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THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

WILLIAM CARRUTHERS, Ph.D., F.R.S., F.L.S., F.G.S.,
SIR ARTHUR E. SHIPLEY, G.B.E., M.A., Sc.D., F.R.S.,

AND

RICHARD T. FRANCIS, F.Z.S.



VOL. V.—NINTH SERIES.

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1920.

“Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit.”—LINNÆUS.

“Quel que soit le principe de la vie animale, il ne faut qu’ouvrir les yeux pour voir qu’elle est le chef-d’œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations.”—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

..... The sylvan powers
 Obey our summons; from their deepest dells
 The Dryads come, and throw their garlands wild
 And odorous branches at our feet; the Nymphs
 That press with nimble step the mountain-thyme
 And purple heath-flower come not empty-handed,
 But scatter round ten thousand forms minute
 Of velvet moss or lichen, torn from rock
 Or rifted oak or cavern deep: the Naiads too
 Quit their loved native stream, from whose smooth face
 They crop the lily, and each sedge and rush
 That drinks the rippling tide: the frozen poles,
 Where peril waits the bold adventurer’s tread,
 The burning sands of Borneo and Cayenne,
 All, all to us unlock their secret stores
 And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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THE ANNALS

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MAGAZINE OF NATURAL HISTORY.

[NINTH SERIES.]

"..... per litora spargite muscum,
Naiades, et circum vitreos considite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum. divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas.
Ferte, Deæ pelagi, et pingui conchylia succo."

N. Parthenii Giannettusi, Eol. 1.

JAN 26 1920

No. 25. JANUARY 1920.

I. — *Notes on Myriapoda.* — XX. *Luminous Chilopoda, with Special Reference to Geophilus carpophagus, Leach.*
By HILDA K. BRADE-BIRKS, M.Sc., M.B., Ch.B., L.R.C.P., M.R.C.S., and the Rev. S. GRAHAM BRADE-BIRKS, M.Sc.

[Plates I. & II.]

In two previous papers, (1) and (2), we have referred to the subject of light-production in centipedes; we are now able to discuss the phenomenon from first-hand observation, but, at the same time, we think it advisable to begin our consideration of this engrossing subject by a review indicating the main lines of previous knowledge concerning it. Especially does this course seem advisable when we remember how little has been written in English about phosphorescent centipedes.

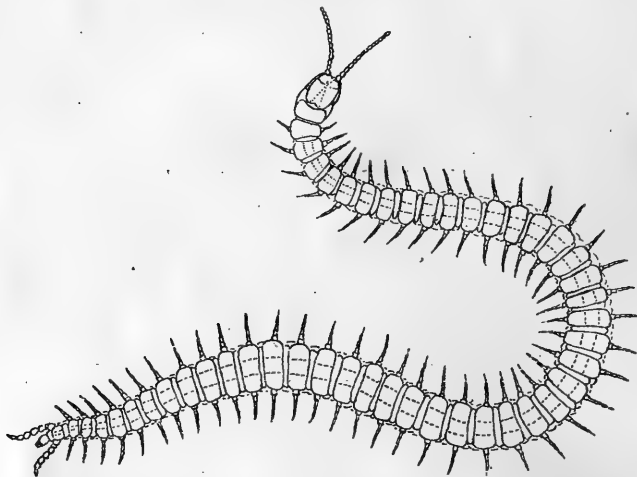
I. REVIEW.

The four classes unnaturally, but conveniently, grouped under the name "Myriapoda" are: (i.) Diplopoda [=millepedes], (ii.) Chilopoda [=centipedes], (iii.) Pauropoda, and (iv.) Symphyla. With a case or two where millepedes

have been recorded as luminous we are not now concerned, and pauropods and symphyles are not known to produce light. Among the centipedes, which have some affinities with insects, only one great group—the Geophilomorpha—is known to exhibit the phenomenon with which the present study deals.

The elongate body of a Geophilomorph (fig. 1) consists of a head and a large number of subsimilar segments, each but the last of which bears a pair of walking-legs. Each leg-bearing segment is more or less flattened dorsally, ventrally, and laterally, the dorsal and ventral surfaces

Fig. 1.



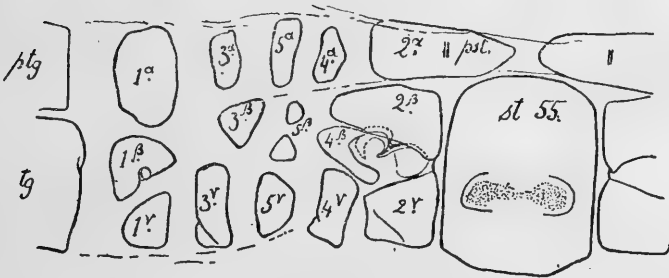
Geophilus carpophagus, Leach, ♂, $\times 5.0$, collected at Darwen, Lancashire, July 1919. H. K. B.-B. ad nat. del.

being subequal and wider than the lateral surfaces. The legs arise from the external margins of the ventral surface, and the stigmata, or breathing-pores, are found on the lateral surfaces. The integument of each segment is supported by a series of chitinous plates, some of which have been used by M. Henry W. Brölemann (3), the eminent French myriapodologist, for purposes of classification. Characteristically the ventral surface possesses one median unpaired plate (the sternite), and the dorsal surface has two unpaired plates (a posterior tergite and an anterior pretergite). In front of the sternite is a pair of plates (the presternal plates), which in certain cases meet and fuse in

the middle line to form a single presternite. In addition to the plates already mentioned, there is a series of varying number and arrangement, which forms the eupleurium. For purposes of comparison, Brölemann has numbered the rows of these plates in the following way:—

The row which includes the stigmata-bearing plate is designated by the number 1; the episternal row, the row nearest to the sternite, is 2; 3 is the row next below 1; 4 is next to 2 and consequently just above the legs, 5 is the row between 3 and 4. Then, since each row is theoretically composed of three sclerites, each plate is indicated by an index-letter: the anterior sclerite is designated by the index α , the middle one by β , and the posterior one by γ (fig. 2).

Fig. 2.



Thalphybius microcephalus. Integumentary sclerites displayed.

st 55., sternite of the fifty-fifth trunk-segment; pst., presternite; tg, tergite; ptg, pretergite; the other lettering is explained in the text. This animal has a complete eupleurium, consisting of five rows with every element represented. J. W. Smith & S. G. B.-B. phot.-del. [After Brölemann, (3) p. 313, fig. 1.]

Brölemann (3) points out that in all Geophilomorphs row 1 is constant, except that in some cases the sclerites are independent, while in others (*Oryinæ*) the presclerite α may be fused with the stigmatiferous sclerite β . Row 2 is equally constant; only a single case is known (*Trematorya*) where the presclerite is lacking. Only rarely are they complete, more often one or other of the three rows is incomplete and is only represented by two sclerites or even only by a single one, or again one of the rows may even be completely wanting.

The sternite is often pierced by a number of minute circular perforations, which are collectively known as the

pore-field. Similar openings are sometimes visible on the episternal plates before and behind the legs (2β and 2γ).

Internally Geophilomorphs present the characteristic features of the arthropod body,* little but the integumentary glands calling for special notice here. These glands are not easy to study and our knowledge of them is, as yet, imperfect. Verhoeff (12), pp. 33 *et seqq.*, has dealt with them in a passage which we have translated as follows:—

“Sternal glands occur in most Geophilids*, but there is great variety in their arrangement. Sometimes, and most frequently, they are present as isolated glands, sometimes they are found in loose clusters, sometimes in dense groups. In the last case their openings form a pore-field, which generally lies in the middle of the sternite and is sometimes surrounded by a chitinous border. When the pores and glands are arranged in a dense group, scattered glands often occur too. The loose clusters are not infrequently found in pairs posteriorly, and often in two pairs in the four corners as well. Nor is the distribution of the sternal glands by any means always the same on all the ventral plates of one species; much more usually a great difference is noticeable between the antero-posterior parts and the middle. Sometimes only the most anterior of the sternal plates have gland-groups (*Schendyla*, as a rule), and less usually only those of the posterior end of the body have them. More frequently it happens that a band-like group of glands is found on the anterior segments at the posterior edges of the ventral plates (*Geophilus*, in some cases), and in those instances there is a division of the glands into two parts in the case of the plates of the mid-trunk, and perhaps in those of the posterior segments too. The isolated glands of the ventral plate empty independently to the outside. These cells are distinctly elongate and have the nucleus in the region of the inner end. Their contraction is caused by muscle-fibres (plate v. fig. 9, *fm.*†), which are placed around the isolated glands and may ramify and exhibit transverse striations (Duboscq). The glandular fluid is of very varying colour: in *Himantarium gabrielis* it is rose-red, so that if anything irritates an individual of this species it becomes covered on the ventral surface with a row of rose-red droplets. In other Geophilids, e.g. *Chætechelyne*, the fluid is more watery and clear. Moreover, it is these ventral glands which cause the phosphorescence of certain Geophilids, but it has, of

* *I. e.*, Geophilomorphs, similarly, in some other places in this review.

† This is reproduced as our fig. 3, *g. v.*

course, not yet been decided whether the fluid itself or light-bacteria cause the luminosity. Certainly this much is established, that forms which have been taken luminescent like *Scolioplanes crassipes* only exhibit this property exceptionally. The luminescence is not of long duration and, according to Duboscq, is particularly noticeable in spring."

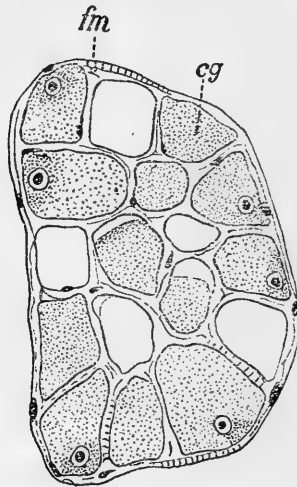
In the closing section of the same work, Verhoeff (12) deals with the subject of luminosity itself. He mentions the following species as luminous forms, with a reservation concerning the certainty of correct diagnosis of the species of *Geophilus* included in the list:—

- Scolioplanes crassipes* (C. L. Koch).
- Geophilus electricus* (L.).
- G. longicornis*, Leach.
- Orphnæus brevilabiatus* (Newport).
- Stigmatogaster subterraneus* (Shaw).
- Orya barbarica* (Gervais).

Verhoeff, whose remarks we had better consider briefly here, then reviews some of the observations and suggestions of the earlier workers and adds a few of his own. One opinion of Dubois, that the luminous substance is to be found in the epithelial cells of the alimentary canal, and that of Macé, that it occurs in anal and coxo-pleural glands, he negatives. He mentions that Gazagnaire, who, he says, pointed out the suitability of *Orya barbarica* for an enquiry into light-production, saw on the sternite and pro- and metacoxa a viscous yellowish mass coming out of the glands and spreading over this region with the emission of a blue-green light. Pressure increased the flow. Next he states that Gazagnaire and Dubois show that both the sexes are luminous in *Orya* and *Scolioplanes*, and, since all the specimens of *Orya* investigated by Gazagnaire exhibited luminosity, Verhoeff concludes that either all *Orya* are luminous or that, at least, luminosity occurs in all individuals at some special time. Verhoeff has made some investigations himself regarding *Scolioplanes*, and he considers it proved that these are by no means always luminous. Verhoeff had never observed *Geophilus longicornis* luminous. He speaks of Dubois' experience of *Scolioplanes crassipes* in fields near Heidelberg. Luminous material was transferred to the fingers and the light emitted was so bright that printing or figures could be made out 10 paces away; the luminous tracks left behind by *Scolioplanes* consisted of little irregular masses covered by a sticky substance. Dubois' statement that the luminous material was only discharged from the

posterior end of the body is taken by Verhoeff to be an erroneous observation. From the fact that Dubois did not find all *Scolioptanes* luminous, Verhoeff thought that the best explanation would be that the sternal glands were infested with luminous bacteria. He adds that Dubois asserted that *Scolioptanes* illuminated the whole body with the exception of the head, but the anterior and posterior parts of the trunk most strongly and persistently. In a more weakly luminous condition there was a correspondence between the light and the situation and extent of the

Fig. 3.



Chatechelyne vesuviana. Gland-group of one of the pore-fields of the ventral plates seen in section.

cg, gland-cell; fm, muscle-fibre. J. W. Smith & S. G. B.-B. phot.-del.
[From Verhoeff, (12) pl. v. fig. 9, with some lettering omitted, after Duboscq.]

alimentary canal. In mentioning a subsequent assertion of Dubois that *Scolioptanes* can illuminate without any appreciable* giving up of a secretion and the same author's query as to whether the luminosity of the whole middle line of the body would be pronounced if the luminous substance arose from skin-glands, Verhoeff points out that a distribution of glands over almost all the sternites would be

* "ohne irgend ein Secret abzugeben."

closely parallel to the alimentary canal and might, on lighting, look as though the luminosity came from the gut. He suggests that if the luminosity occurs within the glands or their reservoirs, without excretion, then the fairly thin chitinous exoskeleton would let the light shine through it. Verhoeff accompanies his description of this phenomenon with two text-figures of the sternal glands which occur in most Geophilomorphs (figs. 4 and 5), and refers the reader

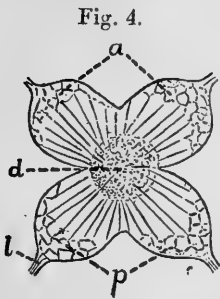


Fig. 4.

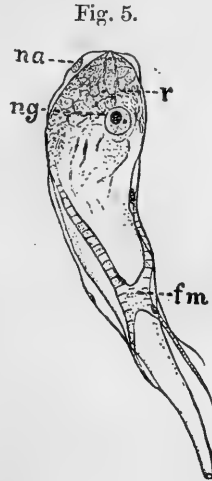


Fig. 5.

Chatechelyne vesuviana.

