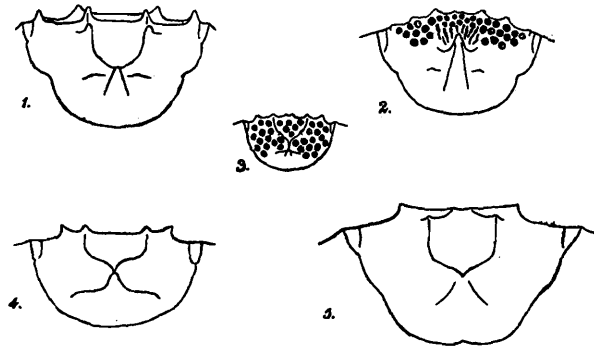


FIG. VIII.

Solenocyclinæ; specific characters in the upper surface of the head  $\times 4$ .

- |  |   |
|--|---|
| 1. <i>Malagasalus clypeatus</i> , Gravely. | 4. <i>Eriomomus trichostigmoides</i> , Gravely. |
| 2. <i>Solenocyclus exaratus</i> (Klug).    | 5. <i>Erionomus planiceps</i> (Eshscholtz).     |
| 3. <i>Pentalobus punctipectis</i> (Kaup).  |   |

Genus **SOLENOCYCLUS**, Kaup, 1868a, p. 10.

Incl. *Ciceronius*+*Semicyclus*, Kaup, 1871. Also *Flaminus*+*Vitellinus*, Kuwert.

Type, *Passalus exaratus*, Klug, 1832, p. 173.

### **Solenocyclus approximatus** (Klug).

*Passalus approximatus*, Klug, 1832, p. 174.

*Passalus approximatus*, Percheron, 1841, pp. 16-17, pl. lxxvii, fig. 5.

Six specimens from Madagascar, five of them being from Fenerive. Length 26.5-29.0 mm.

The clypeus is hidden. The inner tubercles are smaller than in *Malagasalus clypeatus*, and are situated at a greater distance behind the outer tubercles, which are larger.

Between the outer tubercles is a pair of small and more or less closely approximated (sometimes fused) secondary marginal tubercles, and another such tubercle is situated immediately on the outer side of each. The tubercles situated immediately on the inner side of the fronto-vertical suture are somewhat larger than the two pairs of marginal tubercles last referred to, and are widely separated from them, but they are less pronounced than in *Malagassalus clypeatus*. Coarse punctures are scattered all along the sides of the pronotum. The metasternum is practically hairless. In all other respects the present species resembles the preceding one.

### **Solenocyclus morbillosus** (Klug).

*Passalus morbillosus*, Klug, 1832, p. 175.

*Passalus morbillosus*, Percheron, 1841, pp. 18-19, pl. lxxvii, fig. 6.

Eleven specimens from Madagascar, eight being from Fenerive and one (marked "*Ciceronius antanarivae*, Kuw.") from "Antanarivo" (?=Antananarivo). Also two from Andakana, belonging to M. Guy Babault. Length 20.5-24.0 mm. A smaller but more robust insect than the last.

The pair of secondary marginal tubercles situated next to the outer side of the true outer tubercles is distinctly larger than the pair situated close to the fronto-vertical suture, and is situated much nearer to the latter than to the former, which are much larger than either. The margin is often notched medially, and the notch may be bounded by an additional pair of minute secondary tubercles. The frontal ridges diverge at right angles from the low central tubercle and extend direct to the inner tubercles where they bend more or less abruptly and extend parallel to one another, or slightly converging, to the outer tubercles. The general surface of the head is smooth and glossy.

The pronotum is strongly punctured at the sides, and as a rule more or less all over the dorsal surface also. The median groove is strong and complete; the marginal groove is somewhat widely incomplete in front. The mesosternum is more or less coarsely rugose, especially near the lateral sutures; the scars are ill-defined or absent. The metasternum and abdominal sterna resemble those of *S. approximatus*. The grooves of the elytra are almost uniformly punctured.

### **Solenocyclus exaratus** (Klug).

Fig. VIII, 2.

*Passalus exaratus*, Klug, 1832, p. 173.

*Passalus manouffi*, Percheron, 1835, p. 62, pl. iv, fig. 7.

A number of specimens, mostly from Fenerive. Length 28-32 mm.

The outer tubercles, and the three pairs of secondary tubercles on the anterior margin of the head, are all of about equal size and about equidistant from each other, except that the secondary tubercles between the outer tubercles are sometimes weaker than the rest. The central tubercle is very large, with a forwardly directed free apex; the whole surface of the head in front of it is coarsely rugose; the inner tubercles are minute, and are situated close to the base of the central tubercle, and the frontal ridges are absent in front of them.

The pronotum is without strong punctures, except in the lateral parts of the marginal groove and in and beside the scars. Both the marginal and the median grooves are

complete. In other respects this species resembles the preceding one, except that the lateral grooves of the elytra are somewhat more coarsely punctured.

**Solenocyclus grayi** (Kaup).

*Semicyclus grayi*, Kaup, 1871, p. 28.

Five specimens from Madagascar, including two from Andakana sent for identification by M. Guy Babault. Length 30·5–36·0 mm.

The head is smooth and glossy except close behind the anterior margin, where there are a few large and more or less coalescent punctures. The outer tubercles, though obtuse, are distinctly larger than in *S. exaratus*, and there are no secondary tubercles between them. The free apex of the central tubercle is much larger than in *S. exaratus*, and there is no trace of frontal ridges or inner tubercles.

There are a few punctures in the scars and marginal groove of the pronotum, the pronotum being otherwise unpunctured. The median groove is not very deeply impressed, and neither it nor the marginal groove are complete in front. Along the lateral margins of the mesosternum there extends a band of hair-bearing punctures, on the inner side of which the scars are more or less clearly recognizable. The anterior intermediate and lateral areas of the metasternum, and the posterior border of the posterior intermediate areas, are covered with somewhat fine hair-bearing punctures; there are no coarse punctures anywhere on the metasternum. The elytra are somewhat hairy at the shoulders. The puncturing of their grooves is more or less obsolete, at least dorsally.

Genus **PENTALOBUS**, Kaup, 1868a, p. 17.

Incl. *Didimus*, Kaup, 1871. Also *Didimoides*+*Eumelosomus*, Kuwert, 1896.

Type, *Passalus barbatus*, Fabricius, 1801, p. 256.

**Pentalobus klugi** (Kaup).

*Leptaulax klugii*, Kaup, 1868a, p. 12.

Two specimens from Barombi, Cameroons Interior; one from Abetefi, Ashanti; one from Franceville, French Congo; and several from Gaboon. Length 22·0–25·5 mm.

Each antenna bears three short lamellae. The anterior margin of the head bears five or more or less equidistant tubercles. The central and inner tubercles are moderately elevated, and the frontal ridges distinct throughout. The surface of the head is punctured sparsely behind the central tubercle, and somewhat more densely in front. The sides of the pronotum are very broadly and coarsely punctured; the median groove of the pronotum is complete; the marginal groove is incomplete in front. The mesosternum is usually more or less matt with somewhat obscure scars. The anterior intermediate areas of the metasternum are more or less distinctly punctured; the lateral areas are very sharply defined throughout and are enlarged behind; the posterior intermediate areas are smooth and glossy. The abdominal sterna are densely and extensively punctured. The lateral grooves of the elytra are transversely punctured.



**Pentalobus sansibaricus** (Harold).

*Passalus sansibaricus*, Harold, 1880, pp. 262-263.

Five specimens from Zanzibar, one from Abyssinia, one from Abetefi, one from Rhombomp (Sierra Leone), a number from Dar-es-Salaam, and six said to come from Bolivia. Length 16.5-27.5 mm.

*P. sansibaricus* differs from *P. klugi* only in having the antennal lamellae somewhat longer, in having the upper surface of the head thickly punctured more or less all over, in having the mesosternum smooth and polished, with well defined scars, and in having the posterior intermediate areas of the metasternum coarsely punctured. The central plate of the metasternum is lightly and sparsely punctured in small specimens.

**Pentalobus punctipectus** (Kaup).

Fig. VIII, 3, p. 70.

*Leptaular punctipectus*, Kaup, 1868a, p. 11.

One specimen from Gaboon. Length 18 mm.

This species differs from small specimens of the last in having a median pair of secondary marginal tubercles instead of a single median tubercle, and in having the central plate of the metasternum less sparsely covered with stronger punctures.

**Pentalobus barbatus** (Fabricius).

*Passalus barbatus*, Fabricius, 1801, p. 256.

A large number of specimens from Abetefi, Ashanti; also a few from Amu, Ashanti; Gaboon; Old Calabar; Aquapim, Guinea; Barombi, Cameroons; and Angola; all 23-29 mm. long. Also one specimen from East Africa, 20 mm. long, and two from Franceville, French Congo, 17-19 mm. long, between which and the larger forms I am unable to find any structural difference.

This species differs from *P. punctipectis* in having five antennal lamellae, all of them very long and slender; and in having the central area of the metasternum unpunctured.

**Pentalobus parastictus** (Imhoff).

*Passalus parastictus*, Imhoff, 1843, pp. 171-172.

One specimen from Aquapim, Guinea, and one from Barombi, Cameroons Interior. Length 21-24 mm.

The punctures on the head are somewhat shallow, and the anterior margin of the head is lightly exavate medially, but has no median tubercles. The punctures on the central area of the metasternum are more or less concentrated beside the posterior margin. The transverse punctures of the lateral grooves of the elytra are more or less obsolete in the two outermost of these grooves, and all the grooves except the fifth and sixth tend to unite in a matt depression behind. In other respects this species resembles *P. punctipectis*.

**Pentalobus fur** (Kuwert).

*Didimus duplicatus* ab. *fur*, Kuwert, 1898, p. 307.

Three specimens from Abetefi, Ashanti. Length 21-23 mm.

It is possible that this form, which Kuwert regarded as an aberration of *P. duplicatus* (Har.) may be no more than a variety of *P. parastictus*. It differs from the latter only in being without punctures in the posterior angles of the pronotum, in having the punctured area on the central area of the metasternum less strongly marked, in having the punctures of the seventh and eighth grooves of the elytra weaker and less distinctly transverse, and in having the posterior angles of the elytra polished instead of matt. These are much the same characters as those by which Kuwert distinguishes this form from the form which he regards as the typical *duplicatus*, a species which I have not seen.

The above-mentioned species of *Pentalobus* may be distinguished as follows :—

1	{	The anterior margin of the head with a strong median tubercle .. .. .	2.
		The anterior margin of the head medially concave .. .. .	3.
2	{	The posterior intermediate areas of the metasternum unpunctured .. .. .	<i>P. klugi</i> , p. 72.
		The posterior intermediate areas strongly punctured .. .. .	<i>P. sansibaricus</i> , p. 73.
3	{	The anterior margin of the head with a strong median concavity bounded by a pair of strong secondary tubercles .. .. .	4.
		The anterior margin of the head with a faint median concavity not bounded by definite tubercles .. .. .	5.
4	{	Antennae each with three moderately stout lamellae .. .. .	<i>P. punctipectis</i> , p. 73.
		Antennae each with five long and slender lamellae .. .. .	<i>P. barbatus</i> , p. 73.
5	{	Elytral grooves 7-8 strongly marked with transverse punctures, the posterior angles of the elytra matt .. .. .	<i>P. parastictus</i> , p. 73.
		Elytral grooves 7-8 more faintly punctured, the posterior angles of the elytra glossy .. .. .	<i>P. fur</i> , p. 74.

Genus, **ERIONOMUS**, Kaup, 1868a, pp. 16-17.

Incl. *Calidas*+*Epeus*+*Eriosternus*, Kuwert, 1896.

Type, *Passalus planiceps*, Eschscholtz, 1829, pp. 22-23.

**Erionomus palini** (Percheron).

*Passalus palinii*, Percheron 1844, pp. 8-9, pl. cxxxv, fig. 1.

A number of specimens from Abetefi, Ashanti, and two from Gaboon. Length 34.5-38.0 mm.

This species superficially resembles *Pentalobus barbatus*. The antennae have, however, only four lamellae; the anterior margin of the head is approximately straight in the middle; the puncturing of the sides of the prothorax is somewhat less extensive; the lateral areas of the metasternum are hairy; and the punctures of the lateral grooves of the elytra, though very strong, are not transverse.

**Erionomus trichostigmoides** n. sp.

Fig. VIII, 4, p. 70.

Two specimens, one from Dar-es-Salaam, and one said to come from Santa Catharina in S. E. Brazil. Length 27.5-29.5 mm.

This species bears a close superficial resemblance to species of the Oriental genus *Trichostigmus* from which, however, it may readily be distinguished by the structure of the mandibles, and of the lateral areas of the metasternum, which resemble those of its African allies.

The antennal lamellae are extremely short. The surface of the head is polished and somewhat rugulose; the frontal area is fully as broad as long, and the inner tubercles are somewhat indistinct. The pronotum is without strong punctures; its grooves resemble those found in other members of the genus. The mesosternum is punctured and hairy in front, and roughened and hairy behind, with a small smooth and hairless area in the middle. The metasternum is punctured and hairy, except in the central and posterior parts of the central area. The punctures in the grooves of the elytra are more or less obsolete, but the eighth to tenth ribs are covered with small hair-bearing punctures.

**Erionomus alterego** (Kuwert).*Eriosternus alterego*, Kuwert, 1898, p. 138.

Two specimens from Abetefi, Ashanti. Length 29-31 mm.

The antennal lamellae are very short. The anterior margin of the head bears a more or less distinct median pair of marginal tubercles, the outer tubercles are somewhat small, and the secondary tubercles on the outer side of them are broadly truncate. The pronotum resembles that of *E. trichostigmoides*, except that the marginal grooves are more strongly punctured. The smooth and hairless central areas of the mesosternum and metasternum are much larger, though the punctures on the latter plate are stronger where they occur. The elytra are hairless except at the shoulders; their dorsal grooves are scarcely, their lateral grooves distinctly but not transversely, punctured.

**Erionomus planiceps** (Eschscholtz).

Fig. VIII, 5, p. 70.

*Passalus planiceps*, Eschscholtz, 1829, pp. 22-23.

Three specimens from Guinea and two from Abetefi, Ashanti. Length 38.0-41.5 mm.

In this species the outer tubercles are directed upwards instead of forwards, and appear in consequence to be situated a little behind the anterior margin of the head, beneath which, however, dissection shows the true clypeus to be hidden as usual. The marginal grooves of the pronotum are not strongly punctured. The posterior intermediate areas of the metasternum bear a posterior marginal band of fine close punctures, the rest of these areas being smooth much as in *E. alterego*, which the present species also resembles in all other respects.

The above-mentioned species of *Erionomus* may be distinguished as follows:—

- |   |   |   |                           |    |
|---|---|---|---------------------------|----|
| 1 | { | Each antenna with four long slender lamellae .. | <i>E. palini</i> , p. 74. |    |
|   |   | Each antenna with three short stout lamellae .. | ..                        | 2. |

2	{	The sides of the elytra covered throughout with hair-bearing punctures ..	<i>E. trichostigmoides</i> , p. 75.	3.
		The sides of the elytra hairless except at the shoulders ..	..	
3	{	The outer tubercles situated as usual on the anterior margin of the head and directed forwards	<i>E. alterego</i> , p. 75.	
		The outer tubercles situated slightly behind the anterior margin of the head and directed upwards	<i>E. planiceps</i> , p. 75.	

#### Sub-family *MACROLININAE*.

As defined above (pp. 12-13) this sub-family includes the *Macrolininae*, *Pleurariinae*, *Aceraiinae*, *Gnaphalocneminae* and *Tarquiniinae* of my "Account of the Oriental Passalidae." When that account was written only the Indian and Burmese genera and species were adequately represented in the Indian Museum collection. Before it was published I was able to revise to some extent, in the light of a hurried study of the collections in London, Berlin and Hamburg, my ideas regarding the forms from further east; but the arrangement of these forms there suggested is, I believe, capable of considerable improvement, as indicated in the present paper.

The symmetrical genus *Macrolinus* has here been placed next to the genus *Pleurarius*, which seems to replace it in the Indian Peninsula, *i.e.*, before, instead of after, all Oriental genera containing asymmetrical species.

Kuwert's *Heterochilus wallacei* has been removed from the genus *Aceraius* to the genus *Ophrygonius*, where it has been put next to *O. birmanicus* and *O. singapurae*, which it resembles much more closely than it does any species of *Aceraius*. To permit of this change the genera *Ophrygonius* and *Aceraius* have been redefined, greater importance being attached to the character of the mandibles than to that of the elytra; with the result that *Aceraius minor* and *aequidens* of my previous paper have also to be transferred to *Ophrygonius*. The remaining species of *Aceraius* can then be arranged in a single series leading up from forms allied to *minor* and *aequidens* to *grandis* and *occulidens*, which appear to be the most highly specialized members of the genus.

*Parapelopides*, *Trapezochilus*, *Gnaphalocnemis*, *Pelopides*<sup>1</sup> and *Plesthenus*<sup>2</sup> are entirely Oriental or Celebean. They resemble the Oriental forms dealt with above in that,

<sup>1</sup> Kuwert placed two species, *schraderi* and *gravidus*, in this genus (1898, p. 322). Zang, who had not seen either of them (1905 a, p. 316) pointed out the improbability of their being congeneric (1905 b, p. 227), and suggested that the former should be regarded as the type of the genus, presumably on account of its probable relationship with the remaining genus of Kuwert's group *Pelopinae*. The material in the Van de Poll collection tends to confirm my opinion (1914 c, p. 201, footnote 2) that *schraderi* actually belongs to the genus *Protomocoelus*; if, therefore, this species is to be regarded as the type of the genus *Pelopides* this name, having priority over *Protomocoelus*, will probably have to replace it: but there is little hope of settling the identity of *schraderi* with certainty without reference to Kuwert's type. I do not think, however, that Zang's suggestion should be accepted; for Kuwert, in his first definition of *Pelopides* (1896, p. 229), gives only Mindanao as its locality, and this is the locality of *gravidus*, not of *schraderi*. Moreover *gravidus* was known to him before *schraderi*, as it alone is mentioned in his 1891 list, being placed there in the genus *Pelops* (= *Protomocoelus*). *P. gravidus* and not *schraderi* should therefore, I think, be regarded as the type. It is represented in the Van de Poll collection by specimens which appear to have been named by Kuwert himself, and there seems to be no longer any doubt as to its identity.

<sup>2</sup> Boisduval's *lottinii*, and Kaup's *quadricornis* are, it is true, recorded from "New Holland." But it is quite uncertain whether *lottinii* is a *Plesthenus* at all (Kaup, 1868 a, p. 26, and 1871, p. 40; Blackburn, 1900, pp. 207-208);

whenever asymmetry occurs in the mandibles, the dentition is reduced chiefly on the right side.

The distinctive characters of the first four of these genera do not appear to me to have more than specific significance, and I propose to unite them under the name *Pelopides*. The fifth genus, *Plesthenus*, seems to be distinct. It is possible (see below, p. 121) that these genera may have been derived from *Tiberioides*, but as this is by no means certain I have not placed *Tiberioides* beside them, but have left it next to the symmetrical species of *Episphenus*.

*Pharochilus*, *Episphenoides*, *Mastochilus*, *Analaches* and *Cetejus* may likewise be united, the scars on the mentum, with the aid of which they have hitherto been defined, being variable and not sharply distinctive. The somewhat large genus resulting from this union is, however, composed of four more or less distinct groups of species, for which four of the above names may be retained in a subgeneric capacity. Thus *Pharochilus* may be defined so as to include only large Australian species with extremely short antennal lamellae and more or less extensive matt lateral borders to the mentum. And *Episphenoides* may advantageously, I think, be re-united with the very few known species of *Mastochilus*, and may then be defined so as to include the remaining large symmetrical species. *Analaches* and *Cetejus* are very difficult to separate from *Mastochilus* on structural grounds, but contain species of a much smaller size, many of which are distinctly asymmetrical. *Analaches* contains somewhat larger and flatter species than *Cetejus* with distinctly longer antennal lamellae. According to Heller, who has examined Zang's material (1910, pp. 14 and 21), the upper edge of the left mandible is toothed near the base, and this is in agreement with my observations on the few species before me. This tooth is sometimes, however, situated so near to the base as to be hidden beneath the anterior angles of the head. This is so, for instance, in Stoliczka's *australiensis*, which Heller places in the genus *Cetejus*, in spite of its flattened form and long antennal lamellae, but which dissection shows to be an *Analaches*.