Fig. 4.—Sternal gland-group as figured by Verhoeff, (12) p. 312, after Duboscq. *d*, the disk which opens on to the pore-field; *a*, anterior; *p*, posterior elements; *l*, suspensory attachment. J. W. Smith & S. G. B.-B. phot.-del.

Fig. 5.—An isolated cell from the gland-group, $\times 900$, as figured by Verhoeff, (12) p. 312, after Duboscq. *ng*, nucleus of the cell; *r*, cell-network; *na*, nucleus of the gland-alveolus; *fm*, muscle-fibre. J. W. Smith & S. G. B.-B. phot.-del.

to his plate v. figs. 6, 7, & 9 (this last is our fig. 3), while in a footnote, adding a remark that the cause of luminosity is unknown, he mentions bacteria again as a possible cause, and also quotes Gadeau de Kerville's opinion that an exclusively chemico-physical incidence may be a more or less sufficient explanation. He also points out that it is not at all clear why one species illuminates and others nearly related do not.

We must next direct attention to a paper by Gazagnaire (10), with which Verhoeff does not appear to have been

familiar when he wrote his work on Chilopoda (12). Gazagnaire, who mentions the publications of a number of earlier authors asks two questions: Among Geophilidæ which produce light, is it possible to determine more or less precisely a special time at which luminosity occurs? Can we discover something of a physiological process in connection with its production?

Gazagnaire dwells upon the difficulty of the whole subject, and tabulates a number of observations to show that Geophilomorphs have been seen in a lighting condition by various European observers between the end of September and the first fortnight of November, and on the strength of these observations he concludes that "*among the photogenic Geophilidæ, the property of emitting light only manifests itself at a definite period of their existence, a period which, for our European species, can be limited between the end of September and the first fortnight of November.*"

Gazagnaire goes on to comment upon the fact that luminous centipedes have often been noticed two or more near together, and when these have been determined they have seldom been found to be all of one sex. He states that Geophilidæ, like other Chilopods, generally have an antipathy for one another, but he suggests that at the breeding-season this love of isolation breaks down and numbers of individuals gather together at the time when the genital organs become functional, and, as phosphorescence shows itself at the same time, it is natural to conclude that "*the property of emitting light among the photogenic Geophilidæ is intimately connected with the genital function.*"

Dealing with the researches of Fabre in a passage we have translated as follows, Gazagnaire says:—

"The demonstration of this conclusion becomes more evident still if we make an appeal to the data which we possess concerning the probable mode of fertilization in these animals. We owe them to Fabre, our great entomologist.

"For two whole years Fabre followed up his researches on Geophilidæ. He never verified *coitus*. I do not know that anyone since has been more successful than he. The discharge of spermatophores, discovered by Fabre, seems to confirm the fact that among Geophilidæ there is no *coitus*, which is contrary to the belief of G. Newport, expressed in 1840. At the end of September, on examining some *Geophilus convolvens** kept in captivity, Fabre noticed, in the

* [We do not know this specific name.—H. K. B.-B., S. G. B.-B.]

passages made by these animals through the soil in which they lived, some very little systems of network formed of cobweb-like filaments and arranged at a distance from one another. At the centre of each was hung a spherical globule, white, of the size of a small pin-head. This globule was nothing else but a spermatophore. For a month and a half spermatophores are deposited by the males in the same way. What becomes of these spermatophores? How do they effect fertilization? Fabre tells us the 'complete absence of copulatory organs, the protective sperm-capsule, the spermatic nets, all make me believe that the male deposits the spermatophores furtively on nets stretched in the subterranean passages and that it is there that the female, guided by her instinct and urged on by her burden, comes to seek the element complementary to her ovules.'

"There is no *coitus*: that is pretty certain if the information given by Fabre be taken for granted. But in the question which interests us, this fact, in spite of its great import, is only of secondary significance. Whether there is or is not *coitus* is of no importance to us; but what does concern us is the date of the deposition of the spermatophore, which is very probably the date of fertilization too, since in the ordinary air the spermatophores, being very delicate microscopic corpuscles, are condemned to almost certain destruction in a very short time. Excessive humidity cracks them, drying shrivels and hardens them, arachnids to whom they are a great delicacy devour them very quickly.

"Now the date of the deposition of the spermatophores coincides exactly with that of the appearance of luminosity in phosphorescent *Geophilidæ*.

"Fabre, as a matter of fact, has proved that the deposition of the spermatophores of *Geophilus convolvens* (which is not a phosphorescent species) goes on from the end of September to the 12th of November, and the observations which we have cited concerning the capture of photogenic *Geophilidæ* record as extreme dates 25 September (G. Newport) and 14 November (Maille).

"The proof afforded by this last coincidence establishes a conviction, and within the limits of present observations I believe I have the right to conclude that *among phosphorescent European Geophilidæ the appearance of luminosity is not only intimately connected with genital activity, but seems to correspond exactly with the date of the deposition of the spermatophores (very probably also with fertilization)—that is to say, from the end of September to the first fortnight of November.*"

Gazagnaire goes on to state that there may be exceptions of his rule, and quotes J. V. Audouin's capture of luminous *Geophilus electricus* in August. He admits two hypotheses in such cases: either the reconciliation of the sexes has taken place earlier, owing to the occurrence of certain accidental conditions, local, atmospheric; or the date given is the precise date of reconciliation of the sexes in those species, and, in that case, we find ourselves faced with a simple generic or specific difference in the date when the genital organs become functional, a difference of little importance which has been proved often enough in other groups.

He thinks that if we accept only these two hypotheses, then the history of phosphorescent Geophilidæ as known in Gazagnaire's time would not allow us to suppose that in these animals luminosity could go on under the same conditions as in certain other arthropods of the class Insecta—for example, in the Lampyres and Photophores,—nor that the egg, young, and adult, throughout their respective existences, rejoiced in the property of giving light, as the insects just mentioned do in each of the life-stages referred to.

Gazagnaire also adds some comparisons with the phosphorescent Lumbricidæ. According to the evidence before him, worms found phosphorescent are provided with a well-developed clitellum, a fact indicating sexual maturity. This association of circumstances presents to his mind some important parallels to the case of luminous Chilopoda.

We have seen a French contemporaneous account (5) of some researches of Dubois, to which Verhoeff (12) was evidently referring in the summary on luminosity to which we have already drawn attention, but Dubois evidently made several observations for which Verhoeff did not find a place in his account of the phenomenon. Dubois (5) stated that when one of his centipedes (*Scolioplanes crassipes*) was seized it discharged all the luminous substance it contained, but could be made luminous again some time later by mechanical stimulation or by raising the temperature. He confused the contents of the epithelial cells of the intestine with small granules (to which he attributed luminosity) in a discharge from the terminal part of the digestive tract. He speaks of these as the same characteristic birefringent granules, which he says are to be found in the luminous tissues of Pyrophores and Lampyrids. He also states that the physiological process is, in its root-essentials, the same in "myriapods" and Coleoptera, for, in both cases, the discharge of a cell sets free photogenic products. He adds

that the physiological process is here independent of the organ.

In the case of another piece of research (6) on luminosity, Dubois raises several points of special interest to us in the present study. He shows that in *Hippopodius gleba*, a transparent animal of the Hydrozoan family of the Polyphyidæ, the ectoderm in certain places becomes milky and opaque on mechanical stimulation, owing to the immediate production of a multitude of granules deposited in the protoplasm of the ectodermal cells, a production accompanied at night by the emission of light. The chemical composition of these granules is very complex, they are neither fat nor ammonium urate. Dubois considered that each of these granules contained a little vacuole at its centre. In the luminous cells these granules (vacuolids) were seen to have very complex movements, and their absolute independence in the midst of the plasma was such that it might be supposed to be due, he thought, to parasitic micro-organisms; but the attempts of Dubois at culture in various media met with no success, and he concluded that micro-organisms were not the cause in this case.

Dubois (8) in a much later paper, not considered by Verhoeff (12) in the summaries to which we have already referred, tells us that *Orya barbarica* was seen in a luminous state for the first time in 1888 in North Africa, that Gazagnaire found that a phosphorescent substance was excreted by pores opening upon the sternal and episternal plates, that this substance was a viscous fluid, yellowish with an odour *sui generis*, insoluble in alcohol, drying rapidly in air.

Dubois himself found that a luminous fluid was excreted by the ventral surface of the body in *Scolioplanes crassipes*.

Dubois says that in *Orya barbarica* the luminous substance is found in unicellular, pyriform, hypodermic glands, 0.08–0.10 mm. × 0.05–0.06 mm. In stained sections he saw “gouttelettes” in the granular glandular protoplasm; these “gouttelettes” were round to ovoid in shape and were also observed in the secretion—they were not fat, but exhibited the histo-chemical characters of protoplasm or condensed albuminoids. In the centre of each of these “gouttelettes,” immediately after their contact with air, Dubois saw a very refringent spot; these corpuscles, which he states occur in all luminous organs, then had the form to which he gave the name of *vacuolid* (see also 7). The refringent point became the centre of a crystal or group of crystals. Dubois stated that both air and water are necessary for luminescence,

and he concluded that it was not merely oxidation in progress that produced the light ; he found that the secretion stopped glowing if dried and began glowing again on the addition of water. The secretion was acid, and so the hypothesis of Radzizewski, which explained animal luminosity as a slow oxidation in an alkaline medium, is shown, Dubois says, to be incorrect. Dubois considered that the oxygen permitted the respiration of the protoplasmic corpuscles passing from a colloidal to a crystalline condition—that is, from life to death ; hydrated protoplasm is needed for the proper activity of this respiration, and water is necessary for crystallisation to take place under conditions favourable to the emission of light. Oxygen serves to produce the crystallisable substance and water allows of photogenic crystallisation. These, he maintains, are two successive states of one and the same substance, modified by oxygen and water. This substance he terms *luciferin*.

Dahlgren (4), passing the work on luminous centipedes in review, mentions some of the researches we have already noted. He also records (4 c) that Thomas found a species of *Geophilus* being attacked by ants. The centipede was throwing out masses of slimy light material which adhered to the ants.

Up to the time of our own thirteenth paper (2) we were not familiar with living luminous centipedes, and in our last paragraph on the subject of luminosity we spoke of our familiarity with *Geophilus carpophagus*, Leach, in South Lancashire, mentioning that we had never noticed it luminous there. In Kent it is commonly luminous. We thereupon concluded that the phenomenon was hardly likely to be in any way essential to the well-being of the animals, but that it seemed more likely to be due to conditions of nutrition and environment, a view which seemed to be supported by the fact that Kent observers who had kept some luminous centipedes in captivity found that their powers of exhibiting phosphorescence upon stimulation gradually declined, and generally disappeared in the course of three days.

From the foregoing accounts of observations and opinions it will be seen that chaos must reign in the reader's mind after perusing the literature. The next section of this paper, which deals with our own observations, is intended to gather together the main threads of our knowledge of the subject, and to indicate the lines upon which subsequent research should proceed.

As early as 1862, Phipson published a book (11) on 'Phosphorescence,' in which a short chapter is devoted to

luminous centipedes (see also Pl. I. fig. 6 and explanation of same). This book gives a very useful summary of many interesting points relating to the subject. All who have a comprehensive interest in the problems of the production of light by animals will find in the papers of a modern writer, Prof. Dahlgren (4), very valuable summaries of many of the results of a long line of observers. Prof. Dahlgren touches upon luminosity in the plant-world, and surveys its production in many of the systematic subdivisions of the animal kingdom. But from a consideration of that section of Prof. Dahlgren's third paper (4 c), which deals with the power of lighting in the animals with which our present study is especially concerned, we realise at once how much the problems met with here have baffled earlier investigators.

II. OUR RECENT INVESTIGATIONS.

Introduction.

On the 22nd of April, 1919, we were walking together on hills near our own home in Darwen, Lancashire, when we casually collected several Geophilidæ alive and took them home. They proved to be *Geophilus carpophagus*, Leach (fig. 1), and were luminous when stimulated in the dark. With this discovery a new era begins for us in our study of luminous centipedes. We had already experimented with some luminous specimens sent to us alive by members of the Dartford Naturalists' Field Club, and had learned from their hints and our own experience that it was possible to keep these animals alive in jars if a good supply of fresh damp soil be provided for them; moreover, the power to luminesce is retained in captivity over a long period. But with a wealth of material at our doors we were able to carry on our research with much greater confidence.

In Norfolk, during a holiday in May and June, 1919, we obtained one specimen of *G. carpophagus* between the trunk and bark of felled timber in Mr. Witton's wood-yard, Heacham. This was luminous upon stimulation. The Misses Cox of Heacham and Mr. Witton were familiar with the occurrence of luminous centipedes locally, where they seem to be known as "glow-worms."

Subsequently, at a joint field-meeting of the Lancashire and Cheshire Fauna Committee and the Burnley Natural History Society on 26 July, 1919, Mr. W. G. Clutton, one of the Vice-Presidents of the latter organization, took one specimen of *G. carpophagus* at Extwistle, near Burnley, and

this animal was luminous on stimulation later. The same gentleman has since sent us an example from another Lancashire locality captured on the 9th of August, 1919, in the parish of Northtown, about two miles from Padiham and four from Burnley.

We have not been successful in seeing luminescence in Lancashire or Norfolk under natural conditions.

Apparatus.

With living material almost at the very door of our own laboratory in Darwen, a problem of first importance was the invention of apparatus for the examination of these animals alive under the microscope. Eventually we hit upon the plan of hinging together two sheets of glass each 1.5 mm. thick, some 81 mm. broad, and some 107 mm. long ($=3\frac{1}{4}'' \times 4\frac{1}{4}'' =$ photographic quarter-plate), by means of a stout piece of adhesive tape (Pl. I. fig. 7). Such a glass-holder will rest splendidly upon any ordinary microscope-stage. To secure a vigorous adult specimen of *G. carpophagus* in the holder it is only necessary to open the apparatus to its full extent and allow the animal to walk on one of the sheets and to close the other down upon it gently. The glass is sufficiently heavy to hold such a specimen without injuring it at all. Smaller specimens need a holder of smaller dimensions, and with larger species heavier glass could be used with advantage. If one wishes to examine the ventral surface of an animal in the holder, since this apparatus is symmetrical above and below, it is easy to turn it upside down and examine under direct light applied by means of a bull's-eye condenser (Pl. I. fig. 8). For experiments concerning the secretions of the glands the same holder can be used apart from the microscope, but some form of artificial stimulation is necessary. We have generally found that the current from an induction-coil is the best available. To apply this stimulation electrodes are needed inside the holder in contact with the animal's body, and for this purpose we have found two strips of tin-foil, a centimetre or more in width and about 10 centimetres long, very convenient. To apply the electrodes the animal is placed on one side of the open holder, as previously described, and the two electrodes are laid upon its back so that their ends will protrude beyond the closed edges of the sheets of the holder*, the upper sheet of the holder is then gently

* As a matter of fact, the electrodes can be attached to the upper plate of the holder, some time previously, by means of an adhesive, but

lowered and the animal is secured with the two electrodes in contact with its body. The current can then be applied by laying contact wires from the induction-coil one upon each electrode of the holder and completing the circuit in a dark-room by means of a switch or push. A slight modification of this arrangement makes it possible to observe controlled luminosity under the microscope (Pl. I. fig. 8).

For photographic records of luminosity we have adopted a different method. In this case, in order to obviate the possibility of a photographic record of stray electric sparks, it is safest to use pressure alone to stimulate light-production. It is necessary to carry out the experiment in a photographic dark-room. The lower glass plate of the ordinary holder is replaced by a piece of photographic film with the sensitized surface placed downwards (outwards), so that no contact action upon the prepared surface of the film can be initiated by the secretions of the centipede's body. The upper glass plate of the holder is replaced by a dull metal sheet. The animal is then allowed to crawl upon the back of the photographic film and upon it is laid the metal plate. Pressure upon the metal sheet stimulates luminosity, which is photographically recorded on the film (Pl. II. fig. 13). The animal should be killed immediately by dropping it into methylated spirit.

In taking microphotographs of the ventral surface of these centipedes to show such features as the pore-field and the integumentary glands the holder is again employed upon the stage of the microscope, but it is well to weigh evenly the uppermost plate as an additional precaution against slight body-movements. In such cases the movement of walking appendages may be neglected (Pl. I. fig. 9).

In the estimation of the intensity of light we have not attempted any very delicate measurement. In some early experiments we were entirely guided by the eye, and taking the initial intensity as our standard we gave it the arbitrary designation 10. Later we found that a luminous powder used by clockmakers when mounted in Canada balsam served a useful purpose; we estimated the initial luminosity of a stimulated centipede to be about 100 times brighter, and with this assumption, taking the luminosity of the test-slide of clockmaker's powder as one unit of brightness, we were able

the apparatus is often easier to manipulate when the electrodes are free, and this because difficulty is generally experienced in keeping the animal in its proper position until it is secured by gently lowering the upper plate upon it.

to gauge the fall of intensity more exactly. With further refinements much greater accuracy might be attained by such a method.

Stimulation.

In the case of *G. carpophagus* we have found that the following stimulations will cause the production of light :—

- (i.) *Handling.*
- (ii.) *Pressure.*
- (iii.) *Sudden immersion in water.*
- (iv.) *Electric current from an induction-coil.*

Most of these foregoing stimulations were seen in determining other points. Probably special experiments would reveal many other ways of stimulating the production of light by these animals.

- (v.) *Exposure in a glass tube to coal-gas passing through the tube.*

In this case the centipede was only momentarily luminous.

- (vi.) *Attack by ants.*

Here a centipede which did not appear to be luminous when handled became so when ants were placed with it in the same tube.

- (vii.) *On meeting another individual.*

Two centipedes, neither of which exhibited any luminosity on handling separately, were placed one by one in the same tube. Upon the introduction of the latter specimen there was a luminous display arising from one or both individuals.

Reference has already been made in our thirteenth paper (2) to the methods of stimulating luminosity in Kent centipedes by local workers.

- (viii.) *By crushing after death.*

It is convenient to add here that on one occasion when a part of the body of an individual, recently killed, was crushed in the dark phosphorescence was produced. The centipede had been killed in alcohol and the alimentary canal had been removed subsequently before the experiment.

L cation.

Our first enquiry must be: What is the exact seat of luminosity in *G. carpophagus*?

In some of our earlier experiments we found that an excretion on to the ventral surface of the body caused the light in this species, and the examination of specimens ventrally under the microscope showed that opaque rounded masses of material were often present under the pore-field and under the surfaces of the plates known as 2β and 2γ (fig. 2). We know now that these white rounded masses are groups of pyriform and probably unicellular glands intimately associated with the production of light (Pl. I. fig. 9 and Pl. II. fig. 11). When we stimulated specimens provided with these glands in a holder under the microscope in the dark, so that we could observe the production of light by the animal, we found that soon after the application of the stimulus there was a sudden rush of light filling in the grooves behind the sternite and around the outer edges of the plates 2β and 2γ , and also filling in the grooves between these plates and the sternite itself (Pl. I. fig. 10). When the centipedes were examined subsequently in direct light, it was found that the "white glands" of the stimulated segments had disappeared either entirely or almost entirely (Pl. II. figs. 11 & 12). Thus, *luminosity in Geophilus carpophagus is entirely ventral in incidence and is accompanied by the discharge of the "white glands."*

The luminous material in *G. carpophagus* is a viscous fluid, practically colourless, with a characteristic fruity odour not unlike that of some decaying flowers, drying rapidly in air, and strongly acid in its reaction.

By means of a partial illumination (Pl. I. fig. 8), instead of working absolutely in the dark, we were able to observe the incidence of luminosity with greater accuracy and also to watch the behaviour of the "white glands" upon stimulation. The amount of illumination employed in such experiments should be just sufficient to make the outlines of the "white glands" distinguishable under the microscope. We found that immediately upon a muscular contraction of the body and the discharge of the "white glands" to the exterior luminosity is produced, and in one case the expulsion of their contents was sufficiently slow to admit of more detailed observation. On electrical stimulation the opaque patches (contents of the "white glands") under the posterior part of the sternite were seen to move instantaneously

posteriorly, as along a potential canal (like a bottle-neck) opening into the groove behind the sternite beneath its posterior edge and so postero-dorsal to it. Then almost simultaneously with this squirt-like movement, but nevertheless a very small fraction of a second later, luminescence began and was seen along the posterior edge of the sternite and around the edges of the episternal plates 2β and 2γ . We therefore conclude that *the contents of the "white glands" are almost certainly essential for the production of light in Geophilus carpophagus.*

The different groups of "white glands" of the same segment are separately controlled, for it is sometimes seen that the sternal "white glands" are discharged apart from any expulsion of material from those of the episternal plates.

After the discharge of the "white glands" the secretion slowly accumulates again until opaque patches of glands are once more visible in the sternal and episternal regions. The "white glands" of a luminous Darwin specimen, which we diagnosed as *G. carpophagus* ♀, with 51 pairs of legs, collected 14. vii. 1919, were mostly discharged by electrical stimulation the same day. Little or no change was observable on the 19th of July, when the animal was provided with soil, but by the 7th of August there was a considerable recovery. Unfortunately this animal escaped through an error in connection with an experiment performed later.

Incidence.

Is it due to parasitic or symbiotic micro-organisms?

Our next enquiry must be: Are we dealing here with light-production by micro-organisms in symbiotic or pathogenic relationship with the luminous Geophilid, or are we dealing with an entirely chemico-physical phenomenon?

In one of our dissections a white gland was observed under the high power of the microscope to be filled with minute particles agitated by Brownian movement, a movement which was evidently closely paralleled by the experience of Dubois (6) already quoted in the case of the jelly-fish, *Hippopodius gleba*. In our case the particles were of considerable size, being visible through the cell-wall and without an oil-immersion lens.

Before the discovery of luminous Geophilomorphs in Lancashire we attempted to culture luminous micro-organisms from light-producing centipedes sent to us from Kent, but without success, but in the case of *Geophilus*

carpophagus from Darwen we made the examination of films of material obtained in the lighting condition in our holder. On staining by Gram's method it was at once evident that luminosity was not due to micro-organisms of the type known to occur in the blood of some Crustacea, and that if they were present at all they must be filter-passers. Experiments quoted by Dahlgren (4 a), pp. 23-24, in another connection seem to show that no luminous bacteria are known to him to be filter-passers.

Thus our attempts to find micro-organisms that could cause luminosity have all failed, and we conclude that *luminosity in Geophilus carpophagus appears to be an entirely physico-chemical phenomenon.*

The details of our experience in this matter confirm our view. The fresh luminous discharge from a *G. carpophagus* stained by Gram's method in search of micro-organisms was examined under the oil-immersion lens. The appearance was that of innumerable very small (less than 0.75μ) granules, round and regular and evenly distributed in the deposit. A few small irregularly distributed round empty spaces were also observed in the mass of stained material. Were these very small granules *luciferin* granules or "vacuolids" of Dubois? Their regularity and minute size suggested a doubt. On the other hand, Would similar but non-luminous fluids exhibit like staining properties? It happened that such questions were discussed with Mr. C. W. Ashton of the Manchester Royal Infirmary, and as an outcome an experiment was performed on the spot. This experiment enables us to give a decisive answer to such enquiries. To a preparation of fresh egg albumin were added a few melted crystals of pure carbolic acid. A film was made from this bacteria-free acid albumin and stained by Gram's method. Under the oil-immersion lens this film exhibited exactly similar properties to those of the luminous discharge previously examined.

The Physical Considerations.

Radioactivity.

As we turn to the physical aspect of the case, perhaps it will cross our minds at once that radioactivity may be the cause of luminosity. If so, the luminosity would be due, we suppose, to the bombardment of a fluorescent screen by a discharge from the radioactive material. It follows that the animal, in such circumstances, carries substances in its body which will produce or act as a screen. When our friend

Dr. Edgar Newbery, now Professor of Physical Chemistry in the University of Capetown, was kind enough to expose centipedes from Kent, which were luminous when tested in other ways, to the action of Radium, no luminosity of the animals was produced. Moreover, if luminosity was caused by the presence of radioactive substances, could the animals control the appearance of light? Perhaps they could control the chemical production of a temporary screen. Even so, why should luminosity die away so rapidly under all known circumstances in its artificial production? There are some questions here for physicists to settle. At any rate, we can safely conclude that the light is not due to the bombardment of a permanent "screen" in the sternal region by the discharge of a radioactive substance in the excretion of the "white glands." And also that, if a temporary "screen" is produced, it is the result of chemical action, in which the excretion from the "white glands" takes a part.

Crystallization.

When *G. carpophagus* is electrically stimulated under water luminescence is induced much in the same manner as in air. Therefore crystallization, as Dubois (8) meant it, is not the cause of luminosity in this species at any rate. We have not yet proved that liquid crystals are absent. The experiment of inducing phosphorescence below water also throws some doubt upon the conclusion of Dubois that crystallization was the cause of the phenomenon in *Orya barbarica*. Moreover, we shall observe almost immediately in the present study that crystallization takes place in the mucin excreted by the ventral surface of non-luminous centipedes.

Change of State.

The breakdown without chemical action of the solid contents of a gland to form a liquid would absorb energy and not emit it.

Other Physical Possibilities.

In the consideration of any purely physical cause, similar objections are likely to present themselves. It would appear that new substances must be formed before physical phenomena exhibit themselves, and we are forced back upon the conclusion that *no purely physical cause which we have investigated seems adequate to explain the production of light by Geophilus carpophagus.*

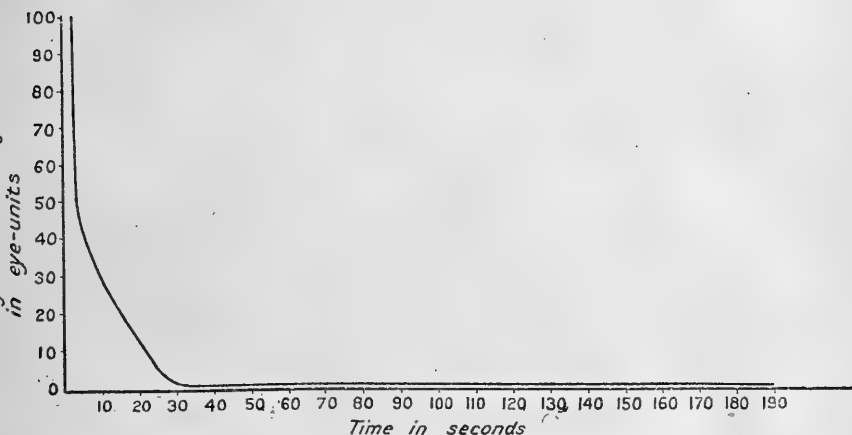
A Comparison.

We may add here that crystals have been observed in the dried films of excretion obtained in our holder, not only from the ventral surface of luminous specimens of *G. carpophagus*, but also in one case from a non-luminous specimen of *Geophilus insculptus*, Attems, taken in a Darwen garden 28. vii. 1919.

The Incidence and Decline of Light Production.

Quite roughly we have prepared a number of curves to show the incidence and decline of luminosity which follows

Fig. 14.



Curve to show incidence and decline of luminosity in *Geophilus carpophagus*. Description in the text. The data employed are those of Experiment 2 (see Table). S. G. B.-B. del.

the electrical stimulation of a specimen of *Geophilus carpophagus*. Although the curves plotted are only roughly estimated, it seems worth while to give the figures of three experiments carried out in our own laboratory and to accompany them by a drawing (fig. 14) of one curve which serves as a type. Here it will be noticed that there is a short space of time between the sudden shock of electrical stimulation, which is only momentarily applied, and the incidence of light-production. The light is brightest when it is first observed, and it fades suddenly at first and more slowly later

as the film dries. The experimental estimation of brightness has already been explained.