*Mastochilus* (*s. lat.*) appears to represent the simpler stock from which the remaining genera, all more highly specialized, have been derived. All these other genera are found mainly in the islands east of Celebes, and whenever their dentition is reduced this occurs most markedly on the left side, instead of on the right as in Oriental groups (see pl. I).

*Kaupioloides*, *Hyperplesthenus*, *Aurelius*, *Labiemus* and *Kaupiolus* all have symmetrical mandibles with complete dentition. In the most highly specialized species the elytra are united, and in all of them the intermediate and lateral areas of the metasternum are fused, a fusion which is closely associated with the union of the elytra, tending to follow it in the other groups of Passalidae in which it occurs. Probably, therefore, these genera are losing, if they have not already lost, the power (or at least the habit), of flight, the wings doubtless becoming more efficient stridulatory structures at the same time. None of these genera are very large, and they may advantageously be united under the name *Labiemus*.

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and in Kaup's original description of *quadricornis* (*loc. cit.*) the only locality referred to is that of the type of *lottinii*, a locality which he has quoted in his monograph, perhaps inadvertently, as that of *quadricornis*. Even if the type of *quadricornis* should prove, on re-examination, to be labelled "New Holland" I should still doubt the validity of the record, in view of the extreme improbability of any such highly specialized species, with Oriental rather than Papuan affinities, occurring there.

*Protomocoelus* resembles *Labiensus* in having the lateral and intermediate areas of the metasternum fused, though so far as I know the elytra are never united; but it has the dentition reduced, especially on the left side. It is probably allied to the asymmetrical forms of *Mastochilus* through the more primitive species of *Labiensus* (i.e., *trigonophorus* and *inaequalis*) but does not appear to be allied to the higher forms of the latter genus.

*Gonatas*, with which the imperfectly separated *Omegarius* (?) and *Tatius* of which I have not seen a specimen) may be united, also tends to have the dentition reduced, especially on the left side

*Pseudepisphenus* and *Tarquinius* form the last line of descent from *Mastochilus* (s. lat.). They are so unlike superficially that it seems best to retain both genera in the absence of other forms throwing light upon them. Concerning their relationship see Gravely, 1914c, pp. 328-329.

The genera of *Macrolininae* may now be redefined thus:—

- |   |   |  |                             |     |
|---|---|--|-----------------------------|-----|
| 1 | { | The supra-orbital and supra-occipital ridges discontinuous; insects always symmetrical; the mentum always with primary but without secondary scars   | <i>Macrolinus</i> , p. 80.  |     |
|   |   | The supra-orbital and supra-occipital ridges continuous, the latter sometimes produced outwards behind the former in asymmetrical species without scars of any kind on the mentum  | ..                          | 2.. |
| 2 | { | The mentum without scars; the outer side of the mandibles angulate at the base or not at all   | ..                          | 3.. |
|   |   | The mentum with scars; or, the outer side of the mandibles angulate opposite the anterior lower tooth  |                             | 7.. |
| 3 | { | Only three lamellae recognizable when the antenna is furled; the mentum strongly grooved in the middle line from front to back   | <i>Pleurarius</i> , p. 84.  |     |
|   |   | More than three lamellae recognizable when the antenna is furled; the mentum at most with an incomplete median groove anteriorly   | .. ..                       | 4.. |
| 4 | { | The inner tubercles separated by a space $\frac{1}{3}$ - $\frac{1}{2}$ as long as that separating the outer tubercles  | <i>Tiberioides</i> , p. 84. |     |
|   |   | The inner tubercles separated by a space $\frac{2}{3}$ -1 times as long as that separating the outer tubercles   | ..                          | 5.. |
| 5 | { | The left outer tubercle acute and little or no larger than the right; or, much larger and curved inwards, with its extremity rounded rather than truncate and never angular on the outer side in front. The dentition complete in symmetrical species; the lowest terminal tooth always present on both sides; the right anterior lower tooth smaller than the left in the more highly asymmetrical species. The sides of the elytra hairless. | <i>Episphenus</i> , p. 85.  |     |
|   |   | The left outer tubercle larger than the right, directed more or less inwards, truncate distally, the outer angle of truncation distinct, forming a more or less forwardly directed apex to the tubercle; or, the sides of the elytra hairy. The dentition complete, or both the lowest terminal and anterior lower teeth reduced   | ..                          | 6.. |

- |    |   |  |                                |     |
|----|---|--|--------------------------------|-----|
| 6  | } | The dentition complete in unworn specimens on both mandibles ;<br>the mandibles in most species symmetrical ; the elytra often<br>hairless except at the shoulders   | <i>Ophrygonius</i> , p. 86.    |     |
|    |   | The lowest terminal and anterior lower teeth of the right<br>mandible absent, or represented only by very minute<br>denticles ; the anterior lower tooth of the left mandible very<br>large ; the elytra more or less extensively hairy at the sides   | <i>Aceraius</i> , p. 89.       |     |
| 7  | } | The dentition of the left mandible not more reduced than that<br>of the right and the right outer tubercle at least as large as<br>the left ; the mentum without primary scars ; the secondary<br>scars very large, more or less completely cutting off the<br>median from the lateral pieces, usually more or less linear ;<br>the lateral and intermediate areas of the metasternum never<br>fused                               |                                | 8.  |
|    |   | Not as above ; the dentition of the right mandible never more<br>reduced than that of the left   | .. ..                          | 9.  |
| 8  | } | The anterior margin of the labrum with a (frequently indistinct)<br>tooth near the middle ; all the elytral grooves deeply<br>impressed throughout, at least the lateral ones strongly<br>punctured ; the pronotal scars hairless ; at least one of the<br>outer tubercles more or less complex, or truncate with an<br>additional tubercle between itself and the anterior angle of<br>the same side of the head (Oriental forms) | <i>Pelopides</i> , p. 93.      |     |
|    |   | The anterior margin of the labrum not toothed ; some at least<br>of the elytral grooves feebly impressed and more or less<br>obsolete behind, none of them at all strongly punctured ; the<br>pronotal scars more or less hairy ; the outer tubercles acute<br>or truncate, but never complex or associated with secondary<br>tubercles (Celebean forms)   | <i>Plesthenus</i> , p. 96.     |     |
| 9  | } | The mentum with well developed primary scars ; the lateral<br>and intermediate areas of the metasternum distinct   | <i>Mastochilus</i> , p. 97.    |     |
|    |   | The mentum without definite primary scars ; or, the lateral and<br>intermediate areas of the metasternum fused   | .. ..                          | 10. |
| 10 | } | The lateral and intermediate areas of the metasternum fused  | .. ..                          | 11. |
|    |   | The lateral and intermediate areas of the metasternum not<br>fused   | .. ..                          | 12. |
| 11 | } | The dentition of both mandibles complete, normal ; mandibles<br>more or less symmetrical   | <i>Labienuus</i> , p. 103.     |     |
|    |   | The dentition of both mandibles reduced—especially that of<br>the left one ; the anterior lower tooth (when present) widely<br>separated from the middle lower tooth, and partially fused<br>with the lowest terminal tooth  | <i>Protomocoelus</i> , p. 107. |     |

<sup>1</sup> The fusion is less obvious than in the American forms where it occurs, as the greater part at least of the posterior intermediate areas are hairless and either smooth or coarsely punctured, while the areas on the outer side and in front of them are very hairy and densely but somewhat finely punctured.

- |    |  |                          |     |
|----|--|--------------------------|-----|
| 12 | The mandibles angulate on the outer side close to the base or not at all ; at most a weak groove extending from this angle to the upper margin           | Gonatas, p. 108.         |     |
|    |  |                          |     |
| 13 | The inner tubercles situated behind the anterior margin of the head ; the outer tubercles asymmetrical   | Pseudepisphenus, p. 111. | 13. |
|    |  |                          |     |
| 13 | The inner tubercles situated on the anterior margin of the head, giving the insect a <i>Leptaulax</i> -like appearance ; the outer tubercles symmetrical | Tarquinius, p. 111.      |     |
|    |  |                          |     |

Genus **MACROLINUS**, Kaup, 1868a, p. 18.

Type, *Passalus latipennis*, Percheron, 1841, pp. 8-9, pl. lxxiii, fig. 3.

**Macrolinus andamanensis** (Stoliczka).

*Basilianus andamanensis*, Stoliczka, 1873, pp. 160-161.

*Macrolinus andamanensis*, Gravely 1914c, p. 242, pl. xiii, figs. 41-41a.

Ten specimens from the Andamans, where Mr. Kemp recently collected two at Port Blair.

Length 3.2-3.6-5 mm.

**Macrolinus sikkimensis** (Stoliczka).

*Basilianus sikkimensis*, Stoliczka, 1873c, pp. 161-162.

*Macrolinus sikkimensis*, Gravely, 1914c, pp. 243-244, pl. xiii, figs. 42-42a.

Nine specimens from the Darjiling District (Tukvar, also specimens recently collected by myself at Pashok, ca. 2,000 ft.), Assam (Margharita) and the Naga Hills, 2,000-5,000 ft.



FIG. IX.

*Macrolinus* spp. ; specific characters in the upper surface of the head  $\times 4$ .

1. *M. obesus*, Gravely.

2. *M. depressus*, Gravely.

M. Vitalis de Salvaza has submitted for examination a specimen from Xieng Khaoung, Tonkin, belonging to the sub-species *tavoyanus*, Gravely. Length 27.3-32.0 mm.

**Macrolinus rotundifrons**, Kaup.

*Macrolinus rotundifrons*, Kaup, 1874, pp. 44-45.

*Macrolinus rotundifrons*, Gravely, 1914c, pp. 244-245, pl. xiii, fig. 43.

Four specimens from Ceylon, one being from Belihul-Oya. Length 27.0-28.5 mm.

**Macrolinus obesus**, n. sp.

Fig. IX, 1.

Four specimens from Ceylon, three being from Belihul-Oya. Length 29.4-33.4 mm.

The antennal lamellae are very short and stout, even more so than in *M. rotundifrons*, the first three being scarcely twice as long as thick, and scarcely more than half as long as the last three. The ridges and tubercles of the head resemble those of *M. rotundifrons*, but the general surface is less extensively punctured and rugose.



The pronotum is at most sparsely punctured in the anterior angles and in and near the scars. The marginal grooves are widely discontinuous in front and somewhat less widely behind; they are very narrow and are unpunctured except at their anterior ends, which are slightly enlarged and directed a little backwards from the anterior margin. The median groove is very fine, and is incomplete in front. The sides and angles are lightly rounded.

The scutellum is smooth and glossy. The mesothoracic epimera are smooth and glossy antero-dorsally, punctured and glossy below and behind this, then unpunctured and matt, and finally smooth and glossy along the oblique ventral margin. The mesosternum is glossy throughout, but is sometimes indistinctly punctured in the more or less rudimentary scars.

The intermediate and lateral areas of the metasternum are fused and are densely punctured. They are hairy except on the greater part of the space corresponding to the posterior intermediate areas, where the punctures are specially coarse. The abdominal scars are strongly and extensively, but somewhat finely, punctured. The elytra are united; they are lightly convex between the shoulders, short in proportion to their length and lightly convex at the sides, being distinctly broader behind than in front; the grooves are strongly and uniformly punctured, about as strongly as are the lateral grooves of *M. rotundifrons* or the dorsal ones of *M. crenatipennis*.

#### **Macrolinus batesi**, Kuwert.

*Macrolinus batesi*, Kuwert, 1898, p. 187.

Four specimens from Perak, Malay Peninsula, and large numbers from Mana-Riang, Renau, Palembang, Sumatra, 3,000 ft. and from Bng. Proepoe, Pad. Bovenland (=interior of Padang), Sumatra, *ca.* 1,600 ft.. Mr. Holman-Hunt has sent specimens for examination from the Selangor-Pahang boundary, *ca.* 3,000 ft., Malay Peninsula; and M. Guy Babault from Medan, Sumatra. Length 25–30 mm.

In my "Account of the Oriental Passalidae" *M. batesi* was regarded as identical with *M. latipennis*. The specimens which I now refer to the former are distinguished by the relative shortness of the second antennal lamella, whose apex does not fall in line with the apices of the first and third lamellae when the antennae are furled; by the small unpunctured frontal area; by the more or less distinctly shouldered outer tubercles; by the large inner tubercles with strongly concave instead of straight or convex connecting ridge; by the narrow marginal grooves of the pronotum, which are hairless except below the scars; by the matt but entirely unpunctured mesosternal scars; and by the coarser puncturing of the lateral grooves of the elytra.

#### **Macrolinus depressus**, n. sp.

Fig. IX, 2.

One specimen from Java, 33 mm. long. Closely allied to *M. batesi*, but larger and proportionally flatter. The outer tubercles are strongly shouldered. The pronotum is unpunctured except in the small round hairless scars, and between these and the posterior

halves of the sides, where it is densely hairy. The posterior intermediate areas of the metasternum and the dorsal grooves of the elytra are unpunctured.

**Macrolinus latipennis** (Percheron).

*Passalus latipennis*, Perche on, 1841, pp. 8-9, pl. lxxiii, fig. 3.

*Macrolinus latipennis*, Gravely, 1914c, pp. 245-246, pl. xiii, figs. 45-46.

One specimen from P.Oelak Tanding ; two from Hili Madjedja, N. Nias ; one each from Bedagei Interior, ca. 600 ft. and Bng. Proepoe, Padang Interior, 1,600 ft., Sumatra ; one from Tengger Mountain and several from Buitenzorg, Java ; two from Mt. Marapok, Dent Province, Borneo ; and one from Mt. Kina-Balu, Borneo, as well as a few without definite locality records. Length 22.5-25.2 mm.

**Macrolinus sulciperfectus**, Kuwert.

*Macrolinus sulciperfectus*, Kuwert, 1898, p. 184.

One specimen from Toli-Toli, N. Celebes, 26.7 mm. long.

**Macrolinus duivenbodei**, Kaup.

*Macrolinus duivenbodei*, Kaup, 1868 a, p. 19 ; 1871, p. 43, pl. iv, fig. 6.

Four specimens from Celebes, three being from Menado and one from Loewoe. Length 26-28 mm.

The first two antennal lamellae are more or less distinctly shorter than the remaining four ; but all six lamellae are slenderer than in the Ceylonese species *waterhousei* & *rotundifrons* associated by Kaup (1871) in this respect with the present species.

**Macrolinus urus**, Heller.

*Macrolinus urus*, Heller, 1898, pp. 23-24, pl. i, fig. 26.

Numerous specimens from Bua-Kraeng, 5,000 ft., S. Celebes. Length 35.4-41.5 mm.

The first three antennal lamellae are much shorter than the last three.

Although the elytra are united in most specimens<sup>1</sup> the lateral and intermediate areas of the metasternum are distinct. This is also the case in *Pleurarius brachyphyllus*, from the Indian Peninsula,<sup>2</sup> a species in which the elytra are concave between the shoulders and the wings show little or no trace of reduction. The elytra of the present species are convex between the shoulders and the wings or always reduced, being intermediate in form between those of *Pleurarius brachyphyllus* and those of *Macrolinus obesus*.

The key given to the identification of the different species of *Macrolinus*, on pp. 323-24 of my " Account of the Oriental Passalidae " requires considerable modification for the species which I have now seen for the first time to be included in their proper places. It may be emended as follows :—

1	The frontal ridges complete and well developed, the inner tubercles more or less distinct	..	2.
	The inner tubercles, and the anterior part or whole of the frontal ridges, obsolete ; species confined to Celebes		13.

<sup>1</sup> In several they are separate, and show no signs of ever having been united.

<sup>2</sup> See Gravely, 1915, p. 496.

- |    |   |  |                                   |
|----|---|--|-----------------------------------|
| 2  | { | The six antennal lamellae stout and as a rule not very long, the first three usually very short; species from the Indian Empire, Indo-China, (?) Siam and Ceylon .. .. .   | 3.                                |
|    |   | The six antennal lamellae long and slender; species from the Malay Peninsula, Sunda Islands, Philippines and Celebes .. .. .   | 9.                                |
| 3  | { | The ridge joining the inner tubercles separated from the anterior margin of the head throughout its whole length by a more or less concave surface; species from the Indian Empire, Indo-China and (?) Siam .. .. .  | 4.                                |
|    |   | The ridge joining the inner tubercles closely approximated to the anterior margin of the head either in the middle or throughout; species from Ceylon .. .. .  | 6.                                |
| 4  | { | The lateral grooves of the elytra narrow, their punctures normal .. .. .   | 5.                                |
|    |   | The lateral grooves of the elytra broad, their punctures transversely linear .. .. . <i>M. sikkimensis</i> , p. 80.  |                                   |
| 5  | { | The outer tubercles slender in profile, truncate; the ridge joining the inner tubercles concave .. .. .  | <i>M. nicobaricus</i> , Gravelly. |
|    |   | The outer tubercles stouter and distinctly bifid in profile, the ridge joining the inner tubercles straight .. .. .  | <i>M. andamanensis</i> , p. 80.   |
| 6  | { | The ridge between the inner tubercles straight throughout almost its whole length; the anterior angles of the pronotum unpunctured; the antennal lamellae somewhat long .. .. .  | <i>M. waterhousei</i> , Kaup.     |
|    |   | The ridge between the inner tubercles convex, evenly curved throughout; the anterior angles of the pronotum strongly punctured; the antennal lamellae short .. .. .  | 7.                                |
| 7  | { | The lateral grooves of the elytra almost as broad as the intervening ridges, their punctures very coarse indeed .. .. .  | <i>M. crenatipennis</i> , Kuwert. |
|    |   | The lateral grooves of the elytra much narrower than the intervening ridges .. .. .  | 8.                                |
| 8  | { | The elytra separate, parallel-sided, with finely punctured grooves .. .. .   | <i>M. rotundifrons</i> , p. 80.   |
|    |   | The elytra united, more ovate, with coarsely punctured grooves .. .. .   | <i>M. obesus</i> , p. 80.         |
| 9  | { | The frontal area small and unpunctured; the inner tubercles large and connected by a strongly concave ridge; the marginal grooves of the pronotum hairless in the anterior angles .. .. .  | 10.                               |
|    |   | The frontal area large and punctured all over; the inner tubercles small, and connected by a ridge which is straight as a whole and situated immediately above the anterior margin of the head, and may have a more or less angular median convexity; the marginal grooves of the pronotum hairless only in their anterior terminal enlargements .. .. . | 11.                               |
| 10 | { | The anterior angles of the pronotum strongly and extensively punctured; the pronotal scars with a few small hairs .. .. .  | <i>M. batesi</i> , p. 81.         |
|    |   | The anterior angles of the pronotum with not more than one or two punctures; the pronotal scars thickly hairy .. .. .  | <i>M. depressus</i> , p. 81.      |

- |    |   |   |
|----|---|---|
| 11 | } | The third lamella of the antennae not distinctly shorter than the fourth ; the median groove of the pronotum obsolete .. .. . 12.                                       |
|    |   | The third lamella of the antennae distinctly shorter than the fourth ; the median groove of the pronotum distinct, complete . . . . . <i>M. sulciperfectus</i> , p. 82. |
| 12 | } | The tip of the second lamella not reaching the line joining the tips of the first and third lamellae when the antenna is furled . . . . . <i>M. weberi</i> , Kaup.      |
|    |   | The tips of all six lamellae arranged in a straight line when the antenna is furled . . . . . <i>M. latipennis</i> , p. 82.   |
| 13 | } | The apex of the central tubercle acute, directed forwards, somewhat overhanging .. .. . <i>M. duivenbodei</i> , p. 82.  |
|    |   | The apex of the central tubercle approximately rectangular in profile, directed upwards, not overhanging .. .. . <i>M. urus</i> , p. 82.                                |

Genus **PLEURARIUS**, Kaup, 1868*b*, p. 1.

Type, *Pleurarius pilipes*, Kaup, 1868*b*, pp. 1-2.

**Pleurarius brachyphyllus**, Stoliczka.

*Pleurarius brachyphyllus*, Stoliczka, 1873, pp. 152-153.

This species is not represented in the Van de Poll collection.

Since compiling the list of localities in my " Account of the Oriental Passalidae " I have collected specimens in Cochin at Kavalai, ca. 1,300-3,000 ft., and between miles 10 and 14 on the State Forest Tramway, 0-300 ft. M. Guy Babault has presented specimens from near Mahé on the Malabar Coast, and from Kodaikanal in the Palni Hills ; he has also sent for examination specimens from Wallardi in Travancore and from the Coorg region.