We have made no examination of the phosphorescence of these animals with the spectroscope.

The Chemical Considerations.

When we come to consider the chemical possibilities of the question, our path is fraught with many difficulties; one of the most important of these is the drawback due to the small amount of material available for chemical analysis.

At the outset it is necessary to consider as carefully as possible the substances with which we are dealing, and so in the first place let us examine the products of the glands of the sternite and its associated sclerites.

We have already described the discharge of the contents of the "white glands" into the grooves behind the sternite in the case of the electrical stimulation of *G. carpophagus*. In one instance a specimen of this species was electrically stimulated in a partial illumination under the microscope. The luminescence of the centipede was not very marked, but there was noticed flowing over the sternal plate and especially over its posterior region a quantity of a viscous excretion, with a suggestion that it arose from the pore-field and from thence spread over the sternite. There can be little or no doubt that such an excretion contains mucin.

We experimented with a specimen of *Geophilus insculptus* taken in a Darwen garden 27. vii. 1919. No "white glands" were observed and the animal was not luminous on electrical stimulation, but mucin was seen to flow through the pore-field of the sternite and form a film by capillary attraction between the sternal plate and the glass of the holder. The mucin obtained was odourless. In a similar instance of a specimen of *G. insculptus* collected in the same garden the next day, the film of mucin obtained was found upon drying to contain crystalline needles when examined under the microscope, a fact already referred to in dealing with crystallization earlier in the present study.

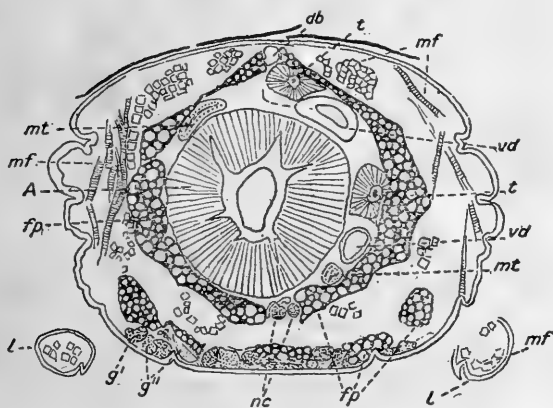
It must be added that in the case of *Stigmatogaster subterraneus* (Shaw)* non-luminous mucin has been seen to flood the grooves around the sternite and the episternal plates, 2β and 2γ , on the electrical stimulation of the animal.

* Often attributed to Leach; *syn.* 1789, *Scolopendra subterranea* Shaw, *Trans. Linn. Soc.* ii. p. 7.

Verhoeff (12) states in the passage we have quoted that various types of sternal glands are present in Geophilomorphs.

After removing the alimentary canal of a specimen of *Geophilus carpophagus* recently killed in alcohol without discharging the "white glands," on opening the body-cavity along the mid-dorsal line, we have found that in addition to the groups of definite opaque "white glands," pyriform in shape and apparently unicellular, which are not firmly attached to the body-wall, there appears to be a considerable mass of similar large transparent or semi-transparent glands

Fig. 15.



Transverse section near the middle of the body of *Geophilus carpophagus*, ♂, 47 pairs of legs, Darwen, August 1919, $\times 40$. Some muscles omitted.

A, alimentary canal; mt, Malpighian tubules; t, t, testes; vd, vd, vasa deferentia; db, dorsal blood-vessel; nc, ventral nerve-cords; fp, fat and pigment-cells; mf, muscle-fibres; l, l, legs; g', g'', glands (? mucin); g', glands (? protoluciferin). H. K. B.-B. del.

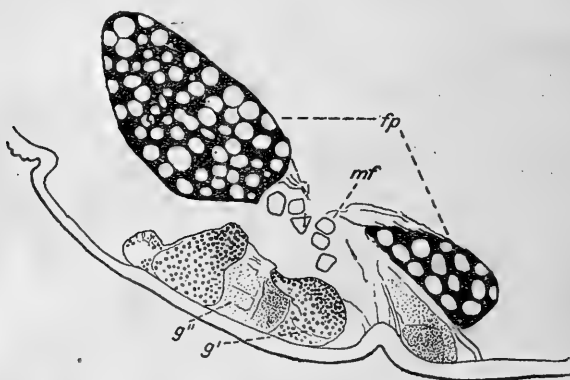
lying loosely and irregularly among the muscles of the ventral part of the body, and covered more or less completely by an association of fat and pigment* cells spread out among the connective tissue around them. Transverse sections (figs. 15 and 16) show the same thing.

* In our thirteenth paper, (2) p. 8, a specimen of *G. carpophagus* [1339], collected by Mrs. Banyard, had what was described as a "tinny appearance"—perhaps that character was due to these pigment-cells.

In *G. carpophagus*, then, more than one type of gland is present, and one of these has been shown to excrete a substance almost certainly essential for the production of the animal's light.

Thus upon such stimulation as results in the ordinary production of light there are present on the ventral surface of the body: the contents of the white glands; and, almost certainly, always the contents of at least one other type of gland; and air, with its ordinary impurities including water-vapour. We do not know enough of the chemical nature of the contents of the individual glands yet to speak confidently, but we can at least conclude that in the excretion which accompanies luminosity there are generally present: (i.) the

Fig. 16.

Enlarged view of some glands of the same section, $\times 160$.

Lettering as in fig. 15. H. K. B.-B. del.

contents of the white glands; for these we propose the name of *protoluciferin**, (ii.) mucin, (iii.) acid. The last two may, or may not, be produced by the same gland, and in either case *protoluciferin* may, or may not, contain acid as well.

We may now examine more closely, from the chemical point of view, the conditions and incidence of luminosity in *G. carpophagus*.

* *Luciferin*, the name proposed by Dubois for the luminous fluid he met with in *Oryza barbarica*, includes the whole excretion of the ventral surface and probably includes mucin and an acid, apart from any substance corresponding to our *protoluciferin*.

Upon stimulation, under the usual circumstances, mucin, acid, and *protoluciferin* are excreted upon the ventral surface of the animal's body into contact with one another and the air with its impurities, and immediately luminosity is produced.

If the discharge be dried luminosity ceases, but upon the addition of water it is continued; so that *water is essential to the production of light in Geophilus carpophagus*.

It should be noted that water will be present in the excretions themselves as a normal constituent of mucin.

It has generally been accepted in other similar cases that atmospheric oxygen was essential to the production of light. It has already been mentioned that *G. carpophagus* can be stimulated to luminesce under water, but atmospheric oxygen might in that case be present, in solution, in the tracheæ of the animal's body, or as a film on the surface of the body itself. To obviate all these factors a newly made film was introduced into a vessel of water, at the ordinary temperature, boiled previously and so free from dissolved air. Luminosity was not inhibited, but continued normally below the surface of the water. Therefore, *atmospheric oxygen is not essential for the production of light in the case of Geophilus carpophagus*.

A similar experiment, perhaps less convincing, but confirmatory, was conducted with the substitution of olive-oil for boiled water. Luminosity again continued below the surface of the oil. With alcohol the excretion was coagulated and the luminosity was inhibited almost instantaneously.

As an outcome of these enquiries, we can add that, *in the case of Geophilus carpophagus, under certain conditions all the essentials for the production of light are secreted by the animal itself, and upon the expulsion of these essentials to the exterior the chemical action which appears to take place in the excretion is accompanied by the production of light.*

The Use of Phosphorescence.

When we come to consider the utility of light-production in the economy of the life of *G. carpophagus*, we are face to face with no mean problem. Future work may provide an adequate solution, but at present we have little but suggestion to offer.

Misleading Factors.

In approaching this question scientifically there are some

misleading factors: Forel (9) has devoted some space to them in the case of insects.

(i.) *Photodermatic sensations.*

When we speak of these Geophilomorphs as blind animals, we must remember that though it is true that they have no eyes, no specialised organs of sight, they may be able to appreciate light by a general absorption of its waves through the surface of the body. Pigment-cells, which we have found abundantly present in the connective tissue close to the chitin of both dorsal and ventral surfaces of the trunk in luminous specimens of *G. carpophagus*, might play an important part in such an absorption.

(ii.) *Smell.*

Again, as we speak of the odour of the luminous fluid in *G. carpophagus*, we must not forget that the odour, as we perceive it, may have no counterpart in the experience of the animal producing it.

Sexual Significance.

Young and adult, male and female alike, exhibit luminosity, and we have already stated (2) that it seems unlikely that the character is a sexual one. In Kent luminous specimens of *G. carpophagus* have been taken in December, January, February, and April, and in Lancashire we have collected specimens which were afterwards luminous upon stimulation from April this year (1919), fairly frequently up to the month of writing this paper (September). Gazagnaire (10) based his theory of the sexual significance of this phenomenon upon records which only covered a limited period of the year.

Protection.

Both the light and the odour may be protective against enemies.

Accidental Property.

We must not lose sight of the fact that luminosity may be an entirely neutral factor in the economy of this animal, and that the product of the "white glands" may be entirely accidentally photogenic.

If such be the case, the *protoluciferin* may be of service to the animal as an efficient constituent of the complex fluid produced by the mingling of the secretions of the glands of the sternal and episternal regions. This complex fluid may have one or a number of uses, and there is a multiplicity of possibilities to choose from. It may act as a cement for nest-building, as a lubricant, or as a protection from the attacks of micro-organisms living in the soil; and here we may note that the films of excretion we examined critically contained remarkably few micro-organisms, and the sternite is evidently kept very clean in a healthy luminous *G. carpophagus*. Or, again, the fluid may act as a directional guide, enabling the animal to retrace its steps by perception of a track of the excretion made on the outward journey. Or, to take a last example of the possibilities, it may, owing to its property of drying rapidly, be of service to the animal in helping to free the body from excessive surface-moisture in damp or wet weather.

Summary.

Briefly to summarise the most important results of our enquiry: up to the present, we may say that in *GEOPHILUS CARPOPHAGUS*, *protoluciferin*, here essential for light-production, is secreted by the white glands which lie immediately dorsal to the sternal and episternal plates. Upon the application of stimuli to the central nervous system, muscular contraction takes place and the *protoluciferin* glands discharge their contents to the exterior into contact with the excretions of other glands opening upon the ventral surface. The fluid thus excreted is viscous, colourless, with an odour *sui generis*, acid in reaction, and exhibiting the micro-staining properties of a bacteria-free acid protein. It contains within itself all the essentials for the chemical action which results in the production of light and the formation of crystals.

Future work lies in the further elucidation of the chemical and physical aspects of the subject, and in the search for the real explanation of the economic value of the phenomenon.

Thanks.

Mention has been made in the course of our paper to the help given to us by Professor Newbery and Mr. C. W. Ashton. We are also indebted to Mr. Henry Stephen, M.Sc., Lecturer in Chemistry in the Victoria University of Manchester,

for his valuable advice about some of the physico-chemical considerations involved. Mr. J. W. Smith of Darwen has again given us the benefit of his great photographic skill in the production of those illustrations in this paper which bear his name. Mr. E. Ashby, of the Cryptogamic Laboratories of the Botanical Department at Manchester University, was kind enough to prepare some microtome sections for us, as we do not possess facilities for this work in our own laboratory. The careful observations made by that keen band of workers, the Dartford Naturalists' Field Club [especially by those members whose names are mentioned in our thirteenth paper (2), and by Mr. A. Cumberland whose name was unfortunately omitted there], have been an inspiration to us; to that band this paper really owes its beginning. To all these we tender our best thanks.

III. REFERENCES.

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16 Bank Street,
Darwen, Lancashire.

Table to show Data of Three Experiments on the Incidence and Decline of Luminosity in Geophilus carpophagus.

	Clock time (seconds).	No. of seconds from beginning of experiment.	Intensity in eye-units.
EXPERIMENT 1.	33:00	0:00	0:00
	34:50	1:50	100:00
	45:00	12:00	50:00
	57:00	24:00	25:00
	1 min. 58:00	85:00	1:00 *
EXPERIMENT 2.	34:00	0:00	0:00
	36:00	2:00	100:00
	37:00	3:00	50:00
	47:00	13:00	25:00
	1 min. 3:00	29:00	2:00
	11:00	37:00	1:00 *
	2 min. 0:00	86:00	0:90
	13:00	99:00	0:90
	40:00	126:00	0:90
	3 min. 0:00	146:00	0:90
40:00	186:00	0:80	
EXPERIMENT 3.	11:00	0:00	0:00
	12:00	1:00	100:00
	14:00	3:00	50:00
	23:00	12:00	25:00
	31:00	20:00	2:00
	35:00	24:00	1:00 *

and as in Experiment 2, after the 24th second.

* *I. e.*, same intensity as that of light given by test-slide.

EXPLANATION OF THE PLATES.

PLATE I.

- Fig. 6.* "The Electric Centipede." An early Victorian idea of the appearance of a phosphorescent Chilopod, being fig. 3756 in Charles Knight's 'Pictorial Museum of Animated Nature,' vol. ii. (c. 1840).
- Fig. 7.* Holder for microscopic examination of luminous centipedes. S. G. B.-B. del.
- Fig. 8.* Apparatus arranged for the examination of luminous centipedes. A, flexible wire from positive terminal of coil direct to the distant strip of foil in the holder; B, wires from negative terminal of coil to push and from push to the near strip of foil in the holder; C, bull's-eye condenser; *h*, holder in position on the stage of the microscope; *s*, supports, on the left for wire B, on the right for the bull's-eye condenser. J. W. Smith phot.
- Fig. 9.* Microphotograph of several segments of *Geophilus carpophagus*, to show the appearance of the "white glands" before discharge; they are seen as cloudy white masses beneath the sternal and episternal plates. The highly illuminated parts of the chitinous exoskeleton stand out as white lines and patches, the posterior limit of the sternal plate is seen as a practically straight white line, its anterior edge is marked by two rather finer white lines which fail to meet in the middle line. Compare with Pl. II. fig. 11. J. W. Smith microphot.
- Fig. 10.* Photograph of a drawing to illustrate the appearance of the ventral surfaces of four segments of *Geophilus carpophagus* as seen in the dark when viewed under the microscope immediately after electrical stimulation (see description in the text). H. K. B.-B. & S. G. B.-B. del. J. W. Smith & S. G. B.-B. phot.

PLATE II.

- Figs. 11, 12.* *Geophilus carpophagus*, ♂, Darwen, collected 9th July, 1919. Drawings of the same (? thirty-third) segment, $\times 40$, made two days after capture. Fig. 11 before, fig. 12 after electrical stimulation and phosphorescence. In this instance three glands only were undischarged by the stimulus. H. K. B.-B. del.
- Fig. 13.* The appearance of luminosity as recorded by photographic film. This result was obtained by the method described in the text, the animal being secured on the back of the film and luminescence stimulated by pressure, $\times 3$. J. W. Smith & S. G. B.-B. phot.

II.—Two new Species of *Sylvilagus* from Colombia.
By OLDFIELD THOMAS.

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THE British Museum owes to Frère Apollinaris Maria of Bogota four cotton-tails of the genus *Sylvilagus* from the neighbourhood of that place. They belong to two species, neither of which can I identify with any older-known form.

One is a member of the short-eared group of which *S. surdaster* and *meridensis* are members, and may be called

Sylvilagus apollinaris, sp. n.

Size about as in *S. meridensis*. Fur long, of medium texture, the longer hairs of the back about 19–20 mm. in length; underfur soft and fine, about 11–12 mm. long. General colour as usual, mixed black and greyish buffy, the dorsal hairs with dark bases (about 8 mm.), with a 4 mm. pale ring, and the long black tip about 7 mm. in length. The general tone resulting is darker than in the longer-eared section of the genus, paler than in *surdaster*, less smoky than in *meridensis*. Under surface white without buffy or cinnamon tinge, the belly-hairs very faintly greyer at their bases. Face with rather well-marked supraorbital white stripe, and a second one along the hinder end of the cheek. Ears very short, little more than half the length of the nuchal patch, well-haired, the proectote grizzled with the margin black, the metentote white. Nuchal patch large, strong pinkish cinnamon. Upper surface of forearms, hands, lower leg, and feet pinkish cinnamon or cinnamon-buff, the tips of the digits alone whitish. Rump more buffy than back, the tail, which is a mere little knob, similar to it for the most part, but with a darker area above, and white below.

Skull broad, upper surface of the brain-case very strongly granulated. Postorbital processes well developed, slightly spatulate, just free of the cranial bones terminally. Palatal foramina ending level with the front edge of the anterior premolar, narrow, not widened mesially, their broadest point at their posterior end. Palatal bridge fairly broad, without any trace of a posterior projecting spine. Bullæ lost in type, but those of a young specimen which appears to be of the same species fairly well developed, markedly larger than in *S. surdaster*.

Dimensions of the type (measured on skin):—

Hind foot 78 mm.; ear 42.

Skull: tip of nasals to hinder edge of interparietal 68; zygomatic breadth 36; nasals (oblique) 28; interorbital breadth 17.4; front of incisors to back of m^3 36; palatal foramina 19×6.3 ; palatal bridge 8; upper check-tooth series (alveoli) 13.8.

Hab. Choachi, near Bogota.

Type. Adult skin and skull. B.M. no. 19.10.15.2. Received in exchange from Frère Apollinaris Maria.

This cotton-tail is one of the very short-eared members of the group, but is obviously different from the species above mentioned or any other that we have. Of those we do not possess, Allen's *Sylvilagus salentus* is the only one needing mention. But this is from the heights above the Cauca Valley, and is therefore completely separated by the Magdalena Valley from Choachi. The black tips to its dorsal hairs are measured as 15 mm. in length, as compared with 7 mm. in *apollinaris*, and the nuchal patch is said to be only a little longer than the ears when laid back. On this account it seems probable that *salentus* is a member of the longer-eared group, though Dr. Allen gives neither measurement nor statement as to the actual length of the ears.

Besides the specimen now described, the British Museum contains two examples received from Mr. Child about twenty years ago, but one had no skull, the other was young, so they have never been previously determined.

The second species sent by Frère Apollinaris is represented by three specimens, and is a member of the longer-eared group. It appears to be quite different from any described form, and may be called

Sylvilagus purgatus, sp. n.

A very pale-coloured species of the longer-eared section.

General appearance most like that of *S. margaritæ*, but even paler. Fur short and coarse, longer hairs of back 16–17 mm. in length; underfur thin and poor, about 8 mm. long. General colour of the same sort of mixture as in *margaritæ*, but decidedly paler and greyer—paler and greyer, in fact, than in any other Colombian cotton-tail; dorsal hairs with about 7–8 mm. at the base dark, then 4 mm. pale buffy, the black tip about 5 mm. Under surface not specially white, the hairs mostly with pale slaty bases, and washed, except just along the middle line, with pale buffy. Crown

rather more ochraceous than back. Eyes surrounded by well-marked white rings. Chin and interramia prominently white. Ears of medium length, the proectote not or scarcely blackened at the edge terminally, extreme edges white; metentote whitish. Nuchal patch large, projected backwards mesially, prominently contrasted deep rich hazel. Hands and feet white above, with an inconspicuous edging of cinnamon externally. Tail apparently like back above, whitish below, but a good example is not present on any one of these skins.

Skull not unlike that of *S. margaritæ*, with similarly broadened postorbital processes, narrow palatal bridge, with tendency to a posterior median spine; palatal foramina broadened mesially and ending behind opposite the middle of the anterior premolar. Bullæ rather large for the group.

Dimensions of the type (measured on skin):—

Head and body (approximate) 420 mm.; hind foot 77; ear 53.

Skull: greatest length 76; condylo-incisive length 67; zygomatic breadth 34; nasals (oblique) 31; interorbital breadth 18; front of incisor to back of m^3 38; palatal foramina, length 20, breadth at middle 6.2, behind 4.5; palatal bridge 6.5; cheek-tooth series (alveoli) 14.7.

Hab. Purificacion, Magdalena Valley, S.W. of Bogota.

Type. Adult female. B.M. no. 19. 10. 15. 3. Received in exchange from Frère Apollinaris Maria. Three specimens.

This cotton-tail is one of a considerable number of species known from Colombia and Venezuela which are all rather closely allied, but it differs from all by its conspicuously paler coloration. Superficially it most resembles *S. margaritæ*, but is, of course, geographically distant from that animal.

The three specimens are all absolutely alike.

III. — *The Classification of the Fishes of the Family Cichlidæ.*—I. *The Tanganyika Genera.* By C. TATE REGAN, M.A., F.R.S.

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IN his 'Catalogue of African Freshwater Fishes' (iii. p. 134, 1915) Boulenger has written of the Cichlidæ: "The classification of the very numerous African members of this family presents the greatest difficulties, and the division into genera, as here followed, is unsatisfactory and open to criticism, the

dentition in certain species being subject to variation, according to age, or even of a purely individual nature." These remarks led me to undertake a study of the osteology of the African Cichlidæ, in the hope of arriving at more precise definitions of the genera and a more natural arrangement. This task was greatly facilitated by the fact that the large series of skeletons prepared under Boulenger's direction was available for study. It has seemed convenient to limit this paper to the Tanganyika genera, but a brief summary of the general results may be given.

The character of most importance in classification is the structure of the apophysis that supports the upper pharyngeals; the majority of the African Cichlidæ may be divided into those with the pharyngeal apophysis formed by the parasphenoid only (*Tilapia* type), and those in which the apophysis is formed by the parasphenoid in the middle and the basioccipital at the sides (*Haplochromis* type). Each of Boulenger's three largest genera (*Tilapia*, *Paratilapia*, and *Pelmatochromis*) contains species of both groups, and the majority of the species in each with the *Haplochromis* type of apophysis may be added to *Haplochromis*, which thus becomes the largest African genus. Most of the other genera can be definitely assigned a position as either related to *Tilapia* (*Paratilapia*, *Pelmatochromis*, *Hemitilapia*, etc.) or to *Haplochromis* (*Hemichromis*, *Champsochromis*, etc.). All the American Cichlidæ (except *Cichla*, which resembles *Haplochromis*) have the pharyngeal apophysis formed as in *Tilapia*.

In order to give satisfactory definitions and to express the apparent relationships some new genera must be created.

Synopsis of the Tanganyika Genera.

- I. Posterior part of parasphenoid with a strong apophysis ending in a flattish triangular or broadly ovate surface for articulation of upper pharyngeals.

Teeth in jaws conical. D. XIII-XVI 12-17.

- A. III 7-9. Scales 30-60; lower lateral line extending far forward. 1. *Tylochromis*.

- II. Posterior part of parasphenoid slightly or moderately raised, bearing a pair of more or less distinct circular or oval facets for articulation of upper pharyngeals.

- A. Mouth terminal; teeth in jaws pluriserial, all tricuspid, or outer mostly bicuspid. Ethmoid unconnected with vomer; inferior apophyses of third vertebra united to form a strong spine. D. XV-XVIII 11-15. A. III 8-11. Scales 31-35.

- Outermost series of teeth mostly bicuspid 2. *Tilapia*.
Teeth all slender, tricuspid 3. *Neotilapia*.

B. Mouth terminal or subterminal; jaws with an outer series of enlarged uni- or bicuspid teeth and 2 or more inner series of small tricuspid or compressed teeth. Ethmoid united with vomer by suture; inferior apophyses of third vertebra meeting below but not united. D. XV-XXI 5-12. A. III-VI 5-10. Scales 30-40.

1. D. XV-XX 8-12. A. III 6-10.

- | | |
|---|------------------------------|
| Mouth terminal; outer teeth bicuspid or some conical, inner mostly tricuspid | 4. <i>Limnotilapia</i> . |
| Mouth terminal; teeth compressed, outer bicuspid and inner tricuspid in young, all unicuspid in adult | 5. <i>Lobochilotes</i> . |
| Mouth subterminal; an outer series of curved conical teeth and a band of small tricuspid teeth | 6. <i>Gephyrochromis</i> . |
| Mouth subterminal; præmaxillaries with an outer series of teeth, which are bicuspid anteriorly and conical laterally, followed by a band of small tricuspid teeth | 7. <i>Simochromis</i> . |
| 2. D. XX-XXI 5-6. A. IV-VI 5-7. Mouth wide, subterminal, with a band of small tricuspid teeth and an outer series of bicuspid teeth; a single series of conical teeth at sides of præmaxillaries..... | |
| 8. <i>Tropheus</i> . | |
| C. Mouth subterminal or inferior; teeth tricuspid or conical. D. XII-XIV 12-14. A. III 8-10. Scales large, 34 to 40. | |
| Mouth subterminal; teeth small, fixed, uni- or tricuspid, in narrow bands | 9. <i>Ophthalmotilapia</i> . |
| Mouth subterminal; teeth movable, slender, tricuspid, in broad bands | 10. <i>Cunningtonia</i> . |
| Mouth transverse, inferior; teeth slender, tricuspid | 11. <i>Asprotilapia</i> . |
| D. Mouth subterminal; teeth slender, tricuspid, movable, in broad bands. D. XVII-XX 8-10. A. III 7-8. Scales large, 32-35 | |
| 12. <i>Petrochromis</i> . | |
| E. Mouth subterminal; teeth fixed, tricuspid or conical. D. XIII-XIV 12-14. A. III 9-10. Scales small, 55-65. | |
| 13. <i>Cyathopharynx</i> . | |
| F. Mouth terminal; teeth conical. D. XII-XIX 8-16. A. III 7-12. Scales large, 28-42. | |
| Maxillary slightly exposed; interorbital region flattish; occipital crest not extending forward beyond middle of orbits | 14. <i>Limnochromis</i> . |
| Maxillary considerably exposed; frontal region humped; occipital crest extending forward at least to anterior end of interorbital region | 15. <i>Cyphotilapia</i> . |

G. Mouth terminal. D. XVI–XVIII 10–15. A. III 8–10. Scales small, 65 to 90.

- Teeth small, in 4 or 5 series, cuspidate in the young, conical in the adult 16. *Boulengerochromis*.
 Teeth large, uniserial, stout, with a small cusp on each side superiorly 17. *Perissodus*.

III. Articular surface for upper pharyngeals formed by parasphenoid in the middle and basioccipital at the sides.

A. Scales large; 3 anal spines; teeth small or moderate.

1. One or two lateral lines; outermost pelvic ray longest.
 a. Bones of head with small canals ending in small pores.
 a. Inferior apophyses of third vertebra well developed.

An outer series of bicuspid or conical teeth and one or more inner series of smaller tricuspid or conical teeth; pharyngeal teeth bicuspid or conical 18. *Haplochromis*.

An outer series of small conical teeth, those of lower jaw directed outwards, and one or more inner series of minute conical teeth; lower pharyngeal teeth small, slender.... 19. *Ectodus*.

An outer series of small conical teeth, those of lower jaw directed more or less outwards; middle teeth of posterior part of lower pharyngeal enlarged and obtuse 20. *Callochromis*.

β. Inferior apophyses of third vertebra vestigial; an outer series of small conical teeth and 1 or 2 inner series of minute teeth 21. *Leptochromis*.

b. Frontals, nasals, præorbitals, lower jaw, and præoperculum with large channels with wide openings.

Suborbitals narrow; 2 lateral lines 22. *Aulonocranus*.

Suborbitals broad, deeply excavated; one short lateral line 23. *Trematocara*.

2. Two lateral lines; innermost pelvic ray longest.

Outer teeth of lower jaw erect 24. *Stappersia*.

Outer teeth of lower jaw directed outwards .. 25. *Enantiopus*.

3. Three lateral lines.

Outermost pelvic ray longest 26. *Grammatotria*.

Innermost pelvic ray longest 27. *Xenotilapia*.