It is doubtful whether *P. pilipes*, the only other species of the genus described, is really distinct from *P. brachyphyllus*, although the former is supposed to come from Sumatra and not from India (see Gravely, 1914*c*, p. 320).

Genus **TIBERIOIDES**, Gravely, 1913, p. 405.

Type, *Tiberius kuwertii*, Arrow, 1906, p. 446.

**Tiberioides kuwertii** (Arrow).

Pl. I.

*Tiberius kuwertii*, Arrow, 1906, p. 446.

*Tiberioides kuwertii*, Gravely, 1914*c*, pp. 215-216, pl. xi, fig. 14.

Two specimens from Darjiling and one from N. Manipur, 3,000-9,000 ft. Length 38.5-39.5 mm.

**Tiberioides borealis** (Arrow).

Fig. X.

*Chilomazus borealis*, Arrow, 1906, pp. 467-468.

One specimen from N. Manipur, 3,000-9,000 ft. Length 38 mm.

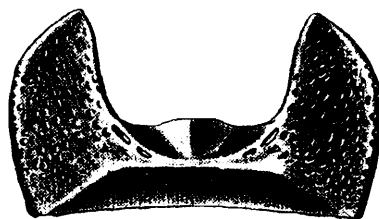


FIG. X.

*Tiberioides borealis*, Arrow, mentum  $\times 8$ .The species of *Tiberioides* may be identified thus:—

- |   |   |  |                              |    |
|---|---|--|------------------------------|----|
| 1 | { | The lateral grooves of the elytra broad, their punctures transversely linear   | <i>T. kuwerti</i> , p. 84.   |    |
|   |   | The lateral grooves of the elytra narrow, their punctures normal .. .. .   | .. .. .                      | 2. |
| 2 | { | The median part of the mentum without depressions or ridges  | <i>T. austeni</i> , Gravely. |    |
|   |   | The median part of the mentum with a low convexity flanked by broad shallow depressions close to the middle of the anterior margin, with a strong transverse ridge behind it | <i>T. borealis</i> , p. 85.  |    |

Genus **EPISPHEMUS**, Kaup, 1871, p. 45.Type, *Episphenus moorei*, Kaup, 1871, p. 45.**Episphenus moorei**, Kaup.

Pl. I.

*Episphenus moorei*, Kaup, 1871, p. 45.*Episphenus moorei* + *pearsoni*, Gravely, 1914c, pp. 217-218, pl. xi, figs. 16-17.

Eight specimens from Ceylon (Belihul-Oya and Colombo) and one said to be from the Himalayas. Length 30.7-34.2 mm.

**Episphenus comptoni** (Kaup).

Pl. I.

*Aceraius Comptoni*, Kaup, 1868a, p. 28.*Episphenus comptoni* + var. *flachi*, Gravely, 1914c, pp. 218-219, pl. xi, figs. 18-19a.

Eleven specimens from Ceylon, including four from Belihul-Oya and one recently collected by Mr. Kemp on Horton Plains. Length 29.3-42.0 mm.

**Episphenus neelgherriensis** (Percheron).

Pl. I.

*Passalus neelgherriensis*, Percheron, 1841, p. 4, pl. lxxvii, fig. 1.*Episphenus neelgherriensis*, Gravely, 1914c, pp. 222-223, pl. xi, figs. 21-21a.

Five specimens from India, one being from Cochin and one from the Madras Presidency. Also specimens presented by Mr. T. Bainbrigge Fletcher from the Nilgiris (Ootacamund), Mysore (Bababudin Hills, 4,500 ft.) and Coorg (Mercara, Santi Koppa and Pollibeta); by M. Guy Babault from Wallardi in Travancore and from the neighbourhood of Trichinopoly and Mahé; and by myself from Cochin (Kavalai, ca. 1,300-3,000). Length 23.3-28.5 mm.

**Episphenus indicus** (Stoliczka), 1873, pp. 159-160.

Pl. I.

*Basilianus indicus*, Stoliczka, 1873, pp. 159-160.*Episphenus indicus*, Gravely, 1914c, pp. 220-222, pl. xi, figs. 20-20b.

Eight specimens, one from the Madras Presidency, one from Mercara, Coorg, and six said to be from Assam. Also specimens presented by M. Guy Babault from Wallardi in Travancore, and from near Mahé on the Malabar Coast; by Mr. T. Bainbrigge Fletcher from Santi Koppa in Coorg; and by myself from Kavalai, 1,300-3,000 ft., in Cochin. Length 27.2-36.2 mm.

The species of *Episphenus* may be identified thus:—

1	{	The anterior margin of the head symmetrical, the anterior margin of the mentum not depressed or grooved	<i>E. moorei</i> , p. 85.	
		The anterior margin of the head more or less asymmetrical; the anterior margin of the mentum more or less depressed or grooved	.. ..	2..
2	{	The anterior margin of the head not very strongly asymmetrical as a rule; the anterior margin of the mentum strongly grooved on either side of a strong median tubercle (occasionally paired)	<i>E. comptoni</i> , p. 85.	
		The anterior margin of the head strongly asymmetrical; the mentum without any strongly marked tubercle	.. ..	3..
3	{	The anterior angles of the head not prominent	<i>E. neelgherriensis</i> , p. 86.	
		The anterior angles of the head more or less prominent	<i>E. indicus</i> , p. 86.	

Genus **OPHRYGONIUS**, Zang, 1904a, pp. 697-700.

Incl. *Heterochilus*, Kuwert, 1896 (preoccupied) = *Rhypsaspis*, Zang, 1905.

Type, *Ophrygonius quadrifer*, Zang, loc. cit. = *Passalus inaequalus*, Burmeister, 1847, p. 468.

**Ophrygonius cantori** (Percheron).*Passalus cantori*, Percheron, 1844, pp. 3-4, pl. cxxxiv, fig. 2.*Ophrygonius cantori*, + subsp. *convexifrons* and *dunsiriensis*, Gravely, 1914c, pp. 224-225, pl. xi, figs. 22-22a.

Numerous Himalayan specimens, including three from Tukvar; one specimen from N. Manipur, 3,000-9,000 ft.; and one from the Ruby Mines District of Upper Burma, 5,000-7,000 ft. Specimens have been presented by M. Guy Babault from Kulu (Kandi

and Mandi); by Mr. C. Beeson from Kumaon (Ramgarh, 6,000 ft., under bark of dead oak); by Dr. B. L. Chaudhuri and myself from the Darjiling District (Senchal, *ca.* 8,000 ft., and Pashok 5,500 ft.); by Mr. S. W. Kemp from the Khasi Hills (Shillong 6,400 ft., and Maflong, 5,900 ft.); and by M. Vitalis de Salvaza from Tonkin (Lao Kay).

One specimen labelled "Darjeeling" in the Van de Poll collection is only 28.5 mm. long. All the remaining Himalayan specimens are 30 mm. long or over. The Manipur specimen is 30 mm. long; all the remaining specimens found east of the Darjiling District are 29 mm. long or under. Although, therefore, occasional specimens may transgress the normal limits of the race characteristic of their locality, the validity of difference in size as a distinction between *O. cantori*, s. str., and its sub-species *convexifrons* is confirmed. The form of mentum, on the other hand, described as distinctive of the sub-species *dunsiriensis*, does not appear to be a good character, and although specimens from the Dunsiri valley range from 28 to as much as 31 mm. in length I think that they can best be regarded as belonging to the sub-species *convexifrons*.

### **Ophrygonius birmanicus**, Gravelly.

*Ophrygonius birmanicus*, Gravelly, 1914c, p. 226. text-fig. 3A.

One specimen from the Ruby Mines District of Upper Burma. Another has been presented by Mr. J. Coggin Brown from Man Lom, Homang, N. Tawngpeng, N. Shan States, Upper Burma, 4,500-5,500 ft.; and others by M. Vitalis de Salvaza from Chapa, Ht. Tonkin, Length 29-33.5 mm.

### **Ophrygonius singapurae**, Gravelly.

*Ophrygonius singapurae*, Gravelly, 1914c, pp. 226-227, text-fig. 3B.

One specimen from Laos, and two from Mt. Marapok, Dent Province, British North Borneo. Length 30.5-32.2 mm.

In fresh specimens the anterior lower teeth each have their apices produced into a sharp and slender point. The left outer tubercle is distinctly thicker at the base than in the preceding species, but may point more definitely inwards than in the type specimen.

### **Ophrygonius wallacei** (Kuwert).

*Heterochilus Wallacei + crinitus + oculitesselatus*, Kuwert, 1898, p. 334.

*Aceraius wallacei*, Gravelly, 1914c, pp. 228-229, pl. xii, figs. 26-26b.

One specimen from Singapore and a number from Borneo (Mts. Kinabalu and Marapok). Length 33.5-38.0 mm.

The anterior lower tooth on each side is much broader than the lowest terminal. Both are small on the right mandible, but are perfectly distinct in fresh specimens.

### **Ophrygonius inaequalis** (Burmeister).

Pl. I.

*Passalus inaequalis*, Burmeister, 1847, p. 468.

*Ophrygonius inaequalis*, Gravelly, 1914c, pp. 227-228, pl. xii, figs. 24-24a.

A number of specimens from Mt. Marapok, Dent Province, British North Borneo; and one from Mt. Kinabalu. Length 23-27 mm.

The punctures in the lateral grooves of the elytra are variable, and I no longer think it at all likely that *oroleius*, Smith, will have to be recognized as a distinct variety.

**Ophrygonius aequalis, n. sp.**

Fig. XI, 1.

A number of specimens from Chapa, Tonkin, have been sent by M. Vitalis de Salvaza. They vary from 27.3-31.6 mm. in length, and differ from *O. minor* only in their larger size, in having only four antennal lamellae pubescent, in having the upper tooth of both mandibles well developed, in having the left outer tubercle still more nearly identical in

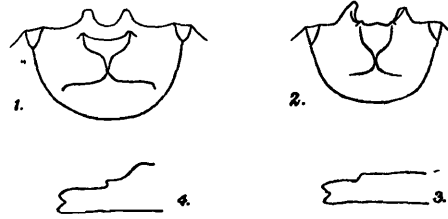


FIG. XI.

- |  |   |
|--|---|
| 1. <i>Ophrygonius aequalis</i> , Gravely, part of upper surface of head $\times 4$ . | 3. <i>Ophrygonius javanus</i> , Gravely, left mandible from without, highly magnified.  |
| 2. <i>Ophrygonius javanus</i> , Gravely, part of upper surface of head $\times 4$ .  | 4. <i>Aceraius lamellidens</i> , Gravely, left mandible from without, highly magnified. |

size and form with the right, in having the frontal area shorter and distinctly transverse, and in having the punctures on the sides of the pronotum densely clustered in and confined to the scars, instead of very thinly scattered over a slightly more extended area.

**Ophrygonius javensis, n. sp.**

Fig. XI, 2-3.

One specimen from Boeloe Lawang, Pasoeroean, Java. Length 26 mm. Closely allied to *O. minor*, from which it differs only in having somewhat better developed upper teeth, and in having the punctures and hair on the elytra confined to the ninth and extreme hinder end of the seventh ribs, instead of over the whole of these two ribs.

**Ophrygonius aequidens (Gravely).**

*Aceraius aequidens*, Gravely, 1914c, p. 240, text-fig. 4E., p. 234.

Six specimens from Mt. Kinabalu. Length 27-31 mm.

The species of *Ophrygonius* as re-defined in the present paper may be recognized as follows :—

1	{	The antennal lamellae short and stout ; the anterior marginal depressions of the mentum quite small ; the sides of the elytra hairy				<i>O. cantori</i> , p. 86.
		The antennal lamellae long and slender ; or, the anterior marginal depressions of the mentum very large ; or, the sides of the elytra hairy	..	..	..	2.
2	{	The antennal lamellae long and slender	..	..	..	3.
		The antennal lamellae short and stout	..	..	..	5.
3	{	The tips of the first two lamellae not falling in line with those of the last four when the antenna is furled ; the anterior marginal depressions of the mentum quite small ; the sides of the elytra hairless	..			<i>O. birmanicus</i> , p. 87.
		The tips of all six lamellae forming a straight line when the antenna is furled ; or the sides of the elytra hairless. The anterior marginal depressions of the mentum usually large	..	..	..	4.



- |   |   |   |                               |    |
|---|---|---|-------------------------------|----|
| 4 | { | The tips of all six lamellae forming a straight line when the antenna is furled; the anterior marginal depressions of the mentum always large and separate; the sides of the elytra hairless ..   | <i>O. singapurae</i> , p. 87. |    |
|   |   | The tips of the first two lamellae not falling in line with those of the other four when the antenna is furled; the anterior marginal depressions of the mentum very variable, often fused or rudimentary; the sides of the elytra densely hairy in front | <i>O. wallacei</i> , p. 87.   |    |
| 5 | { | The anterior marginal depressions of the mentum very large; the sides of the elytra hairless  | <i>O. inaequalis</i> , p. 87. |    |
|   |   | The anterior marginal depressions of the mentum more or less rudimentary; the sides of the elytra hairy .. .. .   |                               | 6. |
| 6 | { | The upper tooth of both mandibles well developed, more or less rectangular; the frontal area markedly transverse  | <i>O. aequalis</i> , p. 88.   |    |
|   |   | The upper tooth of both mandibles rudimentary or at least more obtuse; the frontal area about as long as broad  |                               | 7. |
| 7 | { | The anterior lower tooth of the left mandible very large, much larger than that of the right mandible ..  |                               | 8. |
|   |   | The anterior lower tooth of the left mandible scarcely larger than that of the right .. .. .  | <i>O. aequidens</i> , p. 88.  |    |
| 8 | { | The upper tooth of the left mandible obtuse but moderately large; the seventh ribs of the elytra almost unpunctured   | <i>O. javensis</i> , p. 88.   |    |
|   |   | The upper tooth of the left mandible minute; the seventh ribs of the elytra sparsely punctured and hairy throughout   | <i>O. minor</i> (Gravely).    |    |

Genus **ACERAIUS**, Kaup, 1868a, pp. 26-27.

Type, *Passalus grandis*, Burmeister, 1847, p. 463.

**Acera us lamellatus** n. sp.

Mr. Holman-Hunt has submitted two specimens from the Malay Peninsula (Ulu Gombak), and Mr. Bryant two from Penang, one of each of which has been presented to the Indian Museum collection. Length 23 mm.

This species appears to be allied to various species of the genus *Ophrygonius* on the one hand, and to the genus *Aceraius* on the other. The antennal lamellae and mentum resemble those of *Ophrygonius singapurae*, the former being exceptionally large for so small an insect. The mandibles are of the *Aceraius* type, and resemble those of *A. helferi* except that the convexity of the posterior part of the upper margin is pressed further back from the small upper tooth. In other respects this species resembles *Ophrygonius minor*, except that the eighth ribs of the elytra are punctured instead of (or as well as) the seventh.

**Aceraius helferi**, Kuwert.

Pl. I.

*Aceraius helferi*, Kuwert, 1898, pp. 346-347.

*Aceraius helferi* + *tavoyanus* + *assamensis* + *himalayensis*, Gravely, 1914c, pp. 236-238. pl. xii, figs. 36-39a.

One specimen from Burma and four from Siam, three of the latter being from Renong. M. Vitalis de Salvaza has presented a fine series of this species from Tonkin (Chapa and Xieng Khouang), and has sent for examination specimens from Ban Tink and Lao

Kay in the same country, and from Cambodia. Mr. J. Coggin Brown has presented specimens from Loi Tawng Kyaw 5,500-7,000 ft., Man Lom, Hamang 4,500-5,500 ft., and between Man Lom and Man Hpat, 4,500-5,500 ft., all in Tawnpeng in the Northern Shan States, Upper Burma. Mr. Holman-Hunt has sent for examination a specimen said to come from the Malay Peninsula (Ulu Gombak) and M. Guy Babault one said to come from Sumatra (Médan). Length 29.3-37.2 mm.

I have already pointed out (1914c, p. 292 footnote) that *A. tavoyanus*, from Southern Tenasserim, is not really distinct from *A. helferi* from further north. The series from Tonkin shows in addition that *A. assamensis*, and *A. himalayensis* are no more than imperfectly separated local races of the same form. Specimens from northerly localities (see pl. i, "*Aceraius*, other spp.") ordinarily have much squarer and less slender left outer tubercles than have specimens from further south. But the shape of this tubercle is not altogether constant in specimens from a single locality; and the gradation of the southern form into the northern seems to be so complete as to render impossible the separation of the species even into two definite races.

#### ***Aceraius alutaceosternus*, Kuwert.**

*Aceraius alutaceosternus*, Kuwert, 1898, pp. 347-348.

*Aceraius alutaceosternus*, Gravely, 1914c, p. 236, text-fig. 4E, pl. xii, figs. 34-34a.

One specimen from Perak and one from Borneo. Mr. C. Holman-Hunt has presented a specimen from Bukit Kutu in the Malay Peninsula. Length 35.4-39.5 mm.

The shape of the left outer tubercle of this species is the same as that of the most extreme form found among southern specimens of the preceding, of which it is little more than a local race. The size of the posterior convexity of the upper margin of the left mandible, and the faint median groove on the anterior part of the mentum, appear, however, to afford constant distinctive characters by which it may be recognized.

#### ***Aceraius borneanus*, Kaup.**

*Aceraius borneanus*, Kaup, 1871, p. 52.

*Aceraius borneanus*, Gravely, 1914c, pp. 238-239, pl. xii, figs. 25-25b.

One specimen from the Malay Peninsula (Pahang), four from Sumatra (three being from the interior of Bedagei on the east coast, ca. 600 ft.), many from North Nias (Hili Madjedja and G. Madjeja), five from Middle Nias (Dyma and Kalim Bungo), one from Java, and many from Borneo (Doesonlanden, Brunei, and Mts. Marapok and Kinabalu). Mr. C. Holman-Hunt has presented a specimen from Ulu Gombak, Malay Peninsula. Length 23.0-29.2 mm.

This species appears to be somewhat rare in the Malay Peninsula and Java, but to be abundant in Sumatra and Borneo.

#### ***Aceraius pilifer* (Percheron).**

*Passalus pilifer*, Percheron, 1835, pp. 23-24, pl. ii, fig. 2.

*Aceraius pilifer*, Gravely, 1914c, pp. 235-236, pl. xii, fig. 35.

Numerous specimens from the following places in Java: Tji Bodas, ca. 4,000 ft.; Pengalengan, 4,000 ft.; Mt. Tjikorai, 4,000 ft.; Mt. Gede, 4,000 ft.; Telaga Bodas

Garoet Preanger, 4,000-5,000 ft. ; G. Tji Salimar, W. Preanger, *ca.* 3,000 ft. ; Boeloe Lawang Res. Pasoeroean. Length 27-32 mm.

This species appears to be very common in Java, where it probably replaces the preceding one. It seems to be rare in Sumatra and Borneo. It has not been recorded from the Malay Peninsula.

**Aceraius perakensis**, Kuwert.

*Aceraius perakensis*, Kuwert, 1898, p. 308.

*Aceraius perakensis* + *laevimargo*, Gravelly, 1914c, pp. 229 and 235.

A number of specimens from Mt. Kinabalu. M. Guy Babault has presented a specimen from near Dolok-Baros, Médan, Sumatra. Length 34-40 mm.

*A. laevimargo*, Zang, appears to be identical with the species which I previously separated as *A. perakensis*.

**Aceraius tricornis**, Zang.

*Aceraius tricornis* + *kuwerti*, Zang, 1903a, p. 339.

*Aceraius tricornis* + *kuwerti*, Gravelly, 1914c, p. 235, text-fig. 4 B, pl. xi, fig. 31.

Two specimens from Mt. Maropok, and a number from Mt. Kinabalu. Length 46.0-52.5 mm.

The characters by which *A. tricornis* is separated from *A. kuwerti* prove to be variable, and the second name must fall.

**Aceraius laniger**, Zang.

*Aceraius laniger*, Zang, 1905a, pp. 191-192.

*Aceraius laniger*, Gravelly, 1914c, p. 234.

Three specimens from Borneo, two being from Mt. Kinabalu. Length 54.0-56.5 mm.

The characters distinguishing this species from the last, small though they are, do not appear to vary.

**Aceraius möschleri**, Kuwert.

*Aceraius möschleri*, Kuwert, 1898, p. 344.

*Aceraius möschleri*, Gravelly, 1914c, pp. 229-230, pl. xii, fig. 33.

Four specimens from Mt. Kinabalu in Borneo. Length 35-37 mm.

**Aceraius illegalis**, Kuwert.

*Aceraius illegalis*, Kuwert, 1898, p. 345.