B. Scales small; 3 anal spines.

1. Teeth in 2 to 5 series, conical.

Mouth moderate; teeth small 28. *Hemibates*.

Mouth large; teeth strong 29. *Bathybates*.

2. Teeth uniserial.

a. Teeth conical, curved 30. *Haplotaxodon*.

b. Teeth compressed, strongly curved.

Teeth small, close-set 31. *Xenochromis*.

Teeth large, set well apart 32. *Plecodus*.

C. Scales large; 3 anal spines; teeth strong, compressed.

- Teeth bi- or triserial, distally expanded and truncate 33. *Eretmodus*.
 Teeth uniserial, distally slightly expanded and rounded 34. *Spathodus*.

D. Scales large or small; 4 to 10 anal spines; a band of small teeth and an outer series of conical teeth, the anterior strong.

1. Inner teeth tricuspid 35. *Telmatochromis*.
 2. Inner teeth conical; suborbitals ligamentous. 36. *Julidochromis*.
 3. Inner teeth conical; suborbitals ossified. 37. *Lamprologus*.

1. TYLOCHROMIS, gen. nov.

(type *Pelmatochromis jentinki*, Steind.).

Dorsal XIII-XVI 12-17. Anal III 7-9. Scales cycloid or finely denticulate, large or rather small (30-60); two lateral lines, the lower extending far forward. Mouth terminal; teeth conical, in 2 to 5 series. Lower pharyngeal triangular, with slender pointed teeth at least near the posterior angles and large rounded flat teeth in the middle at least posteriorly. Posterior part of parasphenoid with a strong apophysis ending in a flattish triangular or broadly ovate surface for articulation of upper pharyngeal. Vertebrae 29-32 (15-16 + 14-16); third with inferior apophyses uniting to form a strong median spine.

Tanganyika; Congo; Gambia to Liberia.

The Tanganyika species (*T. polylepis*) differs from its congeners in the smaller scales (55 to 60 instead of 30 to 45).

2. TILAPIA, A. Smith, 1840 (type *T. sparrmanni*, A. Smith).

Dorsal XI-XVIII 9-16. Anal III-IV (V-VI) 7-12. Scales cycloid or feebly denticulate, large (26-36); two lateral lines. Mouth terminal; maxillary concealed or slightly exposed distally; teeth in jaws in several series, the outermost typically bicuspid (some often uni- or tricuspid), rarely all conical; inner series typically tricuspid, some occasionally unicuspid in adults. Lower pharyngeal triangular or heart-shaped, with slender or moderately stout uni-, bi-, or tricuspid teeth. Occipital crest extending forward to posterior end of a median excavation of anterior part of frontals; parietal crests extending forwards at least to between the orbits; nasal bones strongly expanded posteriorly; præmaxillary processes stout, much expanded

proximally, not or barely reaching frontals; posterior part of parasphenoid more or less distinctly raised, bearing a pair of transverse oval facets for articulation of upper pharyngeals. Vertebrae 26–33 (14–17 + 12–16); third with a pair of inferior apophyses which unite below; præcaudals with parapophyses from the fourth, the last or last two pairs each connected by a bridge; ribs, except the first, on parapophyses.

Africa and Syria.

As restricted by the above definition this is a large and varied genus, which nearly corresponds to Boulenger's section I. (scales cycloid or feebly denticulate) with the exception of *T. auromarginata* *. A complete revision will be necessary before a final decision can be reached as to whether it should be split up. At present I am inclined to recognize four subgenera, as follows:—

- I. Lower pharyngeal with short anterior blade.
- | | |
|---|----------------------|
| Ethmoid united with vomer by suture | <i>Coptodon</i> . |
| Ethmoid free from vomer; maxillary concealed; inner edges of rami of lower jaw curved anteriorly; pharyngeal teeth slender | <i>Tilapia</i> . |
| Ethmoid free from vomer; outer teeth of jaws much expanded; end of maxillary exposed; inner edges of rami of lower jaw straight; middle pharyngeal teeth rather stout | <i>Heterotilapia</i> |
- II. Lower pharyngeal with long anterior blade; maxillary concealed; inner edges of mandibular rami curved anteriorly; pharyngeal teeth small, slender, numerous
- Sarotherodon*.

Of these subgenera *Coptodon* includes *T. zillii* and *T. busumana*, *Heterotilapia* is a new subgenus formed for *T. buettikoferi*, which has a very characteristic dentition; the stout pharyngeal teeth are bicuspid, with the posterior cusp large and obtuse and the anterior represented by a transverse ridge which may bear 2 or 3 denticles. *Sarotherodon* (*Melanogones*, *Oreochromis*) includes the species of the *shirana*, *nilotica*, *galilæa*, and *macrocephala* groups. A species of this subgenus (*T. nilotica*) has reached Tanganyika, probably through Lake Kivu.

3. NEOTILAPIA, gen. nov.

(type *Chromis tanganicæ*, Günth.).

Dorsal XVI–XVII 11–13. Anal III 9–10. Scales

* *Otopharynx*, gen. nov. (type *T. auromarginata*, Bouleng.); differs from *Tilapia* in that the prootic forms part of the pharyngeal facet on each side; very near *Chilotilapia*.

cycloid, large (32-34); two lateral lines. Mouth terminal; teeth very slender, tricuspid, in broad bands. Lower pharyngeal with long anterior blade; dentigerous area broadly heart-shaped; teeth small, slender, numerous. Occipital and parietal crests extending forward nearly to anterior end of frontals; parietal crests mid-way between occipital crest and orbital margin; ethmoid well separated from vomer; nasal bones strongly expanded posteriorly; posterior part of parasphenoid raised, bearing a pair of nearly circular facets for articulation of upper pharyngeals. Vertebrae 31 (17+14); inferior apophyses of third united below to form a strong spine.

Tanganyika; two species.

The resemblance in external characters to *T. nilotica* and *T. galilæa* extends to every detail of the skeleton.

4. LIMNOTILAPIA, gen. nov.

(type *Tilapia dardennii*, Bouleng.).

Dorsal XV-XX 9-12. Anal III 8-10. Scales cycloid or finely denticulate, large (32-40); two lateral lines. Mouth terminal, rather small; maxillary not exposed; jaws with an outer series of teeth, all bicuspid or some conical, and one or more inner series of small teeth, all tricuspid or some unicuspid in adult. Lower pharyngeal triangular, with slender uni- or bicuspid teeth; anterior blade short or moderate. Occipital crest extending forward to posterior end of a median anterior excavation of frontals; parietal crests ending above posterior part or middle of orbits, at or near orbital margin; mesethmoid suturally united with vomer: nasal bones moderately expanded posteriorly; præmaxillary processes slender, about reaching anterior edge of frontals; maxillary short and broad, with a large rounded expansion below palatine articulation; rami of lower jaw with straight inner edges; posterior part of parasphenoid slightly raised, bearing a pair of facets for articulation of upper pharyngeals. Vertebrae 33 or 34 (16-17+17); third with a pair of inferior apophyses which meet below, but do not unite; præcaudals with parapophyses from the fourth; each of the last three pairs connected by a bridge; ribs, except the first, on parapophyses.

Tanganyika.

Three species (*L. dardennii*, *pleurotænia*, and *trematocephala*). Very close to *Tilapia*, differing especially in the form of the nasal bones and præmaxillary processes and the structure of the inferior apophyses of the third vertebra; of the species

of *Tilapia* only *T. zillii* and *T. busumana* retain the sutural union of the ethmoid and vomer, and only *T. buettikoferi* has the mandibular rami formed as in *Limnotilapia*.

5. LOBOCHILOTES, Bouleng., 1915 (type *L. labiatus*, Bouleng.).

Dorsal XVII-XIX 9-11. Anal III 6-8. Scales feebly denticulate, large (33-35); two lateral lines. Mouth terminal; lips thick; 3 to 5 series of compressed teeth, outermost bicuspid and inner tricuspid in young, all rounded or truncate, without cusps, in the adult. Lower pharyngeal with slender teeth and with a group of large blunt teeth in the middle posteriorly. Skeleton as in *Limnotilapia dardennii*; vertebræ 32 (15+17).

Tanganyika. A single species.

6. GEPHYROCHROMIS, Bouleng., 1901 (type *G. moorii*, Bouleng.).

Dorsal XVII 8. Anal III 7. Scales feebly denticulate, large (30); two lateral lines. Mouth subterminal, rather wide; jaws with a band of small tricuspid teeth and an outer series of enlarged curved conical teeth, those of the præmaxillaries gradually decreasing in size posteriorly, but the last 2 or 3 on each side again enlarged.

Tanganyika. A single species.

Very near *Limnotilapia* and *Simochromis*.

7. SIMOCHROMIS, Bouleng., 1898 (type *S. diagramma*, Günth.).

Dorsal XVII-XIX 9-10. Anal III 7-9. Scales feebly denticulate, large (33-36); two lateral lines. Mouth subterminal, rather wide; jaws with a band of small tricuspid teeth and an outer series of larger teeth which are bicuspid anteriorly and conical at the sides of the præmaxillaries. Lower pharyngeal triangular, with slender uni- or bicuspid teeth. Vertebræ 32 (15+17). Skeleton as in *Limnotilapia dardennii*.

Tanganyika; a single species.

Simochromis differs from *Limnotilapia* in the form of the mouth and from *Gephyrochromis* in the dentition.

8. TROPHEUS, Bouleng., 1898 (type *T. moorii*, Bouleng.).

Dorsal XX-XXI 5-6. Anal IV-VI 5-7. Scales feebly denticulate, large (28-32). Mouth subterminal, wide, with transverse bands of small tricuspid teeth and a series of larger bicuspid teeth in front of them; sides of præmaxillaries with a series of well-differentiated conical teeth. Vertebrae 33 (17+16). In other characters like *Simochromis*.

Tanganyika; two species.

9. OPHTHALMOTILAPIA, Pellegr., 1904

(type *Tilapia boops*, Bouleng.).

Dorsal XII-XIII 12-14. Anal III 8-10. Scales denticulate, large (34-40); two lateral lines, the upper nearly reaching caudal fin. Eye large; snout short and broad; mouth subterminal, wide, nearly transverse; distal end of maxillary slightly exposed. Teeth in jaws firmly attached, close-set, slender, slightly curved at tip, uni- or tricuspid, in narrow bands; outermost series enlarged. Lower pharyngeal subtriangular, with slender teeth. Parietal crests not extending quite so far forward as occipital crest, which ends above middle of orbits behind a median groove on the frontals which widens out forwards; nasals scarcely broader posteriorly than anteriorly; præmaxillary processes not reaching frontals; maxillary moderately broad; a thin-walled auditory bulla formed by prootic and basioccipital; posterior part of parasphenoid slightly raised, bearing a pair of transverse oval facets for articulation of upper pharyngeals. Vertebrae 34 (16+18); third with a pair of inferior apophyses; præcaudals with parapophyses from third; ribs in sockets at or near ends of parapophyses.

Tanganyika.

Two species, *O. boops* and *O. ventralis* (*Paratilapia ventralis*, Bouleng.), the latter differing from the former in the loss of the lateral cusps of the teeth.

10. CUNNINGTONIA, Bouleng., 1906

(type *C. longiventralis*, Bouleng.).

Dorsal XIII 13-14. Anal III 8-9. Scales denticulate, large (38-43). Differs from *Ophthalmotilapia* in the dentition; teeth in jaws very slender, movable, tricuspid, in rather broad bands.

Tanganyika; a single species.

11. ASPROTILAPIA, Bouleng., 1901
(type *A. leptura*, Bouleng.).

Dorsal XIV 14. Anal III 8. Scales denticulate, large (38); two lateral lines. Snout conical; mouth inferior, transverse; teeth in jaws slender, tricuspid, in narrow transverse bands. Lower pharyngeal subtriangular, with slender teeth. Skeleton essentially similar to that of *Ophthalmotilapia ventralis*, except that the nasal bones are broad posteriorly. Vertebrae 35 (16 + 19).

Tanganyika; a single species.

This genus differs from *Ophthalmotilapia* in the strictly transverse and inferior mouth, with the bands of teeth not extending backwards at the sides.

12. PETROCHROMIS, Bouleng., 1898
(type *P. polyodon*, Bouleng.).

Dorsal XVII-XX 8-10. Anal III 7-8. Scales finely denticulate, large (32-35). Mouth subterminal; lips very thick, the upper with a double fold; teeth very slender, tricuspid, in very broad bands. Lower pharyngeal subtriangular, with moderately long anterior blade. Occipital crest extending forward in advance of parietal crests, which end above middle of orbits near edges of frontals; ethmoid united with vomer by suture; nasal bones not expanded posteriorly; parasphenoid with a pair of facets for articulation of upper pharyngeals. Vertebrae 32 (16 + 16); inferior apophyses of third short, separate.

Two species from L. Tanganyika and one from L. Nyassa.

This genus is essentially similar to *Ophthalmotilapia* in skeletal structure.

13. CYATHOPHARYNX, gen. nov.
(type *Tilapia grandoculis*, Bouleng.).

Dorsal XIII-XIV 12-14. Anal III 9-10. Scales denticulate, small (55-65); two lateral lines, the upper nearly reaching caudal fin. Mouth small, subterminal; maxillary concealed; jaws with 3 to 5 series of slender pointed teeth, with or without small lateral cusps; teeth of the outermost series enlarged, in the lower jaw directed outwards. Lower pharyngeal with nearly circular, slightly concave dentigerous area and rather long anterior blade; teeth numerous, close-set, slender. Occipital crest extending forwards to middle of interorbital region, ending behind a median groove on

frontals; parietal crests ending above posterior part of orbits; ethmoid suturally united with vomer; nasals considerably expanded posteriorly; præmaxillary processes not reaching frontals; maxillary short and broad, broadest below palatine articulation; posterior part of parasphenoid slightly raised, bearing a pair of subcircular facets for articulation of upper pharyngeals. Vertebrae 32-34 (16-17+16-17); third without inferior apophyses; præcaudals with parapophyses from the fourth; ribs, except the first, on parapophyses.

Tanganyika.

Two species, *C. grandoculis* and *C. furcifer* (*Paratilapia furcifer*, Bouleng.).

14. LIMNOCHROMIS, gen. nov.

(type *Pelmatochromis auritus*, Bouleng.).

Dorsal XII-XVII 9-16. Anal III 7-12. Scales finely denticulated, large, 32 to 42; two lateral lines. Mouth terminal; maxillary rather narrow, slightly exposed; teeth conical, in 2 to 4 series. Lower pharyngeal triangular; teeth all slender or a few median posterior teeth slightly enlarged. Occipital and parietal crests extending forward to above middle or posterior part of interorbital region; a median groove on frontals in front of occipital crest; nasal bones expanded posteriorly; ethmoid well separated from vomer; præmaxillary processes moderate or long, sometimes extending to between the orbits; posterior part of parasphenoid slightly raised, bearing a pair of transverse oval facets for articulation of upper pharyngeals. Vertebrae 31 (15+16) to 37 (19+18); third with or without a pair of inferior apophyses which do not meet below.

Tanganyika; four species.

In addition to *L. auritus* this genus includes three species placed by Boulenger in *Paratilapia*—*L. pfefferi*, *nigripinnis*, and *leptosoma*. *L. auritus* and *L. leptosoma* are very similar in their osteology, and the other species are intermediate between them in external characters.

15. CYPHOTILAPIA, gen. nov.

(type *Pelmatochromis frontosus*, Bouleng.).

Dorsal XV-XIX 8-10. Anal III 7-8. Scales cycloid or feebly denticulated, large (28-36); two lateral lines. Frontal region humped. Mouth terminal; maxillary largely exposed; teeth in 3 to 5 series, outermost enlarged, conical or some bicuspid, inner conical or some tricuspid. Lower

pharyngeal triangular, with slender pointed uni- or bicuspid teeth; upper pharyngeals supported by a rather strong apophysis with transverse articular surface formed by the parasphenoid. Occipital crest very strong, extending forwards to or in advance of anterior margin of orbits.

Tanganyika and Upper Congo.

Two species, *C. frontosus* and *C. demeusii* (*Paratilapia demeusii*, Bouleng.).

16. BOULENGEROCHROMIS, Pellegr., 1904
(type *Paratilapia microlepis*, Bouleng.).

Dorsal XVI–XVII 13–15. Anal III 9–10. Scales cycloid, small (75–90); two lateral lines. Mouth terminal; maxillary slightly exposed distally; teeth small, in 4 or 5 series, conical (outer bicuspid and inner tricuspid in the young). Lower pharyngeal subtriangular, with slender bicuspid teeth. Occipital crest extending forward to end of a median excavation of anterior part of frontals; parietal crests confluent with edge of frontals above middle of orbits; ethmoid united with vomer by suture; nasal bones slightly expanded posteriorly; premaxillary processes nearly reaching frontals; maxillary rami rather broad, of even width; posterior end of parasphenoid slightly raised, bearing a pair of transverse facets for articulation of upper pharyngeals. Vertebrae 33 (16+17); third with a pair of inferior apophyses which unite below; praecaudals with parapophyses from fourth; ribs, except the first, on parapophyses.

Tanganyika. A single species.

17. PERISSODUS, Bouleng., 1898 (type *P. microlepis*,
Bouleng.).

Dorsal XVIII 10. Anal III 8. Scales cycloid, small (65); two lateral lines. Differs from *Boulengerochromis* in the dentition. Teeth in jaws uniserial, few, stout, with a small cusp on each side superiorly.

Tanganyika. A single species.

18. HAPLOCHROMIS, Hilgend., 1888
(type *Chromis obliquidens*, Hilgend.).

Dorsal XIII–XIX 6–13. Anal III (IV) 6–12. Scales usually denticulate, large (28 to 45); two lateral lines. Mouth terminal; jaws opposed; an outer series of bicuspid or conical teeth and one or more inner series of smaller tricuspid or conical teeth. Lower pharyngeal triangular; teeth

slender or rather stout, compressed or cylindrical, uni- or bicuspid, acute or obtuse. Occipital crest extending forward to posterior end of a median excavation of frontals; parietal crests ending between the orbits; ethmoid naturally united with or in contact with vomer; nasals not or scarcely broader posteriorly than anteriorly. Articular surface for upper pharyngeals transverse, entered by basioccipital at the postero-lateral angles. Vertebrae 29 to 34 (13-17+15-18); third with a pair of inferior apophyses which unite below.

Africa.

This is the largest African genus, including 14 of the 16 species placed by Boulenger in *Haplochromis*, 8 (23-27, 30-32) included by him in *Pelmatochromis*, at least 26 (10-12, 14-29, 37-38, 40-44) of the 53 referred to *Paratilapia*, and the majority of the species with ctenoid scales placed in *Tilapia* *.

Haplochromis is represented in Tanganyika by one of the forms grouped together as *H. desfontainesii* and by two species placed by Boulenger in *Tilapia*, *H. horii* and *H. burtoni*.

19. ECTODUS, Bouleng., 1898 (type *E. descampsii*, Bouleng.).

Dorsal XIII-XIV 13-15. Anal III 8-11. Outermost pelvic rays longest. Scales denticulate, large (34-38); two lateral lines. Mouth small, terminal; maxillary concealed; teeth conical, in narrow bands, outer of lower jaw directed

* The following genera are closely related to *Haplochromis*:—*Lipochromis*, gen. nov. (type *Pelmatochromis obesus*, Bouleng.). Lower jaw shutting within upper. *Neochromis*, gen. nov. (type *Tilapia simotes*, Bouleng.). As *Haplochromis*, but teeth small, in bands, outer not enlarged, bicuspid, inner tricuspid. *Cnestrostoma*, gen. nov. (type *Paratilapia polyodon*, Bouleng.); jaws with broad bands of small conical teeth, outer not enlarged. *Mylochromis*, gen. nov. (type *Tilapia lateristriga*, Günth.); middle pharyngeal teeth large and obtuse, sharply differentiated from the other teeth, which are slender and bicuspid. *Sargochromis*, gen. nov. (type *Paratilapia codringtoni*, Bouleng.). Fourth vertebra with inferior apophyses that meet below; pharyngeal teeth stout and blunt; articular surface for upper pharyngeals nearly as broad as long, its basioccipital portions nearly meeting behind parasphenoid. *Labrochromis*, gen. nov. (type *Tilapia pallida*, Bouleng.); inferior apophyses on third vertebra formed as in *Haplochromis*; pharyngeal teeth and pharyngeal apophysis as in *Sargochromis*. *Serranochromis*, gen. nov. (type *Chromys thumbergi*, Casteln.); as *Haplochromis*, but inferior apophyses on fourth vertebra very small. *Astatoreochromis*, Pellegr. (*allnaudi*); 4 to 6 anal spines; pharyngeal teeth large and obtuse. *Clinodon*, gen. nov. (type *Hemitilapia bayoni*, Bouleng.); structure of *Haplochromis*, dentition of *Hemitilapia*.

outwards. Lower pharyngeal triangular, with small slender teeth. Skeleton very similar to that of *Callochromis macrops*, but the præmaxillary processes shorter, not reaching frontals; vertebræ 36 (17 + 19).

Tanganyika; a single species.

20. CALLOCHROMIS, gen. nov.

(type *Pelmatochromis macrops*, Bouleng.).

Dorsal XII–XVI 10–14. Anal III 6–9. Outermost ray of pelvic fin longest. Scales denticulate, large (32–38); two lateral lines. Mouth small, terminal or subterminal, nearly horizontal; end of maxillary slightly exposed; jaws with narrow bands of small conical teeth, the outer on sides of lower jaw enlarged and directed more or less outwards. Lower pharyngeals united by interlocking suture to form a triangular plate; enlarged blunt rounded teeth in the middle posteriorly and slender bicuspid teeth elsewhere. Occipital crest ending above middle of orbits behind a groove on frontals that widens forwards; parietal crests ending above posterior part of orbits; præmaxillary processes extending to between orbits; maxillary broadest below palatine articulation, distal part short and broad; ethmoid united with vomer by suture; nasals much expanded posteriorly; posterior part of parasphenoid slightly raised, convex; articular surface for upper pharyngeals formed by parasphenoid in the middle and basioccipital at the sides. Vertebræ 34 (16 + 18); inferior apophyses of third vertebra uniting below to form a median spine.

Tanganyika; four species.

21. LEPTOCHROMIS, gen. nov.

(type *Paratilapia calliura*, Bouleng.).

Dorsal XVI–XVII 10. Anal III 7–8. Scales denticulate, large (37–40); two lateral lines. Mouth terminal, very protractile; maxillary broad, slightly exposed; jaws with an outer series of very small conical teeth and 1 or 2 inner series of minute teeth. Interorbital region narrow. Lower pharyngeal small, triangular, with long anterior blade; teeth small, slender. Occipital crest ending at posterior part of interorbital region behind a long groove on the narrow frontals; parietal crests not extending forwards on frontals; ethmoid in contact with vomer; a thin-walled otic bulla; articular surface for upper pharyngeals formed by parasphenoid in the middle and basioccipital at the sides.

Vertebræ 34 (17+17); third with vestigial inferior apophyses; præcaudals with parapophyses from fourth, last four pairs bridged; ribs, except first, in sockets at or near ends of parapophyses.

Tanganyika; a single species.

22. AULONOCRANUS, gen. nov.

(type *Paratilapia dewindti*, Bouleng.).

Dorsal XII-XIII 12-13. Anal III 9. Scales denticulate, large (36-38); two lateral lines. Mouth terminal, moderately protractile; maxillary moderately broad, exposed distally; teeth very small, conical, in 2 or 3 series, outermost largest. Lower pharyngeal triangular; teeth small. Occipital crest ending on posterior part of interorbital region. Frontals, nasals, præorbitals, lower jaw, and lower limb of præoperculum with large channels with wide openings; suborbitals narrow.

Tanganyika; a single species.

Intermediate between *Haplochromis* and *Trematocara*.

23. TREMATOCARA, Bouleng., 1899 (type *T. marginatum*, Bouleng.).

Dorsal IX-XII 9-12. Anal III 7-10. Scales cycloid, large (28-32); upper lateral line short, lower absent. Near *Aulonocranus*, but maxillary concealed, and the deep channeling of the bones of the head extending to the suborbitals. Occipital and parietal crests not extending forwards on frontals; ethmoid united with vomer by suture; a large otic bulla; articular surface for upper pharyngeals formed by parasphenoid in the middle and basioccipital at the sides. Vertebræ 31 (12+19); third without inferior apophyses; præcaudals with parapophyses from the fourth; ribs, except the first, on parapophyses.

Tanganyika; three species.

24. STAPPERSIA, Bouleng., 1914

(type *S. singularis*, Bouleng.).

Dorsal XIII-XV 13-14. Anal III 13-14. Innermost rays of pelvic fins longest. Scales denticulate, large (37-38); two lateral lines. Apparently differs from *Enantiopus* only in the dentition; teeth small, conical, in 4 or 5 series, outer not directed outwards.

Tanganyika; a single species.

25. ENANTIOPUS, Bouleng., 1906
(type *E. melanogenys*, Bouleng.).

Dorsal XII–XV 13–17. Anal III 12–17. Innermost pelvic rays longest. Scales denticulate, large (37–44); two lateral lines. Mouth terminal, very protractile; teeth small, conical, in 2 series, outer of lower jaw directed outwards. Lower pharyngeal triangular; teeth mostly slender, bicuspid, a few middle posterior teeth large and blunt. Occipital and parietal crests ending above posterior part of orbits; frontals with a median groove, widening forwards; mesethmoid well separated from vomer; articular surface for upper pharyngeals formed by parasphenoid in the middle and basioccipital at the sides. Vertebrae 38 (14+24); inferior apophyses of third meeting below.

Tanganyika; 3 or 4 species.

26. GRAMMATOTRIA, Bouleng., 1899 (type *G. lemairii*,
Bouleng.).

Dorsal XV 14–15. Anal III–IV 10–11. Outermost pelvic rays longest. Scales denticulate, large, about 40 in a lateral longitudinal series; 3 lateral lines. Mouth terminal; end of maxillary exposed; a series of conical teeth followed by a narrow band of minute teeth; outer anterior teeth of lower jaw directed outwards. Lower pharyngeal triangular; middle posterior teeth strongly enlarged and blunt. Skeleton as in *Callochromis macrops*, except that the frontals partly roof over the median groove from each side and the inferior apophyses of the third vertebra are vestigial. Vertebrae 36 (14+22).

Tanganyika; a single species.

27. XENOTILAPIA, Bouleng., 1899 (type *X. sima*, Bouleng.).

Dorsal XIII–XV 12–14. Anal III 7–12. Innermost pelvic rays longest. Scales denticulate, large (34–41); 3 lateral lines. Mouth terminal, very protractile; maxillary very broad, concealed; teeth small, conical, in 2 or 3 series, outer anterior teeth of lower jaw directed outwards. Lower pharyngeal triangular; middle posterior teeth enlarged and obtuse. Skeleton nearly as in *Callochromis macrops*, but with the frontals tending to roof the median groove as in *Grammatotria*. Vertebrae 34–35 (13–14+20–22).

Tanganyika; two species.

28. HEMIBATES, gen. nov.

(type *Paratilapia stenosoma*, Bouleng.).

Dorsal XV 13. Anal III 12-14. Scales cycloid, small (60-70); two lateral lines, the upper nearly reaching caudal fin. Mouth moderate, terminal, with lateral cleft; maxillary slightly exposed distally; teeth small, conical, curved, in 2 or 3 series, outer erect and fixed, inner pointing backwards, depressible. Lower pharyngeal triangular, with slender teeth. Parietal crests ending at edge of frontals above middle of orbits; occipital crest ending behind a short median depression on anterior part of frontals; nasals somewhat expanded posteriorly; præmaxillary processes reaching frontals; maxillary broadest below palatine articulation, moderately broad distally; base of skull with a low, broad convex apophysis, with articular surface for upper pharyngeals formed in the middle by the parasphenoid, and at the sides by the basioccipital. Third vertebra without inferior apophyses.