*Aceraius illegalis*, Gravelly, 1914c, p. 230, pl. xii, figs. 32-32a.

Nine specimens from Borneo (Mts. Kinabalu and Marapok). Length 40-43 mm.

**Aceraius laevicollis** (Illiger).

*Passalus laevicollis*, Illiger, 1800, p. 103.

*Aceraius laevicollis*, Gravelly, 1914c, pp. 230-231, pl. xii, figs. 27-27a.

Many specimens from the Malay Peninsula (Singapore, Larut, Penang, Perak) ; Sumatra (Bedagei Interior, *ca.* 600 ft. ; Tandjong-Djati, Ranau, Palembang, *ca.* 2,000 ft. ; S. E. Serdang, E. Coast, *ca.* 1,000 ft.) ; N. Nias (Hili Madjedja and G. Madjeja) ; Middle Nias

(Dyma); Java; Borneo (Mts. Marapok and Kinabalu, British N. Borneo, Riam Kanan and Pengaron, Martapoera); Bali; and S. Celebes (Tjamba). Length 30·7–37·3 mm.

**Aceraius grandis** (Burmeister).

Pl. I.

*Passalus grandis*, Burmeister, 1847, p. 463.

*Aceraius grandis* + var. *rectidens* + subsp. *hirsutus*, Gravely, 1914c, pp. 231–233, pl. xii, figs. 28–30.

Specimens of the typical form from Sumatra (Mana-Riang, Renau, Palembang, 2,000–3,000 ft.; Bng. Proepoe, interior of Padang, ca. 1,600 ft.; also specimens presented by M. Guy Babault from Médan); North Nias (Hili Madjedja and G. Madjeja); Middle Nias (Kalim Bungo and Dyma); Java (G. Tji Salimar, W. Preanger, ±3,000 ft.; Kawie Mountains, Pasoeroean; Tji Bodas, ca. 4,000 ft.) and Borneo (Mt. Kinabalu and Brunei). Length 40–55 mm.

Specimens of subspecies *hirsutus*, Kuwert, from Nepal; Darjiling District (Tukvar); Assam (Margherita; Chandkhira, Sylhet); Upper Burma (Cachin Cauri); Laos; Tonkin (Xieng Khouang, Hoabink, Chapa and Napé—all presented by M. Vitalis de Salvaza, who has also submitted one from Ban Tink for examination) and S. Palawan. Length 36·8–49·0 mm.

The examination of the above recorded specimens has shown that southern specimens must all be regarded as belonging to a single race. Neither of the names *rectidens* and *addendus* (see Gravely, 1914c, p. 322 footnote) need, therefore, be retained.

**Aceraius oculidens**, Zang.

*Aceraius oculidens*, Zang, 1905a, pp. 190–191.

*Aceraius oculidens*, Gravely, 1914c, p. 234, text-fig. 4A.

Specimens from the Malay Peninsula have been presented by Mr. Holman-Hunt, who has also submitted one for examination from Gap, 2,700–3,000 ft., on the Selangor-Pahang boundary. Length 45·5 mm.

The species of *Aceraius*, as re-defined in this paper, may be identified as follows:—

1	The upper tooth of the left mandible simple, set in a hollow in front of a convexity of the upper margin, from which it is distinctly separated at base	.. .. .	2.
		.. .. .	.. .. .
2	The upper margin without a convexity behind and distinct from the upper tooth; this margin concave or straight, or else uniformly convex the whole way from the tip of the upper tooth backwards; or, the upper tooth bifid	.. .. .	5.
		.. .. .	.. .. .
3	The six antennal lamellae exceptionally long and slender	<i>A. lamellatus</i> , p. 89.	
		.. .. .	3.
3	The antennal lamellae short and stout, the first two more or less rudimentary	.. .. .	3.
		.. .. .	.. .. .
3	The posterior part of the tenth and the whole of the eighth ribs of the elytra unpunctured	.. .. .	4.
		.. .. .	.. .. .
3	The seventh to tenth ribs of the elytra (inclusive) punctured throughout	.. .. .	4.
		.. .. .	<i>A. borneanus</i> , p. 90.

- |    |   |  |                                    |     |
|----|---|--|------------------------------------|-----|
| 4  | { | The convexity of the upper margin of the left mandible moderately high; the mentum with no trace of a median groove .. .. .  | <i>A. helferi</i> , p. 89.         |     |
|    |   | The convexity of the upper margin of the left mandible very pronounced; the mentum with a fine groove in front .. .. .   | <i>A. alutaceosternus</i> , p. 90. |     |
| 5  | { | The anterior angles of the head more or less obtuse, never prominent .. .. .   |                                    | 6.  |
|    |   | The anterior angles of the head sharper, more or less distinctly prominent .. .. .   |                                    | 9.  |
| 6  | { | At most 32 mm. long; usually shorter .. .. .   | <i>A. pilifer</i> , p. 90.         |     |
|    |   | At least 34 mm. long, usually much longer .. .. .  |                                    | 7.  |
| 7  | { | At most 40 mm. long; the right outer tubercle distinct and more or less sharply pointed in unworn specimens, the antennal lamellae and other characters very variable .. .. .  | <i>A. perakensis</i> , p. 91.      |     |
|    |   | At least 43 mm. long; the right outer tubercle more obtuse or absent .. .. .   |                                    | 8.  |
| 8  | { | The right outer tubercle more or less obsolete; the tenth ribs of the elytra hairless and unpunctured throughout .. .. .   | <i>A. tricornis</i> , p. 91.       |     |
|    |   | The right outer tubercle distinct; the tenth ribs of the elytra punctured and hairy anteriorly .. .. .   | <i>A. laniger</i> , p. 91.         |     |
| 9  | { | The right outer tubercle simple, acute and moderately long .. .. .   |                                    | 10. |
|    |   | The right outer tubercle usually shorter, truncate or rounded; sometimes, however, divided into two separate tubercles of which the outer one or both may be more or less long and acute .. .. .   |                                    | 11. |
| 10 | { | The anterior angles of the head scarcely prominent; the tip of the right outer tubercle not bent outwards .. .. .  | <i>A. möschleri</i> , p. 91.       |     |
|    |   | The anterior angles of the head distinctly prominent; the tip of the right outer tubercle bent more or less abruptly outwards .. .. .  | <i>A. illegalis</i> , p. 91.       |     |
| 11 | { | At most 38 mm. long; the anterior angles of the head scarcely more prominent than in <i>A. illegalis</i> , somewhat variable .. .. .   | <i>A. laevicollis</i> , p. 91.     |     |
|    |   | Specimens no larger than <i>A. laevicollis</i> with the left anterior angle of the head produced into a long slender inwardly curved process; larger ones (which may be as much as 55 mm. in length) with the angles more moderately prominent, the largest closely resembling <i>A. laevicollis</i> in form .. .. . |                                    | 12. |
| 12 | { | The canthus without any upwardly directed tubercle .. .. .   | <i>A. grandis</i> , p. 92.         |     |
|    |   | A small and stout erect tubercle arising from the dorsal surface of the canthus immediately in front of the eye .. .. .  | <i>A. occulidens</i> , p. 92.      |     |

Genus **PELOPIDES**, Kuwert, 1896, p. 229.

Incl. *Gnaphalocnemis*, Heller, 1900 (= *Eriocnemis*, Kaup, 1863, preoccupied).

Also *Trapezockilus*, Zang, 1905 (= *Pharortes*, Kuwert, 1896, preoccupied) + *Parapelopides*, Zang, 1904a.

Type, *Pelopides gravidus*,<sup>1</sup> Kuwert, 1898, p. 322.

<sup>1</sup> See above, p. 76, footnote 1.

**Pelopides symmetricus** (Zang).

Pl. I.

*Parapelopides symmetricus*, Zang, 1904a, pp. 695-697, figs. 1-2.*Parapelopides symmetricus*, Gravely, 1914c, pp. 246-247, text-figs. 6A-B.

Two specimens from Mt. Marapok, and a number from Mt. Kinabalu. Length 37·0-42·7 mm.

**Pelopides gravidus** Kuwert.

Fig. XII.

*Pelopides gravidus*, Kuwert, 1898, p. 322.

Five specimens, apparently cotypes, from Davao, Mindanao. Length 43-46 mm.

*P. gravidus* is to some extent transitional between *P. symmetricus* and *P. simplex*. The anterior lower tooth of the right mandible is distinct when unworn, but is smaller than in *P. symmetricus*. The head has both the outer tubercles broad as in *P. symmetricus*,

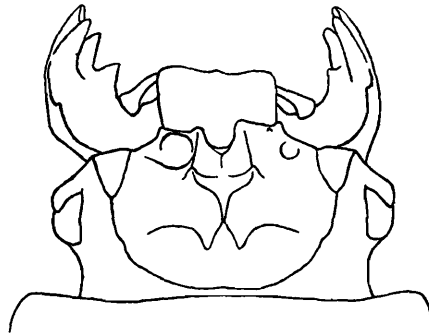


FIG. XII.

*Pelopides gravidus*, Kuwert; head from above  $\times 4$ .

but the inner portion of the right one is distinctly more prominent than that of the left, while the left one is flanked by a very deep and the right by a shallower concavity. The elytra are very like those of *P. monticulosus*. In all other respects *P. gravidus* resembles *P. symmetricus*.

**Pelopides dorsalis** (Kaup).

Pl. I.

*Eriocnemis dorsalis*, Kaup, 1871, p. 41.*Trapezochilus nobilis*,<sup>1</sup> + *respectabilis*, Gravely, 1914c, pp. 247-248, text-fig. 5 C-E., pl. xiii, fig. 48.

Six specimens from Perak and one from Sumatra; also four from Médan (nr. Dolok-Baros, Sumatra, presented by M. Guy Babault. Length 32·5-40·0 mm. The smaller specimens have the grooves of the elytra more strongly punctured than the larger ones.

**Pelopides burmeisteri** (Kaup).*Eriocnemis Burmeisteri*, Kaup, 1868a, p. 22.*Gnaphalocnemis burmeisteri*, Gravely, 1914c, p. 249, pl. xiii, fig. 49.

A number of specimens from Sumatra (Mana-Riang and Tandjong-Djati, Renau, Palembang; Bandar, Palembang; Bng. Proepoe, interior of Padang; Kandg. Ampat, Padang Beneden; also two from Médan, presented by M. Guy Babault); two from Java (one being from Tji Solak, Wynkoop's Bay) and six from Borneo (one being from Sintang and three from Sarawak). Length 38-49 mm.

<sup>1</sup> See also Gravely, 1914c, p. 297 (*T. dorsalis*).

**Pelopides monticulosus** (Smith).*Passalus monticulosus*, Smith, 1852, p. 6, pl. i, fig. 1.*Gnaphalocnemis monticulosus*, Gravelly, 1914c, pp. 249-250, pl. xiii, fig. 49a.

Three specimens from Sumatra (two being from Bedagei Interior, ca. 600 ft.), and a number from Borneo (Mts. Kinabalu and Marapok). Length 39-45 mm.

**Pelopides tridens** (Wiedemann).

Pl. 1.

*Passalus tridens*, Wiedemann, 1823, pp. 109-110.*Gnaphalocnemis tridens*, Gravelly, 1914c, p. 250, pl. xiii, figs. 50-50a.

Nine specimens from Sumatra (Bedagei Interior, ca. 600 ft. ; Gng. Talang, Padang Interior ; Mt. Singalang) ; many from Java (Telaga Bodas, Garoet, 4,000-5,000 ft. ; G. Tji Salimar, ca. 3,000 ft. ; Tji Bodas, Gng. Gede, ca. 4,000' ft., all in Preanger ; also Buitenzorg and Tjandiroto) ; and one said to come from the Key Islands (near New Guinea). Length 46-56 mm.

The species of *Pelopides* may be identified as follows :—

- |   |   |   |                                 |                             |
|---|---|---|---------------------------------|-----------------------------|
| 1 | { | The anterior lower tooth of the right mandible small but distinct in unworn specimens   | ..                              | 2.                          |
|   |   | The anterior lower tooth of the right mandible absent   | ..                              | 3.                          |
| 2 | { | The outer tubercles at least approximately symmetrical ; the anterior lower tooth of the right mandible larger  | <i>P. symmetricus</i> , p. 94.  |                             |
|   |   | The inner angle of the right outer tubercle produced forwards and inwards beyond that of the left ; the former acute, the latter obtuse ; the anterior lower tooth of the right mandible smaller  | ..                              | <i>P. gravidus</i> , p. 94. |
| 3 | { | The left outer tubercle consisting of a single, somewhat slender, obliquely truncate process ; the right one, of a similar but broader and slightly bifid inner process together with smaller pointed outer and middle processes                                      | <i>P. simplex</i> , (Gravelly). |                             |
|   |   | Both tubercles consisting of two or three denticles more or less fused together, the tubercle as a whole being very broad on the right or on both sides   | ..                              | 4.                          |
| 4 | { | The right and left outer tubercles of equal size, though not always of identical form   | <i>P. dorsalis</i> , p. 94.     |                             |
|   |   | The right outer tubercle much broader than the left   |                                 | 5.                          |
| 5 | { | The lateral grooves of the elytra all narrow, simply punctured  | <i>P. burmeisteri</i> , p. 94.  |                             |
|   |   | Grooves 5-7 of the elytra more or less broad ; each containing a polished flattened band, which is marked by a single row of punctures, and defined on either side by a more or less distinct roughened line with which the punctures may be to some extent confluent |                                 | 6.                          |

- |   |  |                                 |
|---|--|---------------------------------|
| { | Grooves 5-7 of elytra somewhat variable in width ; the posterior part of groove 8 rarely wider than the anterior part, never as wide as groove 7 ; insects at most about 45 mm. long | <i>P. monticulosus</i> , p. 95. |
|   | Grooves 5-7 of elytra always very broad ; the posterior part (and sometimes the whole) of groove 8 like them ; insects at least about 45 mm. long                                    | <i>P. tridens</i> , p. 95.      |

Genus **PLESTHENUS**, Kaup, 1871, p. 40.

Type, *Eriocnemis quadricornis*, Kaup, 1868a, p. 26.

Of the four species referred by Kuwert (1898, pp. 324-5) to the genus *Plesthenus* one, *lottini*, Boisduval, probably belongs to an Australian genus,<sup>1</sup> the other three being Celebean (see above, p. 76, footnote 2). Of these three *invitus*, Kuwert, is the most distinct. This species is represented in the Van de Poll collection by perhaps three specimens. Each of them is, however, distinguished by some definite character from the others ; and at least two localities are represented by the three specimens, one of which bears no locality record. It is impossible, therefore, to be certain at present whether the three specimens belong to three separate species or not ; and it will probably be best to describe all under the one specific name, referring at the same time to the individual differences.

The other two species, *quadricornis*, Kaup, and *gelon*, Schaufuss, are together represented by eleven specimens from five localities, two in the north of the island and three in the south. The southern specimens are distinctly larger than the northern, and they have an acuminate or very obliquely truncate right outer tubercle, the left outer tubercle being more or less obsolete ; in the northern specimens, on the other hand, the right outer tubercle tends to be more abruptly truncate, and the left outer tubercle to be more strongly developed, in some instances much more so. Here again it seems impossible to determine with certainty how many species are represented in the material before me, the differences between different forms being in this case undoubtedly correlated with locality. I propose, therefore, to treat all as a single species *quadricornis*, recognizing *gelon* as a more or less distinct southern race. The races seem to be distinguished more definitely by size than by structure.

I am unable to identify any of the specimens before me with either of the species described since Kuwert's work was published (see above p. 9), but it is possible, I think, that these may prove to be no more than varietal forms of *P. quadricornis*.

**Plesthenus invitus**, Kuwert.

Pl. I.

*Plesthenus invitus*, Kuwert, 1898, p. 325.

Three specimens, one of which is from Tondano, Minahassa and another from Menado. Both the specimens whose localities are recorded are 45.5 mm. long ; the other specimen is much bigger, being 53 mm. long.

This species differs from *Pelopides burmeisteri*, *monticulosus* and *tridens* only in the generic character mentioned above (p. 79), in having the left anterior lower tooth wholly distinct from the lowest terminal tooth instead of partially fused with it, and in the weaker

<sup>1</sup> Presumably *Mustochilus*.



and more crescentic scars on the mentum. The outer tubercles of the head are practically symmetrical, the right one being slightly broader than the left, at least in the Tondano specimen. In this specimen the space between the inner and outer tubercles is surrounded by fine but distinct ridges, of which the lateral and posterior are straight, and the anterior procurved. In the large specimen the lateral ridges are absent, the anterior one is procurved and the posterior one recurved; and in the Menado specimen even the anterior and posterior ridges are indistinct.

**Plesthenus quadricornis**, Kaup.

Pl. I.

*Eriocnemis quadricornis*, Kaup, 1868a, p. 26.

*Plesthenus quadricornis*, 1871, p. 40, pl. iv, fig. 4.

Four specimens of the northern race, *quadricornis*, *s. str.* (see above, p. 96), from Toli-Toli and three from Menado, both in Northern Celebes. One specimen of the southern race, *gelon* (Schaufuss, 1885, pp. 187-188), from Samanga, one from Patunuang, and two from Macassar, all in Southern Celebes. Length of the northern race 49-53 mm. Length of the southern race 55-60 mm.

*P. quadricornis* differs from *P. invitus* only in having the right outer tubercle somewhat longer, and sometimes more obliquely truncate or even acuminate, and in having the left outer tubercle smaller and acuminate or obsolete. In the Toli-Toli specimens the left outer tubercle is an acutely pointed process, scarcely shorter than the inner side of the somewhat obliquely truncate right outer tubercle. In the Menado specimens it is much shorter, the apex being rectangular or even obtuse. This is the case in the specimens from Samanga and Patunuang also; but in these the right outer tubercle is somewhat slenderer and more obliquely truncate; in size, moreover, these specimens resemble those from Macassar and not the preceding. In the Macassar specimens the left outer tubercle is scarcely recognizable, and the right outer tubercle is acuminate.

The two above described species of *Plesthenus* may be identified thus:—

{	The outer tubercles approximately symmetrical, both of them truncate	.. ..	<i>P. invitus</i> , p. 96.
	The outer tubercles asymmetrical, the right one much larger than the left and truncate, except when the latter is obsolete, in which case it may be acuminate; the left one never truncate	.. .. . . . . .	<i>P. quadricornis</i> , p. 97.

Genus **MASTOCHILUS**, Kaup, 1868a, pp. 19-20, corrected 1868b, p. 31.

Type, *Passalus polyphyllus*, MacLeay, 1826, p. 439.

This genus, as pointed out above (p. 77), may be divided into four more or less distinct sub-genera:—

1 {	The mentum laterally with a narrow depressed matt border, or more extensively matt; large Australian forms with very short antennal lamellae; always symmetrical	..	<i>Pharochilus</i> , <sup>1</sup> p. 98.
	The mentum uniformly glossy in fresh specimens; the antennal lamellae much longer; or not Australian		2.

<sup>1</sup> Kaup, 1868a, pp. 20-21. Type, *Passalus dilatatus*, Dalman.

2	}	Robust symmetrical insects at least 34 mm. long; almost all Australian <sup>1</sup> .. .. .	<i>Mastochilus</i> , s. str., p. 100.	
		Smaller insects—never more than 33 mm. long; almost all from New Guinea and the neighbouring islands; <sup>2</sup> often asymmetrical .. .. .	.. .. .	3.
3	}	The upper margin of the left mandible strongly angulate; the antennal lamellae longer and the body more flattened ..	<i>Analaches</i> , <sup>3</sup> p. 101.	
		The upper margin of the left mandible, behind the upper tooth, not or scarcely angulate; the antennal lamellae shorter and the body more robust .. .. .	.. .. .	<i>Cetejus</i> , <sup>4</sup> p. 102.

### ***Mastochilus (Pharochilus) dilatatus* (Schönherr).**

*Passalus dilatatus*, Schönherr, 1817, p. 334, appendix, p. 144.

A few specimens from Queensland (Cardwell) and New South Wales (Richmond River and Sidney). Length 31-36 mm.

The inner tubercles are large, somewhat as in *M. quaestionis*, but they are widely separated, the frontal area being always strongly transverse, and not elevated. The general texture of the upper surface of the head resembles that of *M. australasicus*. The more or less confluent and transverse grooves on the mentum are deeply crescentic, being almost equidistant from the anterior and posterior margins near the middle line; and the punctured lateral parts of the mentum have a narrow matt border on the outer side. The elytra resemble those of *M. quaestionis* and *M. australasicus*, except that the punctures are somewhat transverse, especially towards the posterior end, where the ridges between them are apt to be more or less obsolete.

### ***Mastochilus (Pharochilus) nitidulus*, MacLeay.**

Pl. I.

*Mastochilus nitidulus*, MacLeay, 1871, p. 175.

*Pharochilus nitidulus*, Kuwert, 1898, p. 333.

Two specimens from New England, New South Wales, presented by Mr. H. Schrader. Length 41 mm.

The lateral lobes of the mentum resemble those of *M. dilatatus*. The median part of the mentum resembles that of *M. politus*, which species this one resembles in all other respects.

<sup>1</sup> The only exception known is *M. pectinigera* (Heller) from New Guinea (length 39.5 mm). Concerning the position of *obliquus*, Kirsch, see Heller, 1910, pp. 17-18.

<sup>2</sup> The only exception known is *Analaches australiensis*, which is apparently found both in Australia and New Guinea (length 25.5-30.0 mm).

<sup>3</sup> Kuwert, 1896, p. 230. Type, *Epilaches puberilis*, Kuwert, 1898, p. 337 (see Zang, 1905a, p. 238, footnote; also p. 24).

<sup>4</sup> Kaup, 1871, p. 53. Type, *Aceraius virginalis*, Kaup, 1868b, p. 5.

**Mastochilus (Pharochilus) politus** (Burmeister).

Fig. XIII, 1.

*Passalus politus*, Burmeister, 1847, pp. 465-466.

A number of specimens from Queensland and Victoria, and two from Tasmania (Brighton). Also three presented by Mr. H. Schrader, two being from Tingha and one from the Clarence River, both in New South Wales. Length 30.5-37.0 mm.

The upper surface of the head resembles that of *M. dilatatus*, except that there is a secondary tubercle developed on the upper side of the base of each of the outer tubercles, which consequently appear very high and obliquely truncate in side view. The ridge

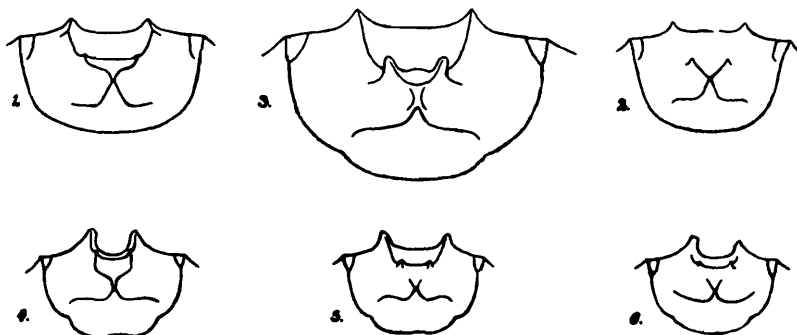


FIG. XIII.

*Mastochilus* spp., specific characters in the upper surface of the head  $\times 4$ .

- |  |   |
|--|---|
| 1. <i>M. (Pharochilus) politus</i> (Burmeister). | 4. <i>M. (Analaches) australiensis</i> (Stoliczka). |
| 2. <i>M. (Pharochilus) punctiger</i> , Gravelly. | 5. <i>M. (Cetejus) grabowskii</i> (Kuwert).         |
| 3. <i>M. (s. str.) quaestionis</i> (Kuwert).     | 6. <i>M. (Cetejus) peltostictus</i> (Kaup).         |

bounding posteriorly the crescentic groove on the mentum is usually more pronounced, and the lateral matt border is very broad and extends round in front on to the inner side of the punctured area. The punctures in the lateral grooves of the elytra, though sometimes irregular, and inclined to be more or less transverse behind, as a rule resemble those of *M. quaestionis* and *australasicus* more closely than they do those of *M. dilatatus*.

**Mastochilus (Pharochilus) punctiger**, n. sp.

Fig. XIII, 2.

Two specimens from New South Wales. Length 33 mm.

The small triangular frontal area is bounded laterally by high frontal ridges and inner tubercles, somewhat as is *M. quaestionis*, but is not itself elevated. The ridges joining the inner tubercles to each other and to the outer tubercles are absent, a broad transverse flattened rugose band extending between the supraorbital ridges from the inner tubercles to the anterior margin of the head; behind this band the head is smooth and glossy. The mentum is somewhat coarsely and sparsely punctured between the scars, with a more or less triangular, extensive (but sometimes indistinct) depression in front. Its lateral parts are more closely and finely punctured on the inner side, obliquely striate with a more or less smooth matt border on the outer.

The median groove of the pronotum is deeply impressed, but may be incomplete in front; the marginal grooves are coarsely punctured in their anterior extremities, which bend slightly inwards; the remainder of them is very finely punctured, as are also the pronotal scars. The general surface of the pronotum is unpunctured. The scutellum

bears a number of scattered punctures, especially in front. The mesosternum is matt, with a coarsely punctured  $\wedge$ -shaped area in front. It is without scars. The posterior intermediate areas of the metasternum are closely and coarsely punctured, with the exception of a band bordering the somewhat narrow and rugose lateral areas. The elytra resemble those of *M. australasicus*.

**Mastochilus (s. str.) quaestionis** (Kuwert).

Fig. XIII, 3, p. 99.

*Episphenoides quaestionis*, Kuwert, 1898, p. 327.

A number of specimens from New South Wales, several being from the Richmond River. Length 44-51 mm.

Easily distinguished from all other known species by its large inner tubercles, which are situated very close to one another and to the central tubercle, the whole of the small triangular concave frontal area being strongly elevated. The small central part of the mentum is usually marked with a pair of more or less confluent shallow transverse grooves a little behind, and a small depression in the middle of, the anterior margin; but either or both of these may be faint or absent; or one may be so strongly developed as to obliterate the other; strong ridges, however, are never present. The lateral parts of the mentum, in front of the primary scars, are glossy, punctured and hairy throughout. The pronotum has no median groove; its scars are punctured. The elytra are more coarsely punctured at the sides than above.

**Mastochilus (s. str.) australasicus** (Percheron).

Pl. I.

*Passalus australasicus*, Percheron, 1841, pp. 67, pl. lxxvii, fig. 2.

A number of specimens from Queensland, New South Wales (Richmond River) and Victoria (Melbourne); also a series said to come from Dodinga in Halmaheira;<sup>1</sup> also specimens presented by Mr. H. Schrader from Tingha and New England, New South Wales. Length 37-48 mm.

The small inner tubercles are situated nearly half as far from the outer tubercles as the latter are from each other, and almost directly behind them. The ridge uniting the inner tubercles is often absent. When present it may lie close in front of the frontal ridges, or some distance in front of them. The frontal area, which may thus be almost non-existent or of considerable size, is smooth and glossy; the area between it and the anterior margin of the head is very rough. The pronotum, mentum and elytra resemble those of *M. quaestionis*.

**Mastochilus (s. str.) polyphyllus** (MacLeay).

*Passalus polyphyllus*, MacLeay, 1826, p. 439.

Several specimens from Queensland and New South Wales (Sidney); also one said to come from Dodinga in Halmaheira.<sup>1</sup> Length 34-40 mm.

The central and inner tubercles are more widely separated than in the preceding species; and the frontal ridges, instead of running direct between the two, diverge either from an

<sup>1</sup> Probably part of a series from Australia which has been wrongly labelled.

anterior prolongation of the central tubercle or at very acute angle, and curve first outwards and then a little forwards, with the result that the frontal area appears markedly transverse. The ridge joining the inner tubercles together is present, but there are no ridges in front of these tubercles. The mentum is glossy throughout, and bears a small but deeply impressed V- or U-shaped groove in the middle in front; only the lateral parts are punctured. The pronotum resembles that of *P. punctiger*, the median groove being very strongly developed. The dorsal grooves of the elytra are imperfectly, the lateral ones strongly but not very coarsely, punctured.

**Mastochilus (Analaches) australiensis** (Stoliczka).

Fig. XIII, 4, p. 99.

*Cetejus australiensis*, Stoliczka, 1873, pp. 157-158 (continuation of footnote to p. 156).

A number of specimens from Queensland, one from New South Wales and one from New Guinea (Stephansort, Astrolabe Bay). Length 25.5-30.0 mm. The smallest and flattest species known from Australia, also the only one with asymmetrical outer tubercles.

All six antennal lamellae are extremely long and slender. The upper tooth of both mandibles is obsolete, and the denticle behind it, though well developed, is more or less hidden beneath the ends of the supra-orbital ridges; from this denticle a slight ridge extends downwards to the outer angle of the mandible, which is produced into an acute and outwardly (almost forwardly) directed tooth. The outer tubercles are very large, the left one slightly more so than the right; the gap between them is semi-circular. The inner tubercles are situated at their base; the frontal area is about twice as broad as long. The general surface of the upper side of the head is more or less strongly punctured. The secondary scars on the mentum are transverse and matt; with the middle of the anterior margin they enclose more or less completely a small triangular glossy area.

The pronotum is more or less sparsely covered at the sides with large punctures, which tend to concentrate in and around the scars. Its marginal grooves are punctured throughout and are scarcely bent inwards at their anterior ends. The median groove is more or less obsolete. The dorsal grooves of the elytra are finely punctured; the lateral ones are much broader than the ridges between them, and the transverse ridges between their enlarged matt punctures are more or less obsolete.

**Mastochilus (Analaches) puberilis** (Kuwert).

*Epilaches pubarilis*, Kuwert, 1898, p. 337.<sup>1</sup>

One specimen from Milne Bay, British New Guinea, and one presented by the British Museum, also from New Guinea. Length 31-33 mm.

The mandibles are not angulate externally, and the denticle near the base of the upper margin is not covered by the anterior angles of the head. The outer tubercles resemble those of *M. australiensis*, but the inner ones are situated a considerable distance behind them. The frontal area is smaller and more triangular. The pronotum is somewhat indistinctly punctured in the scars and marginal grooves; except for this it is unpunctured; the median groove may be somewhat stronger. The dorsal grooves of the elytra are

<sup>1</sup> First mentioned in Kuwert's 1891 list, where the name is spelt *puberilis* as above.

unpunctured; the lateral ones are strongly punctured. In other respects this species resembles *M. australiensis*.

**Mastochilus (Cetejus) grabowskii** (Kuwert).

Fig. XIII, 5, p. 99.

*Cetejus grabowskii*, Kuwert, 1898, p. 330.

Three specimens from Humboldt Bay, New Guinea.<sup>1</sup> Length 28.5-29.0 mm. A stouter insect than *M. australiensis* or *M. puberilis*, with shorter antennal lamellae.

The mandibles are not angulate externally, and there is no denticle exposed on the upper margin behind the rudimentary upper tooth. The upper surface of the head resembles that of *M. puberilis*, except that the outer tubercles are more outwardly directed, that the central and inner tubercles are more widely separated, and that the frontal ridges are more or less incomplete between them. The secondary scars on the mentum are represented by a more or less broken transverse groove a little behind the anterior margin. The scars, anterior angles, and marginal grooves of the pronotum are coarsely punctured; the median groove is very strong. All the grooves of the elytra are somewhat coarsely punctured.

**Mastochilus (Cetejus) sodalis** (Kaup).

*Aceraius sodalis*, Kaup, 1868a, pp. 29-30: and 1868b, p. 5.

A number of specimens from Ternate and Batjan, one of the latter being from Labuan; also one from Taruna, Gt. Sangir, 2,000 ft. Length 24.0-25.8 mm.

This species closely resembles the last, but is smaller and therefore less perceptibly asymmetrical; it has a somewhat shorter frontal area, and has the groove formed by the secondary scars on the mentum deep and unbroken.

**Mastochilus (Cetejus) peltostictus** (Kaup).

Fig. XIII, 6, p. 99; also pl. I.

*Aceraius peltostictus*, Kaup, 1868b, pp. 5-6.

Two specimens from Ceram and many from New Guinea, one of the latter being from Stephansort. Length 22.5-26.3.

The outer tubercles are strongly asymmetrical, the left one being slightly longer than the right, broad and truncate instead of slender and pointed, and more inwardly directed. The groove representing the secondary scars on the mentum is more strongly arched away from the anterior margin than in *M. sodalis*, and the grooves of the elytra are more finely punctured, especially the dorsal ones. In other respects *M. peltostictus* resembles *M. sodalis*.

---

<sup>1</sup> The two specimens which I recorded from Stephansort (1914c, p. 334), though compared with named specimens in Berlin, do not agree with Kuwert's description of the present species, and are apparently *M. peltostictus*, Kaup.

The above-mentioned species of *Mastochilus* may be grouped into four sub-genera as indicated above (pp. 97-98), and may be distinguished from one another thus:—

I. Sub-genus **PHAROCHILUS**, Kaup.

- |   |   |  |                              |
|---|---|--|------------------------------|
| 1 | { | The median part of the mentum with at most two or three punctures .. .. .                        | 2.                           |
|   |   | The median part of the mentum strongly punctured throughout .. .. .                              | <i>M. punctiger</i> , p. 99. |
| 2 | { | The lateral lobes of the mentum with a more or less narrow matt border on the outer side .. .. . | 3.                           |
|   |   | The lateral lobes of the mentum broadly matt on the outer side .. .. .                           | <i>M. politus</i> , p. 99.   |
| 3 | { | The ridges of the elytra obsolete in the extreme posterior angles                                | <i>M. dilatatus</i> , p. 98. |
|   |   | The ridges of the elytra normal  | <i>M. nitidulus</i> , p. 98. |

II. Sub-genus **MASTOCHILUS**, s. str.

- |   |   |   |                                   |
|---|---|---|-----------------------------------|
| 1 | { | The frontal area small, almost equilaterally triangular, raised above the general surface of the head   | <i>M. quaestionis</i> , p. 100.   |
|   |   | The frontal area not raised above the general surface of the head, usually much broader than long   | 2.                                |
| 2 | { | The secondary scars very variable in development; when present always extending inwards from the ends of the anterior margin of the median part of the mentum         | <i>M. australasicus</i> , p. 100. |
|   |   | The secondary scars always developed as a pair of fine grooves defining a small and more or less equilaterally triangular shield in the middle of the anterior margin | <i>M. polyphyllus</i> , p. 100.   |

III. Sub-genus **ANALACHES**, Kuwert.

- |   |   |  |                                   |
|---|---|--|-----------------------------------|
| 1 | { | The lateral grooves of the elytra much broader than the ridges between them; the transverse ridges between their enlarged matt punctures more or less obsolete .. .. . | <i>M. australiensis</i> , p. 101. |
|   |   | The lateral grooves of the elytra narrow and strongly punctured .. .. .  | <i>M. puberilis</i> , p. 101.     |

IV. Sub-genus **CETEJUS**, Kaup.

- |   |   |  |                                  |
|---|---|--|----------------------------------|
| 1 | { | The left outer tubercle pointed, directed forwards or a little outwards  | 2.                               |
|   |   | The left outer tubercle truncate, directed inwards   | <i>M. peltostictus</i> , p. 102. |
| 2 | { | The secondary scars on the mentum represented by a more or less broken transverse groove a little behind the anterior margin | <i>M. grabowskii</i> , p. 102.   |
|   |   | The groove formed by the secondary scars on the mentum deep and unbroken   | <i>M. sodalis</i> , p. 102.      |

Genus **LABIENUS**, Kaup, 1871, p. 39.

Incl. *Aurelius*, Kuwert, 1896; *Hyperplesthenus*, Kuwert, 1898; *Kaupioloides*, Gravelly, 1913; *Kaupiolus*, Zang, 1903b (= *Vellejus*, Kaup, 1871, preoccupied).

Type, *Eriocnemis ptoax*, Kaup, 1868a, p. 25.

**Labienus inaequalis**, n. sp.

Figs. XIV, 1 and XV. 1.

Two specimens from Hattam, Arfak, Dutch New Guinea. Length 37·7-38·7 mm.

This species is closely allied to *L. trigonophorus*, from which it differs in the following particulars only. The anterior margin of the labrum is more strongly concave. The primary scars on the mentum are much smaller, and the secondary ones much larger, the latter almost meeting in the middle line immediately in front of the posterior margin. The general surface of the head is less rugose than in *L. trigonophorus*, and the left outer tubercle is much larger and more definitely directed inwards; the frontal ridges are obsolete in front-

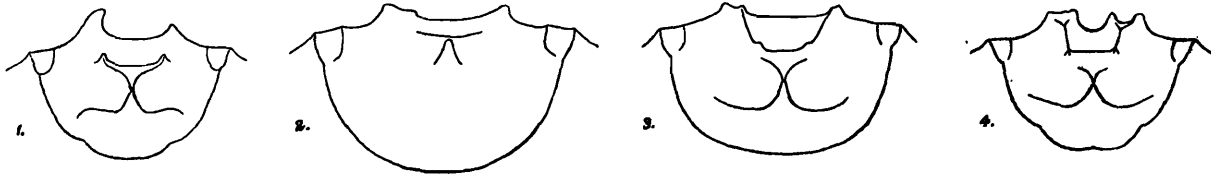


FIG. XIV.

*Labienus* spp. ; specific characters in the upper surface of the head  $\times 4$ .

- |                                    |                                     |
|------------------------------------|-------------------------------------|
| 1. <i>L. inaequalis</i> , Gravely. | 3. <i>L. ptoxoides</i> , Gravely.   |
| 2. <i>L. dohrni</i> (Kuwert).      | 4. <i>L. compergus</i> (Boisduval). |

of the inner tubercles. The anterior angles of the prothorax are somewhat more obtuse; the median groove is complete. The posterior intermediate areas of the metasternum are almost unpunctured as well as being hairless; the lateral areas are thickly punctured and hairy as in *L. trigonophorus*, their surface being on the same level as that of the intermediate areas, an abrupt change of level occurring only where they touch the central area. Neither in *L. trigonophorus* nor in *L. inaequalis* are the elytra united.

**Labienus dohrni** (Kuwert).

Fig. XIV, 2; also pl. 1.

*Aurelius dohrni*, Kuwert, 1898, p. 326.

Four specimens from Dutch New Guinea, three being from Hattam, Arfak, and one from Kapaur. Length 42-47 mm.

This species is easily recognized by the small free forwardly directed apex of the central tubercle and the absence of inner tubercles. The frontal and parietal ridges are obsolete or absent. The outer tubercles may be simple and symmetrical, or the left one may be more or less distinctly double; the anterior margin of the head is usually more or less rough between them, this rough area being separated from the rest of the head by a fine ridge or groove.

The pronotum is much broader behind than in front; its median groove is indistinct; it is without punctures except in the posterior angles (including the true scars, though other unpunctured depressions may be present near them), which are densely hairy and punctured. The scutellum bears two longitudinal lines of fine punctures. The mesothoracic episterna are punctured except in the posterior angles. The mesosternum is smooth and polished; its scars are distinct, but very small and less close to the margin than usual. The metasternum resembles that of *L. trigonophorus*. The grooves of the elytra are deep but unpunctured.



**Labienus ptoxoides**, n. sp.

Figs. XIV, 3 and XV, 2.

Two specimens, one from Andai and the other from Mt. Arfak, both in New Guinea. Length 44-46 mm.

This species is allied to *L. gracilis* and *L. ptox*. The antennae resemble those of *L. ptox*, the first two lamellae being quite short and the remaining four very long. The secondary scars of the mentum are straight, and extend to the posterior margin. The head closely

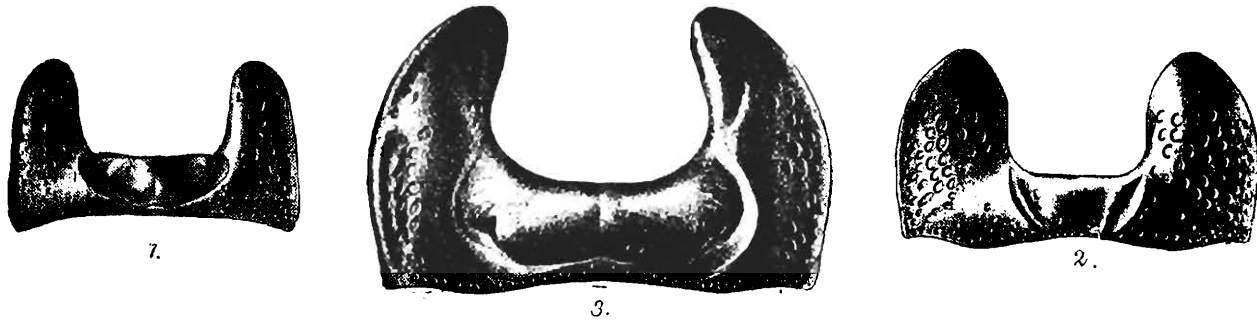


FIG. XV.

*Labienus* spp. ; mentum  $\times 8$ .1. *L. inaequalis*, Gravelly.3. *L. ptox*, Kaup.2. *L. ptoxoides*, Gravelly.

resembles that of both *L. gracilis* and *L. ptox*, especially the latter. The pronotum resembles that of *L. ptox*, the scars being more densely hairy and punctured than in *L. gracilis*. In all other respects the present insect resembles both species.

**Labienus ptox**, Kaup.

Fig. XV, 3.

*Eriocnemis ptox*, Kaup, 1868a, p. 25.*Labienus ptox*, Kaup, 1871, p. 39.

Numerous specimens from New Guinea (Stephansort, Bongu, Milne Bay and Roon Islands), Aru (Ureiuning and Wamma Dobbo) and Waigeu. Also one said to come from Borneo and three from Sumatra. Length 48-58 mm.

This species differs from the last only in its larger size and in having the scars on the mentum strongly arched instead of straight.

**Labienus compergus** (Boisduval).

Fig. XIV, 4 ; also pl. 1.

*Passalus compergus*, Boisduval, 1835, pp. 244-246.*Vellejus compergus*, Kaup, 1871, p. 36.

Several specimens from New Guinea (Milne Bay ; Stephansort, Astrolabe Bay ; Andai ; Kapaur ; and Hattam, Arfak) and one from Waigeu. Length 32-36 mm.

The antennae resemble those of the majority of species belonging to the genus. The right outer tubercle is more or less distinctly double. The left outer tubercle may be similar, or may be composed of three more or less distinct processes. The pronotal scars are unpunctured and hairless. The mesosternal scars are variable. The posterior intermediate areas of the metasternum are unpunctured. All the grooves of the elytra,

especially the lateral ones, are distinctly punctured. In other respects this species resembles *L. ptoz*.

***Labienus moluccanus* (Percheron).**

*Passalus moluccanus*, Percheron, 1835, pp. 31-33, pl. ii, fig. 7.

Numerous specimens from Ceram (Roemasosa]-Pasama in the central part, Wahaai in the north, Elpapoeti Bay in the south, Honitetoe in the West), Limtoe in Nusa Laut, Saparua, Hitu and Leitimor in Amboina, Batjan. Length 42-52 mm.

This species differs from the last only in having the frontal ridges more or less obsolete behind the inner tubercles, in having the two processes of each of the outer tubercles less distinct (much as in *L. ptoz* and *ptoxoides*) and in having the elytra united in the middle line.

***Labienus gigas* (Kaup).**

Pl. 1.

*Eriocnemis gigas*, Kaup, 1868a, p. 23.

Seven specimens from Batjan, including five from Laboean, one from Halmaheira one from Ternate, and two without locality records. Length 56-64 mm. I am unable to distinguish between *L. gigas* from Ternate and *L. crassus* from Batjan.

The elytra are united as in *L. moluccanus*, which the present species resembles in all respects, except in having each of the outer tubercles composed of three more or less distinct blunt processes, and in having the posterior intermediate areas of the metasternum, and as a rule the pronotal scars, punctured, though not hairy.

The species of *Labienus* known to me may be identified thus:—

1	{	The secondary scars on the mentum convergent behind, curved or straight, not very widely separated as a whole	2.
		The secondary scars on the mentum strongly arched outwards, very widely separated as a whole	8.
2	{	The outer tubercles simple, conical; the grooves of the elytra punctured	3.
		Not as above	4.
3	{	The left outer tubercle scarcely longer than the right; the mentum with primary scars	.. <i>L. trigonophorus</i> (Zang) <sup>1</sup> .
		The left outer tubercle much longer than the right; the mentum without primary scars	.. .. <i>L. inaequalis</i> , p. 104.
4	{	The central tubercle free apically	.. .. <i>L. dohrni</i> , p. 104.
		The central tubercle not free	.. .. 5.
5	{	The outer tubercles long and simply truncate	.. : <i>L. glaber</i> (Gravely) <sup>1</sup> .
		The outer tubercles much shorter, not simply truncate	.. .. 6.
6	{	Both outer tubercles composed of two blunt denticles; the scars of the pronotum without punctures or hair	.. .. <i>L. impar</i> (Kuwert). <sup>1</sup>
		The inner denticle of the right outer tubercle more or less obsolete; the scars of the pronotum with hair-bearing punctures	.. .. 7.

<sup>1</sup> See Gravely, 1913, for figures of these species.

	{	The antennal lamellae normal	..	<i>L. gracilis</i> , Heller. <sup>1</sup>	
7	{	The first two antennal lamellae very short, the remaining four exceptionally long	..	<i>L. ptoxooides</i> , p. 105.	
8	{	The first two antennal lamellae very short, the remaining four exceptionally long	..	<i>L. ptox</i> , p. 105.	
	{	The antennal lamellae normal	..		9.
9	{	The elytra separate; insects of moderate size		<i>L. compergus</i> , p. 105.	
	{	The elytra united; insects of large size			10.
10	{	The outer tubercles much narrower than the space between them, each being composed of two more or less distinct blunt processes only; the posterior intermediate areas of the metasternum smooth	..	<i>L. moluccanus</i> , p. 106.	
	{	The outer tubercles at least as broad as the space between them, each including an additional blunt process on the inner side of, and some distance from, the two found in <i>L. moluccensis</i> ; the posterior intermediate areas of the metasternum coarsely punctured		<i>L. gigas</i> , p. 106.	

Genus **PROTOMOCELUS**, Zang, 1905b, p. 154.

=*Pelops*, Kaup, 1871, preoccupied.

Type, *Passalus australis*, Boisduval, 1835, pp. 246-247, pl. vi, fig. 21.

**Protomocoelus australis** (Boisduval).

Pl. I.

*Passalus australis*, Boisduval, 1835, pp. 246-247, pl. vi, fig. 21.

*Pelops australis*, Kaup, 1871, p. 38.

Five specimens from the Solomon Islands (including one from San Cristoval and one from Bougainville), three from New Britain, many from New Guinea (Milne Bay) Stephansort and Isola Yule), and several from Waigeu, Aru (Wamma Dobbo and Ureiuning) and Ceram. Also one specimen said to come from Australia. Length 30-47 mm. The Solomon Islands specimens (except the one from Bougainville, which is only 35 mm. long), and the specimen labelled Australia, are much the largest, none of the others exceeding 37 mm. in length. Apart from the Bougainville specimen the smallest of the Solomon Islands specimens is 41 mm. long. I am unable, however, to find any constant structural difference between the Solomon Islands specimens and the others, and am consequently unable to recognize *P. solomonis* (Kaup) as distinct. *P. australis* is somewhat variable, and the validity of Kuwert's species may be doubted.<sup>2</sup>

*Protomocoelus australis* is probably allied more closely to *Labiensus inaequalis* than to any other species yet described. It differs from it, however, in the structure of the mandibles (see above, pp. 78 and 79); in the broader and often more widely separated, but very variable.

<sup>1</sup> See Gravelly, 1913, for figures of this species.

<sup>2</sup> *Passalus impressicollis*, Boheman 1858, p. 40, cannot belong, as supposed by Kuwert, to the present genus, for its outer tubercles are equal and obtuse instead of unequal and acute. It comes from Sydney, and not from Menado as stated by Kuwert; it is said by Boheman to be allied to *Mastochilus polyphyllus*, and doubtless belongs to the same genus.

scars on the mentum ; in having the frontal ridges more or less obsolete behind instead of in front of the inner tubercles ; in the deep concavity between the outer tubercle and the anterior end of the supraorbital ridge of the left or of both sides of the head ; in having the right outer tubercle about as long as the left although more slender ; in having no distinct median groove on the pronotum ; in usually having punctures on the posterior intermediate areas of the metasternum ; and in having the dorsal grooves of the elytra as distinctly punctured as the lateral ones. The elytra are not united in either species.

Genus **GONATAS**, Kaup, 1871, p. 50.

Incl. *Omegarius*+ ? *Tatius*, Kuwert, 1896, p. 229.

Type, *Passalus naviculator*, Percheron, 1844, pp. 1-2, pl. cxxxiv, fig. 1.

**Gonatas minimus** (Kuwert).

Pl. I.

*Omegarius minimus*, Kuwert, 1898, p. 313.

*Omegarius minimus*, Gravely, 1913, pp. 110-111, text-fig. 3A.

Three specimens from New Britain, of which two are from Herbertshöhe ; one said to be from Australia and one without locality record. Length 20-25 mm.

**Gonatas pumilio**, Kaup.

*Aceraius pumilio*, Kaup, 1868b, p. 6.

*Gonatas pumilio*, Kaup, 1871, p. 50.

*Omegarius pumilio*, Gravely, 1913, p. 112, text-fig. 3B.

Several specimens from New Guinea (Torres Straits, Fly River, Kapaur), Waigeu Amboina (Leitimor), and Ceram (Honiteto in the western, Wahaai in the northern, and



FIG. XVI.

*Gonatas* spp. ; mentum  $\times 8$ .

1. *G. cetioides*, Zang.

2. *G. tenimbrensis*, Gravely.

3. *G. carolinensis*, Gravely.

4. *G. minor*, Gravely.

5. *G. naviculator* (Percheron).

Roemasosal-Pasania in the central parts of the island). Also one specimen said to come from the Sulu Islands. Length 18.5-23.0 mm.

**Gonatas cetioides**, Zang.

Fig. XVI, 1.

*Gonatas cetioides*, Zang, 1905a, p. 316.

One specimen from Herbertshöhe, New Britain. Length 25 mm.

The antennae resemble those of *G. minimus*, the mandibles those of *G. pumilio*. The posterior margin of the mentum is very lightly curved as in both species, but the lateral

forwardly directed parts of the scars are much more, and the other parts less, deeply impressed than in either. The lateral areas of the metasternum are somewhat smoother and the pronotum and elytra somewhat more convex than in either.

**Gonatas schellongi**, Kuwert.

Pl. I.

*Gonatas schellongi*, Kuwert, 1898, p. 314.

Numerous specimens from New Guinea (Stephansort, Milne Bay, Humboldt Bay, Torres Straits), Kei Islands, and New Brittain (Herbertshöhe). Length 28-32 mm.

The antennal lamellae are longer than in the two preceding species, and the posterior margin of the mentum is more strongly curved, the scars consequently forming a W- rather than a  $\omega$ -shaped figure. The left mandible is as broad as the right and scarcely if at all longer; its anterior lower tooth is less distinct than in *G. minimus*, but more distinct than in other species of the genus. The form of the outer tubercles varies slightly, and *G. tridentatus*, Kuwert, is unlikely, I think, to prove distinct; *G. differens*, *albertisi*, *major* and *novaebritanniae* will perhaps also prove to be identical with the present species. The lateral areas of the metasternum are punctured and hairy. The dorsal grooves of the elytra are less distinctly punctured than are the lateral ones.

**Gonatas germari**, Kaup.

*Aceraius germari*, Kaup, 1868a, pp. 30-31.

*Gonatas germari*, Kaup, 1871, p. 51.

*Gonatas germari*, Gravelly, 1914c, pp. 250-251, pl. xiii, figs. 47-47a.

Numerous specimens from Ternate and Batjan (Labuan), five from Halmaheira (Dodinga) and Great Banda, one from Morty Island near Halmaheira, one from the Kei Islands, and one said to be from Australia. Also one from New Guinea (Dorey) and four from Buru (Wakollo in the central part of the island, and Ilat on the east coast) all of much larger size. Length, excluding the Dorey and Buru specimens, 23.5-26.5 mm.; length of Dorey specimens 29.0 mm.; length of Buru specimens 31.0-32.5 mm.

The antennae and mentum resemble those of *G. schellongi*. The left mandible is distinctly longer than the right, and its anterior lower tooth is more or less obsolete. The lateral areas of the metasternum are punctured and more or less hairy. The difference between the distinctness of the punctures in the dorsal and lateral grooves of the elytra is less great than in *G. schellongi*.

**Gonatas tenimbrensis**, n. sp.

Fig. XVI, 2.

Five specimens from Tenimber (or Timor Laut), four being from Jandema. Length 25.5-27.0.

Closely allied to the preceding species, from which it differs only in having still less or no trace of the left anterior lower tooth, in having antennae with shorter lamellae like those of *G. minimus* and *G. cetioides*, and in having the lateral areas of the metasternum unpunctured and hairless. The scars on the mentum are deeply impressed throughout.

**Gonatas carolinensis**, n. sp.

Fig. XVI, 3, p. 108.

Three specimens from the Caroline Islands. Length 22·4-23·2 mm.

This species differs from the last only in its smaller size, slightly longer antennal lamellae, and more even mentum, the scars being less deeply impressed, especially medially.

**Gonatas minor**, n. sp.

Fig. XVI, 4, p. 108.

Four specimens from Mefor ("Mafor") and one from Run ("Roon") Islands. Length 21·3-22·2.

The antennae are very long as in *G. germari*. The difference in length between the right and left mandibles is somewhat greater in *G. minor* and in the next species than in any other. The mentum resembles that of *G. germari*; its scars are less deeply impressed than in *G. tenimbrensis*, but more deeply impressed than in *G. carolinensis*. The lateral areas of the metasternum are smooth and hairless. In other respects the present species resembles *G. germari* and *G. naviculator*.

**Gonatas naviculator** (Percheron).

Fig. XVI, 5, p. 108; pl. I.

*Passalus naviculator*, Percheron, 1844, pp. 1-2, pl. cxxxiv, fig. 1.*Gonatas naviculator*, Kaup, 1871, pp. 50-51.

Numerous specimens from Saparua Island, several from Ceram (Kairatoe in the Western and Roemasosal-Pasama in the central part of the island) and Buano, one from Nusa-Laut, and one said to come from New Guinea. Length 23·0-28·5 mm.

*G. naviculator* can be distinguished from all other species of the genus known to me by the strongly and as a rule abruptly curved posterior margin of the mentum, though this character is not always so clearly marked in specimens from the mainland of Ceram as in those from the neighbouring islands. The antennal lamellae are comparatively short and stout as in *G. tenimbrensis*, etc. The mandibles resemble those of *G. minor*. The outer tubercles are somewhat slenderer than in *G. germari*, which the present species resembles in other respects.

The above-mentioned species of *Gonatas* may be identified thus:—

- |   |   |   |    |                             |
|---|---|---|----|-----------------------------|
| 1 | { | The posterior margin of the mentum very lightly curved ;  | .. | 2..                         |
|   |   | the scars more or less $\omega$ -shaped   |    |                             |
| 1 | { | The posterior margin of the mentum more strongly curved ;   | .. | 4..                         |
|   |   | the scars more or less W-shaped   |    |                             |
| 2 | { | The dentition of both mandibles complete and well developed   | .. | <i>G. minimus</i> , p. 108. |
|   |   | The anterior lower tooth of the left mandible rudimentary or absent   |    |                             |
| 3 | { | The antennal lamellae very slender ; the scars on the mentum distinctly $\omega$ -shaped  | .. | <i>G. pumilio</i> , p. 108. |
|   |   | The antennal lamellae stouter ; the scars on the mentum intermediate between the $\omega$ and W form, very deeply impressed laterally |    |                             |

4	}	The left anterior lower tooth small but distinct; the left mandible of about the same size as the right .. .. .	<i>G. schellongi</i> , p. 109.	
		The left anterior lower tooth more or less rudimentary; the left mandible more or less distinctly longer and slenderer than the right .. .. .		5.
5	}	The posterior margin of the mentum moderately strongly arched .. .. .		6.
		The posterior margin of the mentum very strongly arched; the antennal lamellae somewhat short and stout; the lateral areas of the metasternum somewhat rough and hairy .. .. .	<i>G. naviculator</i> , p. 110.	
6	}	The lateral areas of the metasternum more or less rough and hairy; the antennal lamellae very long and slender .. .. .	<i>G. germari</i> , p. 109.	
		The lateral areas of the metasternum smooth and hairless .. .. .		7.
7	}	The antennal lamellae somewhat short and stout; the scars on the mentum very deeply impressed .. .. .	<i>G. tenumbrensis</i> , p. 109.	
		The antennal lamellae longer and slenderer; the scars on the mentum less deeply impressed .. .. .		8.
8	}	The left mandible and the antennal lamellae moderately long and slender; the scars on the mentum very lightly impressed, especially near the middle line .. .. .	<i>G. carolinensis</i> , p. 110.	
		The left mandible and the antennal lamellae somewhat longer and slenderer; the scars on the mentum normal .. .. .	<i>G. minor</i> , p. 110.	

Genus **PSEUDEPISPHENUS**, Gravelly, 1914c, p. 327.

Type, *Pseudepisphenus perplexus*, Gravelly, 1914c, pp. 327-328, text-fig. 8, A-B.

**Pseudepisphenus perplexus**, Gravelly.

Pl. I.

*Pseudepisphenus perplexus*, Gravelly, 1914c, pp. 327-328, text-fig. 8, A-B.

One specimen from Snow Mts., 4,000-6,000 ft., Dutch New Guinea, presented by the British Museum. Length 29.5 mm.

Genus **TARQUINIUS**, Kuwert, 1896, p. 227.

Type, *Tarquinius paradoxus*, Kuwert, 1898, p. 279; Gravelly, 1914c, pp. 178 & 327, text-fig. 8, C.-D. (see pl. I).

Subfamily **LEPTAULACINAE**.

The genera of Leptaulacinae may be separated thus:—

The sides of the elytra hairy .. .. .	<i>Trichostigmus</i> , p. 112.
The sides of the elytra hairless .. .. .	<i>Leptaulax</i> , p. 112.

Genus **TRICHOSTIGMUS**, Kaup, 1871, p. 31.

**Trichostigmus ursulus**, (Schaufuss).

*Leptaulax ursulus*, Schaufuss, 1885, p. 187.

A number of specimens from S. Celebes (Lompa-Battau, 3,000 ft., and Tjamba).

Length 16.0-19.5 mm.

*Trichostigmus ursulus* resembles *Leptaulax bicolor*, except in the generic character and in having the sides of the pronotum more sparsely punctured in the neighbourhood of the scars and not at all in the anterior angles.

**Trichostigmus thoreyi**, Kaup.

*Trichostigmus thoreyi*, Kaup, 1868a, pp. 13-14.

A single specimen presented by Mr. C. F. Baker from Imugin, N. Viscaya, Phillipines.

Length 16.7 mm.

*T. thoreyi* differs from the preceding and only other known species of the genus only in the structure of the pronotum.

The species of *Trichostigmus* may be distinguished thus :—

{	The pronotum with a few punctures in the anterior angles, its marginal grooves broad and deep and coarsely punctured	<i>T. thoreyi</i> , p. 112.
	The pronotum unpunctured except near the scars, its marginal grooves very fine ..	<i>T. ursulus</i> , p. 112.

Genus **LEPTAULAX**, Kaup, 1868a, p. 11.

Incl. *Leptaulacides*, Zang, 1905a, p. 106, footnote 1.

Type, *Passalus dentatus*, Fabricius, 1792, p. 241.

The account of this genus which I published in 1914 was based mainly on the examination of specimens from Continental Asia. I had, it is true, received a few specimens from the Archipelago; and I was able to make a hurried examination of the named collection in Berlin. But I had had no opportunity of examining a large and representative collection at leisure, an opportunity which has now been afforded by the obtaining of the Van de Poll collection for the Indian Museum.

The careful examination of this additional material convinces me that the drastic reduction in the number of species, advocated in my previous paper, was fully justified except in the case of *L. barbicauda*, Zang; and, indeed, that a few further reductions must be made. Thus *L. obtusidens* proves to be a synonym of *L. bicolor*; and *L. novaeguineae*, together with the names regarded as synonyms with it, are almost certainly synonyms of the same species, or partly of the same species and partly of *L. dentatus*.

I have seen nothing in the collection that can be distinguished as *L. macassariensis*; but a specimen labelled with this name, and associated with specimens both of *L. bicolor* and *L. dentatus*, proves to belong to the former species. I am still inclined to think, judging from Schaufuss's description, that the type may prove to be of a distinct species, the puncturing of the head being apparently much coarser than in *L. bicolor*, and the convexity



of the body much greater than in *L. cyclotaenius*, the only other species known to me from Celebes with which it can possibly be identified. But for the present it seems best to drop the name *macassariensis*, raising the Bornean *anibarbis* to specific rank.

The variation of *L. cyclotaenius* in size, form, and head-puncturing proves to be much greater than I previously supposed, especially in Malaysian specimens; and the distinction between the Malaysian and continental races breaks down. The name *himalayae* therefore becomes a synonym only. *L. anipunctus* is very near *L. cyclotaenius* and may prove to be identical with it. For the present it seems best to regard it as a variety of that species.

I am no longer able to regard the varieties *vicinus* and *glabriventris*, of *L. bicolor* and *dentatus* respectively, as distinct.

The three species *L. bicolor*, *L. cyclotaenius* and *L. dentatus* are so variable as to require very special care in their discrimination. The first and third can always be told apart by the structure of their parietal ridges, which extend outwards to the supraorbital ridges in the former, and end abruptly not far from the central tubercle in the latter. In *L. cyclotaenius* these ridges are variable; but the puncturing of the lateral grooves of the elytra is much more distinctly scalariform than is ever the case in *L. bicolor* (this is usually, but not always, so in *L. dentatus* also); and the central area of the metasternum is almost invariably punctured either irregularly or over a more or less V-shaped area, punctures being absent or confined to a single symmetrically placed pair in *L. dentatus*. In the rare cases where the general appearance of the specimen resembles that of *L. cyclotaenius*, and the central area of the metasternum is entirely without punctures—I have only seen one such, and very few in which these punctures were not at least moderately numerous, all of these being from Sumatra or the Malay Peninsula—one can only base one's identification on the somewhat indefinite and variable characters afforded by the shape of the frontal ridges and the puncturing of the head.

#### **Leptaulax planus** (Illiger).

*Passalus planus*, Illiger, 1800, p. 104.

*Leptaulax planus*, Gravelly, 1914c, pp. 260-261 and 310, pl. xiii, fig. 58.

One specimen from Siam, nine from the Malay Peninsula (four of them from Perak, and one from Larut), many from Sumatra (Bedagei Interior, ca. 600 ft.; Tandjong Morawa; Serdang; S. E. Serdang, ca. 1,000 ft.; Png. Pandjang, Padung Interior, ca. 2,000 ft., Tandjong-Djati, Ranau, Palembang, ca. 2,000 ft.) and Borneo (Sarawak; Brunei; Doesonlanden; Martapura; Mt. Marapok, Dent Province; Mt. Kina-Balu) and one from Celebes (Tondano, Minahassa). M. Guy Babault has sent specimens for examination from Medan, Sumatra. Length 12.3-14.0 mm.

#### **Leptaulax glaber** (Kirsch).

*Trichostigmus glaber*, Kirsch, 1877b, pp. 139-149.

*Leptaulax glaber*, Gravelly, 1905c, p. 307.

One specimen from Batjan and four from New Guinea (Humboldt Bay, Mt. Arfak and Takar). Length 14.0-15.8 mm.

But for the reddish-brown colouration commonly found on the anterior parts of the elytra, this species might easily be confused with small and much flattened specimens of the

Polynesian form of *L. bicolor*. The specimens before me, however, show the extent of this colouration to be extremely variable; for in one of the Humboldt Bay species it covers about a half and in the other about a third of the whole area, while in a third specimen from New Guinea it is confined to a somewhat indistinct patch between the shoulders and in the fourth it is entirely absent. The chief characteristics of the species, apart from colour, are its extreme flatness, the fineness of the marginal grooves of the pronotum, and the almost entire absence of punctures from the pronotum and metasternum. The frontal ridges extend outwards and slightly forwards, to end somewhat abruptly at a considerable distance behind the outer marginal tubercles.

**Leptaulax sambawae**, n. sp.

Four specimens from B. Aroe Hassa, Sambawa, 2,000-5,000 ft., and two from Poera, Allor Islands, 3,000-4,000 ft. Length 24-27 mm.

This species differs from *L. bicolor* only in having the pronotum somewhat less distinctly rectangular in shape, and entirely unpunctured except somewhat indistinctly in the scars and still more indistinctly in the marginal grooves; in having the punctures on the posterior intermediate areas of the metasternum more or less obsolete; and in having the elytra distinctly wider behind than in front with their lateral grooves much less strongly punctured. The abdominal sterna are polished and are entirely unpunctured in two specimens, the terminal segment being marked in others with hair-bearing punctures.

**Leptaulax barbicauda** (Zang).

*Leptaulacides barbicauda*, Zang, 1905a, pp. 164-165.

Several specimens from the Malay Peninsula, (Gap, ca. 3,000 ft., Selangor-Pahang boundary) submitted by Mr. C. Holman Hunt. Length 27-30 mm.

This species is transitional between *L. sambawae* and *L. bicolor*, and is so near the latter most variable species that I have some hesitation in regarding it as distinct. It is, however, distinctly bigger, with large and strongly rectangular pronotum, the general appearance of the insect consequently resembling that of *L. dentatus*. The puncturing of the pronotum and metasternum is weaker than is usually the case in *L. bicolor*, tending to resemble rather that found in *L. sambawae*; there are always, however, a few punctures in the anterior angles of the pronotum, and the punctures in the pronotal scars and on the posterior intermediate areas of the metasternum are somewhat stronger.

**Leptaulax bicolor** (Fabricius).

*Passalus bicolor*, Fabricius, 1801, p. 256.

*Leptaulax bicolor* + var. *vicinus*, Gravely, 1905c, pp. 257-259 and 307-309.

Numerous specimens, including one or more from each of the following localities:—Ceylon (Belihul-Oya); Parambikulam, Cochin State, 1,700-3,200 ft. (collected by myself); Santi Koppa, N. Coorg (presented by Mr. T. Bainbrigg Fletcher); Tukvar, Darjeeling District; Pashok, Darjeeling District, 2,000 ft. (collected by myself); Margherita, Assam; Port Blair, Andamans (collected by Mr. S. W. Kemp); Tonkin (Nape, Thadua, Chapa, Hoabink, and Xieng Khouang, submitted by M. Vitalis de Salvaza; and Cape Fouquet, submitted by M. Guy Babault); Siam; Perak, Malay Peninsula; Gap, 3,000 ft.,

Selangor-Pahang boundary, Malay Peninsula (one specimen sent for examination by Mr. C. Holman-Hunt); Hili Madjedja and G. Madjedja, North Nias; Kalim Bungo, Middle Nias, Sumatra (Bedagei Interior, ca 600 ft.; Beloe Lawang, Pasoeroean; Mana Riang, Palembang, 2,000-3,000 ft.; Tandjong-Djati, Ranau, Palembang, ca. 2,000 ft.; Kandg. Ampat, Lower Padang; Bng. Proepoe, Pad. Bovenland, ca. 1,600 ft.; Engano Island, Benkoelen; also specimens from Médan, submitted by M. Guy Babault); Java (Bogor=Buitenzorg; Tji Bodas, Gng. Gede, ca. 4,000 ft.; Telega Bodas, Garoet, Preanger, 4,000-5,000 ft.; Mt. Tjikorai, 4,000 ft., Sukabumi, 2,000 ft., and Pengalengan, 4,000 ft., W. Java; G. Tji Salimar, ca. 3,000 ft., W. Preanger; Tji Solak, Wunkoops Bay; Mt. Tengger, 4,000 ft., E. Java; Malang); Borneo (Mt. Marapok; Mt. Kinabalu; Sarawak; Pontianak; Doesonlanden; 1° S., 115° E.; Banguay Island); Philippine Islands (Davao: also specimens presented by Mr. C. F. Baker from Imugin, N. Viscaya; Mt. Makiling, Luzon; Zamboanga, Mindanao; Mt. Bonatao and Los Banos); Talaut Islands (Salibabu); Celebes (Lompa-Battau, 3,000 ft., Tjamba and Bantimoeroeng in the south; Menado; Loka, Bonthain); Halmaheira (Gilo); Morty; Ternate; Batjan (Labuan); Wakollo, Central Buru; Ilat, Buru East Coast; Mysol; Kei Islands; New Guinea (Humboldt Bay; Kapaur; Dore; Run). Length 12-24 mm.

In the large and representative collection now before me I find it impossible to subdivide the species satisfactorily into groups distinguished by the amount of puncturing on the abdominal sterna. There is, however, a marked though imperfect correlation of the extent of this puncturing with the localities from which the specimens come, specimens with smooth sterna being characteristic of Ceylon, the Andamans and Nicobars, the Philippines, and the Archipelago east of the Sunda Islands. In specimens from Java the abdominal sterna are as a rule less extensively punctured than in specimens from Sumatra and Borneo; but specimens with absolutely unpunctured abdominal sterna do occur in Borneo and in small islands near Sumatra, if not actually on the mainland.

The form of the mesosternal scars is also variable. Normally they are rounded on the inner side, and are not very large; but in specimens from the archipelago east of Borneo the inner side is usually straight, extending much further backwards. Such forms also occur further west, though more rarely. Celebes specimens appear to occupy a somewhat intermediate position.

In very small specimens from the Archipelago east of Celebes, which are usually extremely flat like *L. planus*, the frontal ridges resemble more or less closely those of *L. glaber*, ending behind the anterior margin of the head and usually between its inner and outer tubercles; and the marginal tubercles of often closely approximated. When a series of specimens is examined, however, this character also proves to be somewhat indefinite, and I am no longer able to regard *L. obtusidens*, Kuwert, as distinct.

The size of the punctures in the lateral grooves of the elytra is very variable both in *L. bicolor* and in *L. dentatus*. As a rule it is much smaller in the former than in the latter, but the difference in the case of extreme specimens is very small. There is never any difficulty, however, in distinguishing the two species from each other, by the structure of the parietal ridges, which extend to the supra-orbital ridges in *L. bicolor*, but end abruptly about half way between the central tubercle and the supra-orbital ridges in *L. dentatus*.

**Leptaulax anibarbis**, Kuwert.

*Leptaulax anibarbis*, Kuwert, p. 293.

*Leptaulax macassariensis*, subsp. *anibarbis*, Gravely, 1914c, pp. 256 and 305-306, pl. xiii, fig. 54.

One specimen from Mt. Kinabalu. Length 22.2 mm.

**Leptaulax cyclotaenius**, Kuwert.

*Leptaulax angustifrons* + *cyclotaenius* + *himalayae*, Kuwert, 1898, pp. 285-286.

*Leptaulax anipunctus*, Zang, 1905a, pp. 234-235.

*Leptaulax cyclotaenius* + *anipunctus*, Gravely, 1914c, pp. 255-257, pl. xiii, figs. 53 and 55.

A number of specimens of the typical form from the following localities:—Margherita, Assam; Xieng Khouang, Tonkin and Cambodia (presented by M. Vitalis de Salvaza); Perak, Malay Peninsula (also specimens from Gap, 2,700-3,000 ft., Selangor-Pahang Boundary, and foothills of Gunong Hitam, Selangor, Malay Peninsula, submitted by Mr. C. Holman-Hunt); Sumatra (Kandg. Ampat, Lower Padang; Gunung-Agung, Palembang, 5,000 ft.; S. E. Serdang, ca. 1,000 ft.; Engano Island, Benkulen Residency; also specimens from Médan, Sumatra, submitted by W. Guy Babault); Borneo (Mts. Kinabalu and Marapok); and North Celebes (Tondano, Minahassa; Toli-Toli).

Also several specimens of the variety *anipunctus*, Zang, from Chapa and Lao Kay, Tonkin, and from Cambodia, presented by Mr. Vitalis de Salvaza.

Length 11.7-20.5 mm.

The varietal form *anipunctus* differs from the typical form only in having the pronotum somewhat sparsely, though extensively, punctured in the anterior angles and round about the scars, instead of densely punctured at the sides from end to end; and in having the posterior intermediate areas of the metasternum somewhat weakly punctured on the inner side only.

The structure of the head is very variable. The parietal ridges are usually long as in *L. bicolor* in small specimens, and short as *L. dentatus* in larger ones. The latter usually have the surface of the head densely punctured and the frontal area longer than broad; the former usually have the surface of the head more or less unpunctured and the frontal area broader than long. Very small specimens are usually extremely flat like *L. planus*, larger ones being somewhat stouter; this is the case in *L. bicolor* also.

**Leptaulax dentatus** (Fabricius).

*Passalus dentatus*, Fabricius, 1792, p. 241.

*Leptaulax dentatus* + var. *glabriventris*, Gravely, 1914c, pp. 252-255, pl. xiii, figs. 52-52d.

Numerous specimens from the following localities:—Madras; Nepal; Darjiling District (Tukvar, Van de Poll collection; Singla, presented by H. E. Lord Carmichael; and Kalimpong, presented by myself); Tonkin (Lao Kay, Vientiane, Hoabink, Napé), Laos (Kham-Keut) and Cambodia (Kompong Kedey) submitted by M. R. Vitalis de Salvaza; Renong, Siam; Karen Hills, Burma, 4,000 ft.; Andamans (Port Blair, presented by Mr. S. W. Kemp); Penang; Perak, Malay Peninsula; Carey Island (presented by Mr. C. Holman-Hunt); Hili Madjedja, N. Nias; Kalim Bungo, Middle Nias; Sumatra (Médan, submitted by M. Guy Babault; Tanjong-Djati, ca. 2,000 ft. and Mana-Riang, 2,000-3,000 ft., Renau, Palembang; S. E. Serdang, E. Coast, ca. 1,000 ft.; Bedagei

Interior, East Coast, ca. 600 ft. ; Kandg. Ampat, Lower Padang) ; Java (Malang ; Tengger Mt., 4,000 ft. ; Tjicopo ; Boeloe Lawang, Pasoeroean ; Senggoro, southern Pasoeroean ; Central Java, 1,500 ft.) ; Bali ; Borneo (Mts. Kinabalu and Marapok ; Doesonlanden ; Martapura, S. E. Borneo) ; Philippines (Mindoro ; S. Palawan ; Balabac : also specimens presented by Mr. C. F. Baker from Imugin, N. Vissale ; Mt. Makiling and Limay, Luzon ; Iligan, Mindanao ; Mt. Banalao ; and Los Banos) ; Taruna, Great Sangir ; Celebes (Tondano ; and Tangari, Minahassa, Menado and Toli-Toli in the north ; Bonthain, Bua-Kraeng 5,000 ft., Tjamba and Bantimurang in the south) ; Sapit, Lombok, 2,000 ft. ; Buru (North Coast ; Kajeli ; Iliat, East Coast ; Wae Kibo ; Tifu Bay) ; Hitu, Amboina ; Ceram (Wahaai ; Rumasosal-Pasania ; Kairatoe) Buano ; Nus Laut. Also a specimen said to come from British Honduras, and others from the following localities which I have been unable to trace :—Sula Besi (Doherty) ; Labunarang, Andonara (Doherty) ; Pach. (Mouhot) ; Mat. (Wallace). Length 17.5-32.7 mm.

The puncturing of the abdominal sterna is very variable and proves, as in *L. bicolor*, to be of no use for the distinction of definite varieties—hence the name *glabriventis* becomes a synonym. The central area of the metasternum bears at most a pair of symmetrically placed punctures. It never bears irregular punctures such as are ordinarily characteristic of *L. cyclotaenius*.

#### **Leptaulax timoriensis** (Percheron).

*Passalus timoriensis*, Percheron, 1841, pp. 19-21, pl. lxxviii, fig. 1.

*Leptaulax timoriensis*, Zang, 1905c, p. 223.

Three specimens from Gng. Leo, Dutch Timor, 2,000-4,000 ft. ; five from Dilli, Port Timor, 2,500 ft. ; one from Ilwaki, Wetter ; and two from the Alor Islands. Length 24-35 mm.

This species is very near *L. dentatus*, being distinguished only by the structure of the pronotum, which is less distinctly rectangular, and is unpunctured in the anterior angles, except in very small specimens in which one or two punctures may be present in this position. In small specimens the puncturing in and around the pronotal scars and marginal grooves is more extensive than in large ones.

#### **Leptaulax anna**, Zang.

*Leptaulax anna*, Zang, 1905a, p. 316.

Four specimens from B. Aru Hassa, Sambawa, 2,000-5,000 ft. Length 30-31 mm.

*L. anna* is very like *L. timoriensis*, but has the pronotal scars less densely punctured, has the elytra more distinctly broadened behind with their lateral grooves matt and marked with somewhat worn-looking punctures, and has the metasternum hairy laterally and in front. In the Van de Poll specimens (30-31 mm. long) the lateral and intermediate areas of the metasternum are united ; but in a smaller specimen in our collection (26 mm. long and a co-type) they are distinct, though the ridge between them is somewhat weak behind. The elytra are separate.

**Leptaulax humerosus**, Kuwert.

*Leptaulax humerosus*, Kuwert, 1898, p. 289.

*Leptaulax humerosus*, Gravely, 1914c, pp. 251-252, pl. xiii, fig. 51.

Numerous specimens from the following localities :—Perak, Malay Peninsula ; Sumatra (Mana-Riang, 2,000–3,000 ft., and Tandjong-Djati, ca. 2,000 ft., Renau, Palembang ; Bng. Proepoe, Padang Interior, ca. 6,000 ft. ; S. E. Serdang, ca. 1,000 ft. and Bedagei Interior, ca. 600 ft., East Coast ; Beloe Lawang, Pasoeroean) ; Java (Malang ; Pengalengan, S. Preanger, 4,000–5,000 ft. ; G. Gedeh, N. W. Preanger, 4,000 ft. ; Telaga Bodas, Garoet, Preanger, 4,000–5,000 ft. ; G. Tji Salimar, W. Preanger, 3,000 ft. ; Tengger Mountain, E. Java, 4,000 ft.) ; Borneo (Martapura and Kinabalu). Length 15.8–22.5 mm.

Easily distinguishable from *L. anna*, which it resembles as regards the sculpturing of the elytra, by its smaller size, by its more strongly rectangular pronotum with thickly punctured sides and more or less prominent anterior angles, and by its slenderer elytra.

The species of *Leptaulax* which I have been able to recognize may be distinguished from one another thus :—

1	{	The elytra polished throughout .. .. .	2.
		The depressed surface of the two or three outermost grooves of the elytra dull, the punctures somewhat worn-looking .. .. .	11.
2	{	The puncturing of the lateral grooves of the elytra not strongly transverse ; the parietal ridges united with the supraorbital ridges .. .. .	3.
		The puncturing of the lateral grooves of the elytra strongly transverse ; or, the parietal ridges ending more or less abruptly about half way to the supraorbital ridges .. .. .	8.
3	{	The abdominal sterna covered evenly all over with somewhat obscure, broad, shallow punctures .. .. .	<i>L. planus</i> , p. 113.
		The puncturing of the abdominal sterna variable in extent, sometimes absent, when present always finer, and when extensive deeper and less uniform .. .. .	4.
4	{	The marginal grooves of the pronotum extremely fine, their puncturing more or less obsolete ; the sides of the pronotum and the posterior intermediate areas of the metasternum at most weakly punctured .. .. .	5.
		The marginal grooves of the pronotum coarser, strongly punctured ; the sides of the pronotum and the posterior intermediate areas of the metasternum as a rule strongly and extensively punctured .. .. .	7.
5	{	The pronotum strongly rectangular, the elytra more or less parallel-sided ; small insects, not more than 18 mm. long .. .. .	6.
		The sides of the pronotum somewhat rounded, the elytra more or less dilated behind ; large insects, not less than 24 mm. long .. .. .	<i>L. sambawae</i> , p. 114.

- |    |   |   |                                  |     |
|----|---|---|----------------------------------|-----|
| 6  | { | The frontal ridges ending in the inner marginal tubercles ; insects always unicolorous above  | <i>L. roepstorfi</i> , Kuwert.   |     |
|    |   | The frontal ridges extending parallel to the anterior margin of the head to a point between the inner and outer marginal tubercles, where they end somewhat abruptly ; the anterior parts of the elytra commonly reddish brown in otherwise black insects | <i>L. glaber</i> , p. 113.       |     |
| 7  | { | Large insects (over 28 mm. long) ; the puncturing of the pronotum and metasternum very scanty   | <i>L. barbicauda</i> , p. 114.   |     |
|    |   | Smaller insects (not more than 25 mm. long) ; the puncturing of the pronotum and metasternum much denser  | <i>L. bicolor</i> , p. 114.      |     |
| 8  | { | The parietal ridges united with the supraorbital ridges ; the central area of the metasternum unpunctured   | <i>L. anibarbis</i> , p. 116.    |     |
|    |   | The parietal ridges ending more or less abruptly about half way to the supraorbital ridges ; or, the central area of the metasternum punctured  | .. .. .                          | 9.  |
| 9  | { | The central area of the metasternum almost invariably with at least a few more or less irregularly placed punctures ; the parietal ridges variable  | <i>L. cyclotaenius</i> , p. 116. |     |
|    |   | The central area of the metasternum with at most one pair of symmetrically placed punctures ; the parietal ridges always ending more or less abruptly about half way to the supra-orbital ridges  | ..                               | 10. |
| 10 | { | The pronotum strongly rectangular ; its anterior angles more or less extensively punctured  | <i>L. dentatus</i> , p. 116.     |     |
|    |   | The pronotum more rounded ; its anterior angles unpunctured, except in small specimens, where a small group may be present  | <i>L. timoriensis</i> , p. 117.  |     |
| 11 | { | The grooves of the elytra not tuberculate   | ..                               | 12. |
|    |   | A more or less distinct polished tubercle formed out of each of the transverse ridges in the lateral grooves of the elytra.   | <i>L. beccarii</i> , Kuwert.     |     |
| 12 | { | The pronotum convex, punctured only in the scars and marginal grooves and usually in the anterior angles ; the elytra short, dilated behind ; the metasternum hairy laterally and in front, its lateral and intermediate areas often united               | .. <i>L. anna</i> , p. 117.      |     |
|    |   | The pronotum somewhat flattened, densely punctured laterally, its sides practically straight ; the elytra slender, more or less parallel sided ; the metasternum hairless, the intermediate and lateral areas always distinct                             | <i>L. humerosus</i> , p. 118.    |     |

ZOOGEOGRAPHICAL RESULTS.

It would be useless to attempt to give here a detailed account of the distribution of the various species of Passalidae. For in the case of Oriental genera the information gathered together in my "Account of the Oriental Passalidae" can readily be supplemented by the

additional records contained in the present paper; and in the case of other genera no compilation is possible without a much more detailed revision of synonymy than I am at present able to achieve. But the general distribution of the family requires some further consideration in the light of certain facts set forth in the present paper.

It will be convenient to deal with the Indo-Australian area first.

This area is inhabited by three subfamilies of Passalidae, namely the Aulacocyclinae, Macrolininae and Leptaulacinae.

The Aulacocyclinae, though not a very large subfamily, appears to be a somewhat highly specialized one. In none of its species are there frontal and parietal ridges or inner and outer tubercles, such as are found in the more primitive species of all other subfamilies; and in the three largest genera, *Comacupes*, *Taeniocerus* and *Aulacocylus* the basal piece and lateral lobes of the male genital tube form one piece, either by consolidation or by the suppression of the basal-piece, instead of being separate as in other subfamilies (see Sharp and Muir, 1912, p. 580; also above, p. 5), while the middle lower tooth on each mandible is immovable. In all other Passalidae, even in such primitive forms as *Oileoides subrecticornis*, this tooth is jointed. Jointing does not occur, so far as I know, in any beetles other than Passalids, and is clearly an indication of specialization; but its absence in *Comacupes*, *Taeniocerus* and *Aulacocylus* is probably secondary and not primitive, especially as it is correlated with specialization of the male genital tube. In the two remaining genera, *Ceracupes* and *Cylindrocaulus*, the structure, both of the tooth in question and of the male genital tube, resemble those found in other subfamilies.

The largest genus, *Aulacocylus*, is centred in the Australian Region, but extends into the Sunda Islands and Indian Peninsula. This discontinuous distribution suggests that ground is being lost in the Oriental Region, where the smaller genera *Comacupes* and *Taeniocerus* predominate. These genera are confined to the Oriental Region, except for a single species of *Comacupes* (*C. foveicollis*) which has established itself in Celebes. Only one species, *Taeniocerus bicuspis*, is found north of the Malay Peninsula; this extends northwards to the Himalayas.

The genera *Ceracupes* and *Cylindrocaulus*, in which the male genital tube and middle lower tooth resemble those of other subfamilies, only occur towards and beyond the northern confines of the Oriental Region. With these presumably primitive characters they combine cephalic excrescences which give them a most unusual appearance. Such excrescences frequently indicate the senility of a group, and it seems probable that *Ceracupes* and *Cylindrocaulus* are senile survivors of a transitional group through which the more typical Aulacocyclinae of the present time have been derived. *Ceracupes* is less abnormal than *Cylindrocaulus* and occurs in Burma, the Himalayas, Tonkin and Formosa. The latter only occurs still further north, namely in China and Japan. Its species are the only Aulacocyclinae known to have fused elytra.

The Macrolininae fall into two series of genera, whose distribution must be considered separately. The first of these comprises the genera *Macrolinus* and *Pleurarius*, whose combined range covers the Oriental Region and Celebes, but does not extend into the Papuan Sub-Region. Ceylon is occupied by species of *Macrolinus* which are closely allied to one another but differ in certain characters, common to all of them, from the remaining



species of the genus.<sup>1</sup> The genus *Pleurarius* appears entirely to replace *Macrolinus* in the Indian Peninsula. This genus has otherwise been recorded only from Sumatra, whence it was originally described. In the absence of further records from that island I am inclined to doubt the validity of the record and to believe the genus to be confined to the Indian Peninsula. If this is so the genus probably contains one species only, a species whose elytra are united. Other groups of *Macrolinus* occupy respectively (1) the Indo-Chinese Sub-Region, (2) the Malayan Sub-Region and (3) Celebes, except that one rare Celebean species belongs to the Malayan group. Species of *Macrolinus* with fused elytra are known only in the Ceylonese and Celebean groups.

The second series of genera of Macrolininae (Pl. I) is found throughout the Indo-Australian area and is remarkable for the pronounced asymmetry which is developed in most of its more highly specialized members. It comprises the Aceraiinae and Gnaphalocneminae of my previous papers, one of which was devoted to a special study of its distribution (1914b).

The study of more extensive material fully confirms the geographical separation, in Ceylon and Australia respectively, of the primitive and closely related symmetrical forms by the more highly specialized and less closely related descendants of each; but shows that I was mistaken in confusing the Celebean Passalid fauna with the Papuan, and that my suggestions regarding phylogeny can be improved upon.

Concerning the distribution of the genera *Episphenus*, *Ophrygonius* and *Aceraius* there is nothing fresh to add. The first named is confined to the Indian Peninsula and Ceylon, the two last to the rest of the Oriental Region. The species inhabiting Ceylon are less highly specialized than those inhabiting the Indian Peninsula, which in their turn are less highly specialized than those found on the other side of the Ganges, taking these as a whole. And in each of these areas the most asymmetrical (*i.e.*, the most highly specialized) is also the most abundant, the most variable, and among the largest. It also has gregarious habits (Gravely, 1914b, pp. 202-204; 1914c, pp. 311-313).

Similarly, in the genus *Pelopides*, the most abundant species in the Sunda Islands are large and highly asymmetrical (*P. tridens*, etc.); but in the Malay Peninsula the most abundant species (*P. dorsalis*) is smaller and more nearly symmetrical. The most symmetrical species of all appears to be confined to Borneo, the island where a primitive form would be least expected; but it does not seem to be common there.

The genus *Pelopides* is found all over the Malayan Sub-Region, and extends beyond it into the extreme south of Burma, but no further. Its connection with simpler genera is obscure, but it would be quite in keeping with the general relationship between the evolution and distribution of asymmetrical Passalids for some ancestral form to be found in Continental Asia. It seems to me possible that such may be represented in the genus *Tiberioides*, a symmetrical genus whose presence in the area occupied by *Ophrygonius* and *Aceraius* does not accord well with any direct relationship with them. If this is the case, the grooves on the mentum of *T. borealis* no doubt represent an early stage in the development of the large secondary scars found in all species of *Pelopides*. Closely allied to *Pelopides* is the genus *Plesthenus*, which is confined to Celebes (see above, p. 96).

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<sup>1</sup> For the distinctive characters of the several local groups of species of *Macrolinus* see sections 1-3 of the table on pp. 82-84 above.

The most primitive species of the Australian Region belong to the genus *Mastochilus*, a genus which, like the Oriental *Episphenus*, contains both symmetrical and more or less strongly asymmetrical species. The subgenera *Pharochilus* and *Mastochilus*, which with one exception (*M. pectinigera*; Heller, from New Guinea) are confined to Australia, contain large and robust symmetrical insects. The subgenera *Analaches* and *Cetejus*, which with one exception (*M. australiensis* from Australia) are found in the islands north of Australia, contain smaller and often slighter insects which are almost always more or less asymmetrical. Of the two species of *Episphenus* inhabiting Ceylon the dominant one is slightly asymmetrical, the other, which is symmetrical, being closely allied to it, but much less abundant and of smaller size. In Australia, on the contrary, the various symmetrical species are dominant, the asymmetrical *Mastochilus (Analaches) australiensis* being comparatively rare; which suggests that *M. australiensis* is a comparatively recent importation and has not been derived directly from its symmetrical compatriots. This suggestion is supported by the fact that *M. australiensis* is much more closely related to Papuan than to Australian species, being indeed one of the most highly asymmetrical members of its genus, and by the fact that it has been recorded from New Guinea as well as from Australia.

The genus *Mastochilus* probably represents the primitive stock from which the genera *Labiensus* (with *Protomocoelus*), *Gonatas* and *Pseudepisphenus* (with *Tarquinius*) have been derived.

In *Labiensus* specialization affects mainly the metasternum, apparently in association with the wings, which tend to lose their normal function and doubtless to become more efficient stridulating organs at the same time. In the most highly specialized members of the genus, which appear to be confined to the Moluccas, the elytra are united in the middle line, species with separate elytra being apparently to be confined to New Guinea, the Aru Islands, etc.

*Protomocoelus* appears to have been derived from the simpler forms of *Labiensus*. Its dentition is reduced, in which respect it is the most highly specialized of all the species with a modified metasternum. But the elytra are not united nor do they show any tendency to become ovate. The genus occurs in the Solomon Islands and has been recorded from the Moluccas, as well as from the Islands inhabited by the simpler forms of *Labiensus*.

The genus *Gonatas* constitutes a second line of descent from *Mastochilus*. The metasternum, wings and elytra are always normal; but the mandibles become very strongly asymmetrical, and the posterior margin of the mentum very strongly arched, in highly specialized forms. The progressive stages of this development are still preserved in the less highly specialized species. The most primitive species of all, *G. minimus*, appears to be confined to New Guinea and its neighbouring islands; but *G. pumilio*, the species most closely allied to it, although occurring there appears to be centred in the Moluccas. Much larger and more abundant than either are *G. schellongi*, *G. germari* and *G. naviculator*, which must be regarded as the dominant species of the genus. *G. schellongi* is somewhat more primitive than either of the others, and is confined to New Guinea, the other two being centred in the Moluccas, though recorded from New Guinea and from Java and the Philippines also.

The third and last line of descent from *Mastochilus* is found in the genera *Pseudepisphenus* and *Tarquinius*, two extremely rare forms known only from New Guinea. Their affinities have already been fully discussed elsewhere (Gravely, 1924c, 328-329).

The Leptaulacinae are centred in the Malayan Sub-Region, whence several have spread westwards and eastwards to the Indo-Chinese Sub-Region and Celebes respectively. The two dominant species, *L. bicolor* and *L. dentatus*, have spread beyond these limits into the Indian Peninsula and Ceylon in the west, and into the Moluccas, New Guinea, and possibly even Australia in the east. Isolated species have arisen in several of the islands or island groups of both the eastern and western parts of the archipelago. The number of distinct species appears, however, to be small and the more widely distributed species especially are extremely variable and often difficult to distinguish from one another. They are also extremely abundant. This probably indicates that the subfamily is of relatively recent origin and that it has not yet reached a condition of equilibrium.

The importance of Palk Strait, the Gangetic Plain, the China Sea and Isthmus of Kra (together), the Straits of Macassar and Torres Strait in the distribution of the Macrolininae has already been pointed out (Gravely, 1914c, p. 338). The further study of the Passalidae of the Australian Region shows that the Molucca and Gilolo Straits are of no less importance and, indeed, that to the former belongs the special importance which I previously attached to the Straits of Macassar, the fauna of Celebes being even more unlike that of the Australian Region than it is unlike that of the Oriental Region.

The Passalids hitherto recorded from Celebes are as follows :<sup>1</sup>—

<i>Comacupes foveicollis</i> subsp. <i>minor</i>	.	{ Genus otherwise purely Oriental; <i>C. foveicollis</i> , s. str., confined to Borneo.
<i>Aulacocyclus celebensis</i>	..	Endemic. Genus Indo-Australian.
<i>Macrolinus sulciperfectus</i>		{ Endemic. Belongs to the group of <i>Macrolinus</i> other- wise known only from the Malayan Subregion.
„ <i>duivenbodei</i>		{ These two constitute a group which is endemic.
„ <i>urus</i>		
<i>Aceraius laevicollis</i>		{ A Malayan species. The genus is so definitely Oriental that I am inclined to doubt this record.
<i>Plesthenus</i> spp.	∴	Endemic. Allied to the Oriental <i>Pelopides</i> .
<i>Trichostigmus ursulus</i>		{ Endemic. The only other known species of the genus is Oriental.
<i>Leptaulax planus</i>		{ Oriental species which appear to be extending their range. One at least has reached New Guinea and possibly Australia.
„ <i>bicolor</i>	..	
„ <i>cyclotaenius</i>		
„ <i>dentatus</i>		

Although a large proportion of these species are endemic, and it is doubtful whether either of the two most characteristic asymmetrical Oriental genera, *Aceraius* and *Pelopides*, occur in Celebes at all, it will be seen that every species known from Celebes is related to species which are essentially Oriental, although some have established themselves in the Australian Region also.

<sup>1</sup> Concerning Kuwert's record of "*Pelops*" *impressicollis* see above, p. 107, footnote 2.

The Passalid fauna of the Moluccas is closely allied to that of New Guinea, and several species have been recorded as common to both. In the genus *Gonatas*, however, it is noteworthy that of the two species with most primitive mentum the one with complete dentition is only known from New Guinea; while of the three common species with more highly specialized mentum the one with the most primitive dentition seems to be confined to New Guinea and the other two to the Moluccas. Similarly, in the genus *Labiemus*, species with normal elytra appear to be confined to New Guinea and those with fused elytra to the Moluccas. The allied *Protomocoelus*, in which the mandibles are modified instead of the elytra, belongs however to New Guinea, and, although it is undoubtedly more widely distributed than any of its allies, the single record of its occurrence in the Moluccas should be confirmed before it is finally accepted. *Pseudepisphenus* and *Tarquinius* are only known from New Guinea.

The information at present available regarding the distribution of American and Ethiopian Passalidae is much less satisfactory than that regarding the Indo-Australian subfamilies. The probable distinctness of the American and Ethiopian Passalid faunas, in spite of several records to the contrary, has already been dealt with (above, pp. 10-11). It is perhaps worthy of note here that no Ethiopian Passalidae are known to have the elytra united, and that in America, although species with fused elytra attain the largest size, the commonest and most widely distributed species have separate elytra. Among the Pseudacanthinae *Popilius cornutus* is the largest and most highly specialized of the species with separate elytra and is the commonest and most widely distributed species in the subfamily. Among the Proculinae no species appears to be exceptionally abundant. Among the Passalinae *Paxillus leachii*, *Passalus interstitialis* and *Passalus interruptus* are particularly abundant and widely distributed. The last named is probably the most abundant and widely distributed of all, and is also extremely variable. The group of species to which it belongs appears to me to be the culminating point of the general trend of evolution throughout its genus, a genus whose wealth of closely interrelated species suggests that it bears the same kind of relation to the rest of the American Passalid fauna as *Leptaulax* does to the rest of the Indo-Australian.

## SUMMARY.

### 1. *External Morphology.*

The clypeus is exposed and separated by a suture from the frons only in the subfamily Pseudacanthinae. In a few other genera, mostly American, it is exposed but united to the frons. In the majority of Passalids the whole of the upper surface of the anterior part of the head, between the supra-orbital ridges and in front of the frontal ridges, is frons, the whole of the clypeus being doubled beneath this out of sight (pp. 1-3, fig. i, 1-4).

It is uncertain whether the inner and outer marginal tubercles of the Leptaulacinae are homologous with the inner and outer tubercles respectively of other Passalidae (pp. 3-4).

The dentition is reduced only in somewhat highly specialized forms. In American subfamilies it seems to be associated with the loss of the habit of flight, and to come about

through the fusion of the two lowest terminal teeth. In Indo-Australian subfamilies it is always associated with cephalic asymmetry and never with the loss of the habit of flight, and comes about through the fusion of the anterior lower and lowest terminal teeth (pp. 9-10, fig. ii).

The loss of the habit of flight appears to allow of greater specialization of the wings as stridulating organs. It produces definite structural modifications in the insect (pp. 4-5). The following genera contain, so far as is known, only flightless forms:—*Cylindrocaulus*, *Platyverres*, *Pleurarius*, *Proculejoides*, *Proculejus*, *Procululus*, *Proculus*, *Pseudacanthus* and *Publius*. The following species are also flightless:—*Labiensus moluccanus* and *gigas*, *Macrolinus obesus* and *ursus*, *Passalus quitensis* and *Vindex synelytris*.

The structure of the male genital tube is almost uniform throughout the family. The genera of Aulacocyclinae other than *Ceracupes* and *Cylindrocaulus* differ, however, from the rest of the family in that the basal piece and lateral lobes are represented by one undivided plate (p. 5).

The central tubercle is usually larger in females than in males in species in which it varies greatly in size (p. 5).

### 2. Classification.

Seven subfamilies have been recognized, of which one, the Aulacocyclinae, confined to the Indo-Australian area with China and Japan, is somewhat widely removed from all the others (p. 9). Two others are confined to the Indo-Australian area. These are distinguished from American and Ethiopian subfamilies by the structure of the mandibles (p. 9). The Ethiopian subfamily is distinguished from the four American ones by the structure of the anterior margin of the head (pp. 10-11).

The number of genera has been greatly reduced. Specific synonymy has not been dealt with, but there can be little doubt that a similar reduction is required in the number of species.

### 3. Geographical Distribution.

Passalidae appear to flourish only under more or less moist tropical conditions.

American, Ethiopian and Indo-Australian forms belong respectively to different subfamilies, probably without exception (pp. 9-12).

The group of Macrolininae with strong asymmetrical tendencies is of special zoogeographical interest. Its most primitive species inhabit Ceylon and Australia. These are closely allied to one another but give rise to divergent lines of descent, confined respectively to the Oriental Region with Celebes, and to the Australian Region. Both these regions are composed of a series of smaller areas, each characterized by a distinct Passalid fauna, which is more highly specialized in those nearer to Celebes than in those further away. These areas are: in the Oriental Region—Ceylon, the Indian Peninsula, the Indo-Chinese Subregion and the Malayan Subregion; and in the Australian Region—Australia, New Guinea and the Moluccas (pp. 120-124). These facts bear out the suggestion (Gravely, 1913, p. 204) that conditions towards the centre of the Archipelago are peculiarly favourable for evolution, and that as more and more highly specialized forms have arisen there, they have migrated outwards, driving before them the less highly

specialized, which have rarely survived except where they have been able to establish themselves behind some obstacle to migration.

The fauna of Celebes, though related to the Oriental fauna, is very distinct from it, and contains a large proportion of endemic species and one endemic genus (p. 123).

The genera *Macrolinus* and *Pleurarius* are Oriental. The former genus has produced local races in Celebes and in each of the areas into which the Oriental Region proper has been divided above, with the single exception of the Indian Peninsula where it is replaced by the latter genus (pp. 120-121).

The Leptaulacinae appear to be centred in the Malayan Subregion and to be undergoing rapid development and expansion (p. 123).

The Aulacocyclinae appear to be a very highly specialized subfamily, now on the decline. The genera *Ceracupes* and *Cylindrocaulus* appear to be the senile representatives of an old group, in some respects more primitive than the forms at present dominant in the subfamily. They are only found towards and beyond the limits of distribution of the rest of the subfamily (p. 120).

The Solenocyclinae appear to be peculiar to the Ethiopian Region, and the Pseudacanthinae, Proculinae and Passalinae to America. The information at present available as to their distribution is much less complete than is that available concerning Indo-Australian forms (pp. 5 & 124).

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Synonyms are printed in italics : page numbers referring to keys, descriptions, locality or synonymic records, and figures are printed in ordinary type ; other numbers are in bold face.

The summary of the paper on pp. 124-126 has been designed partly as a guide to the whereabouts of the principal facts recorded. References to it are not included in this index. References to the list of recently described genera and species on pp. 7-9 have similarly been omitted.

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