Tanganyika; a single species.

29. BATHYBATES, Bouleng., 1898 (type *B. ferax*, Bouleng.).

Dorsal XIII-XVII 11-17. Anal III 14-18. Scales cycloid, small (65-150); two lateral lines, the upper extending nearly to caudal fin. Mouth large, terminal, with lateral cleft; maxillary hidden; teeth strong, curved, conical, in 2 to 4 series, outer fixed, inner depressible. Lower pharyngeal triangular, with slender teeth. Parietal crests ending near edge of frontals above middle of orbit; occipital crest extending as far forward or a little farther; ending behind a median depression on the frontals which widens out anteriorly; ethmoid united with vomer by suture; nasals somewhat expanded posteriorly; præmaxillary processes not reaching frontals; maxillary broadest below palatine articulation, moderately broad distally; base of skull with a low, broad, convex apophysis, with the articular facets for the upper pharyngeals well separated, oblique, formed by the parasphenoid in the middle and the basioccipital at the sides. Vertebrae 35-36 (16-17 + 19-20); third without inferior apophyses.

Tanganyika; six species.

30. HAPLOTAXODON, Bouleng., 1906

(type *H. microlepis*, Bouleng.).

Dorsal XVII-XVIII 11-13. Anal III 9. Scales small (70-80); two lateral lines, the upper nearly reaching caudal

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fin. Mouth terminal, very oblique; end of maxillary exposed; teeth uniserial, conical, curved. Lower pharyngeal triangular, with small slender unicuspid teeth. Skeleton as in *Hemibates*, except that the maxillary has only a small process below the palatine articulation and is broadest distally; præmaxillary processes not reaching frontals; vertebræ 38 (19+19).

Tanganyika; a single species.

31. XENOCHROMIS, Bouleng., 1899
(type *X. hecqui*, Bouleng.).

Dorsal XVI–XVII 10–11. Anal III 9–10. Scales small (60–70); two lateral lines, the upper nearly reaching caudal fin. Mouth terminal; end of maxillary exposed; teeth uniserial, compressed, a little concave in front, strongly curved, rather small and forming a close-set series. Lower pharyngeal triangular, with small unicuspid teeth. Skeleton as in *Haplotaxodon*, except that the ethmoid is well separated from the vomer. Vertebræ 35 (17+18).

Tanganyika; a single species.

32. PLECODUS, Bouleng., 1898
(type *P. paradoxus*, Bouleng.).

Dorsal XVIII–XX 11–13. Anal III 12–13. Scales small (75–80). Differs from *Xenochromis* only in having the teeth large, few, and set well apart.

Tanganyika; a single species.

33. ERETMODUS, Bouleng., 1898
(type *E. cyanostictus*, Bouleng.).

Dorsal XXIII–XXV 3–5. Anal III 6–7. Scales denticulate, large (32–35); two lateral lines. Teeth rather strong, distally expanded, compressed and truncate, in 2 or 3 series. Lower pharyngeal subtriangular, with small slender teeth. Occipital crest ending behind a broad and deep depression on anterior part of skull, formed by frontals, and in front by ethmoid and lateral ethmoids; parietal crests ending above posterior part of orbits; ethmoid separated from vomer; jaws strong; præmaxillary processes stout; maxillary broadest distally. Articular surface for upper pharyngeals formed by parasphenoid in the middle and basioccipital at the sides. Vertebræ 30 (15+15); a pair of inferior

apophyses formed equally by third and fourth vertebræ; præcaudals with parapophyses from third; ribs on parapophyses.

Tanganyika; a single species.

34. SPATHODUS, Bouleng., 1900
(type *S. erythrodon*, Bouleng.).

Dorsal XXIII 5. Anal III 6-7. Scales denticulate, large (30-31); two lateral lines. Teeth rather strong, distally slightly expanded, compressed and rounded, uniserial. Apparently differs from *Eretmodus* only in the dentition.

Tanganyika; a single species.

35. TELMATOCHROMIS, Bouleng., 1898
(type *T. temporalis*, Bouleng.).

Dorsal XVIII-XXII 6-8. Anal V-VII 5-7. Scales rather large (40-52); nuchal scales very small; two lateral lines. A band of small tricuspid teeth and an outer series of conical teeth, the anterior strong. Skeleton as in *Eretmodus*, but no parietal crests and inferior apophyses on third vertebra only. Vertebra 33 (16 + 17).

Tanganyika; two species.

36. JULIDOCHROMIS, Bouleng., 1898
(type *J. ornatus*, Bouleng.).

Dorsal XXII-XXIV 5. Anal VIII-IX 4-6. Scales rather large (45-50); nuchal scales very small; two lateral lines. A band of small conical teeth and strong anterior canines. Skeleton as in *Telmatochromis*, but suborbitals unossified, and parietal crests distinct. Vertebrae 34 (17 + 17).

Tanganyika; a single species.

37. LAMPROLOGUS, Schilthuis, 1891
(type *L. congolensis*, Schilth.).

Dorsal XVI-XXI 6-11. Anal IV-X 4-8. Scales large or small; nuchal scales very small; two lateral lines, or the lower absent. A band of small conical teeth and anterior canines. Suborbitals ossified. Vertebrae 31-35 (14-17 + 16-19); third or fourth with inferior apophyses. Skeleton as in *Telmatochromis*, but parietal crests distinct.

Tanganyika and Congo; 27 species.

The above data enable the origin and relationships of the Cichlid fauna of Lake Tanganyika to be discussed.

Tylochromis is found in the Congo and in West Africa, and is represented in Tanganyika by a single species; it is an isolated genus, whose nearest relative is *Ptychochromis* of Madagascar. Of the large African genus *Tilapia* only the widely-distributed *T. nilotica* has reached Tanganyika, apparently through L. Kivu; the endemic *Neotilapia* has the structure of *T. nilotica* and its allies, but differs in its dentition, having all the teeth tricuspid.

A small group of endemic genera begins with *Limnotilapia*, which is nearly related to, but is in some respects more generalized than *Tilapia*, and leads on the one hand to *Lobochilotes* and on the other to *Gephyrochromis*, *Simochromis*, and *Tropheus*; in this group the *Limnotilapia* dentition (outer teeth bicuspid, inner tricuspid) undergoes various modifications; *Lobochilotes*, teeth compressed, unicuspid; *Gephyrochromis*, outer teeth conical; *Simochromis* and *Tropheus*, anterior outer teeth bicuspid, lateral conical.

Another little group of endemic genera commences with *Ophthalmotilapia*, which is closely related to *Limnotilapia*, but has all the teeth tricuspid (or sometimes unicuspid), small, and fixed. This genus has given rise to *Cyathopharynx*, distinguished by the small scales and the form of the lower pharyngeal, and to *Cunningtonia*, *Asprotilapia*, and *Petrochromis*, in which the tricuspid teeth are long, slender, and movable. It is interesting to note that the total number of dorsal rays is nearly the same in *Petrochromis* as in the other genera, but that the spines have increased at the expense of the soft rays; this genus has a species in L. Nyassa, but there can be little doubt that it originated in Tanganyika.

The endemic *Limnochromis*, with conical teeth, does not differ very essentially from *Limnotilapia* in other characters. *Cyphotilapia* has one species from Tanganyika and another from the Upper Congo; if, as seems likely, this genus is *Limnochromis* specialized, it probably originated in the lake. The monotypic *Boulengerochromis* is essentially a small-scaled *Limnotilapia*, and *Perissodus* seems to differ from it only in the peculiar dentition.

The seventeen genera mentioned above have the pharyngeal apophysis formed by the parasphenoid alone; two (*Tylochromis*, *Tilapia*) are widely distributed genera, each represented in the lake by a single species; one endemic genus (*Neotilapia*) is closely related to *Tilapia*; the rest may have originated in the lake from a single ancestral type, which *Limnotilapia*

most nearly resembles; they are peculiar to Tanganyika, except for a *Petrochromis* in Lake Nyassa and a *Cyphotilapia* in the Congo.

The remaining genera have the pharyngeal apophysis formed partly by the basioccipital; the widely distributed *Haplochromis* has two endemic species in Tanganyika; there are also a number of endemic genera with small conical teeth, closely related to *Haplochromis*; of these *Aulonocranus* leads to *Trematocara*, and *Ectodus* through *Callochromis* to *Xenotilapia* and *Grammatotria*.

A well-marked group includes genera with small scales, a'l endemic; of these *Hemibates*, with small conical teeth, is intermediate between *Haplochromis* and *Bathybates*, with strong pluriserial teeth, and *Haplotaxodon*, with rather small uniserial teeth. *Xenochromis* and *Plesodus* differ from *Haplotaxodon* only in their peculiar dentition. Another well-marked group apparently derived from *Haplochromis* includes the genera with strong anterior teeth; this group includes *Eretmodus* and *Spathodus*, with incisor-like teeth and three anal spines, and *Telmatochromis*, *Julidochromis*, and *Lamprologus*, with strong conical teeth and 4 to 10 anal spines. All but *Lamprologus* are peculiar to the lake, and the great diversity of the Tanganyika species of *Lamprologus* and its close relationship to the more generalized *Telmatochromis* make it almost certain that it originated in Tanganyika.

The above remarks may be summarized thus:—Nearly all the Tanganyika Cichlidæ are endemic species belonging to genera that originated in the lake; except *Neotilapia* these genera fall into two divisions, which may have evolved in the lake from two ancestral types, one nearly related to *Limnotilapia* and the other to *Haplochromis*.

IV.—New or little-known Tipulidæ (Diptera).—I. *Ethiopian Species*. By CHARLES P. ALEXANDER, Ph.D., Urbana, Illinois, U.S.A.

THE new species described in the following pages will be discussed more fully and figured in a monographic treatment of the crane-flies of the Ethiopian region that the writer has in preparation.

The species described were sent to me for naming by Rev. J. A. Reis, Dr. E. Warren, and Prof. A. J. T. Janse, to all of whom I express my sincere thanks.

The holotypes are preserved in the collection of the writer, unless stated otherwise.

Dicranomyia connectans, sp. n.

Colour dark brown; tarsi white; wings brown, the tips darker; cord far out near the wing-tip; anal angle lacking; Cu_2 and 1st A fused for a short distance back from the wing-margin.

Male.—Length 6.6–8.8 mm.; wing 7.3–8.2 mm.

Female.—Length 6.7 mm.; wing 6.8 mm.

Rostrum yellowish brown, darkest above. Palpi dark brown. Antennæ dark brown, the first segment paler brown; flagellar segments elongate-oval, with long black verticils. Head dark brown.

Pronotum dark brown, yellowish laterally. Mesonotal prescutum reddish brown without stripes, the humeral region a little brighter. Pleura pale, sparsely yellowish pollinose. Halteres very elongate, dark brown. Legs with the fore coxæ brown, the other coxæ yellowish; trochanters dull yellow; remainder of the legs dark brown excepting the tarsi, which are largely white; on the fore legs only the extreme bases of the metatarsi are a little infuscated; the other legs have about the basal third of the metatarsus brown, broadest on the middle legs; two terminal tarsal segments bright yellow. Wings cuneiform, with no anal angle, the cord lying far out near the wing-tip; membrane strongly brownish, darkest at the apex; stigma oval, dark brown; veins dark brownish black. Venation as in *D. cuneiformis*, de Meij., with the following exceptions:—cell 1st M_2 shorter, nearly square, the basal deflection of Cu_1 just before the middle of its length; 1st A runs close to Cu and is fused with Cu_2 at the wing-margin, this short fusion about equal to Sc_2 .

Abdomen elongate, dark brown, including the hypopygium.

Hab. West Africa.

Holotype, ♂, Lolodorf, Cameroun, January 9, 1919 (*J. A. Reis*).

Allotopotype, ♀, January 9, 1919.

Paratopotypes, 2 ♂, January 9–15, 1919.

D. connectans is closely related to *D. cuneiformis*, de Meij. (Java), but is readily separated from this and all other known species of the genus by the apical fusion of Cu_2 and 1st A .

Dicranoptycha natalia, sp. n.

General coloration dark brown, the wings with a strong dark brown suffusion.

Male.—Length 8–8.5 mm.; wing 8.3–8.6 mm.

Rostrum and palpi dark brown. Antennæ rather short, dark brown, the second scapal segment a little brighter; the first two flagellar segments enlarged and closely approximated, the third to fifth short-cylindrical, the remaining flagellar segments gradually elongated. Head brown, with a yellowish pollen.

Mesonotum dark brown, sparsely pollinose, without stripes. Pleura brown. Halteres brown, paler at the base, darkest on the knobs. Legs with the coxæ brown, the apical portions of the middle and hind coxæ on the outer face more yellowish; trochanters yellow, with a jet-black spot on the margin, and here produced into a sharp tooth as in the genus; legs dark brown, the basal portion of the femora more yellowish, this narrowest on the fore legs, broadest on the hind legs. Wings with a very strong dark brown suffusion, deepest along the costal region; the fork from the first anal vein into cell *Cu* and a streak in cell *R* paler; veins dark brown. Venation: *Sc* ending slightly beyond the fork of the sector; *Rs* about one-fourth longer than the long cell 1st *M*₂.

Abdomen dark brown, the hypopygium a little brighter, segments 7 and 8 and the terminal half of segment 6 black.

Hab. South Africa.

Holotype, ♂, Maritzburg, Natal, 1916 (*Dr. Conrad Akerman*).

Paratopotype, a badly broken male.

Type in the collection of the Natal Museum.

Rhamphidia flavitarsis, sp. n.

Rostrum longer than the head; mesonotum dark brown, almost black above, the pleura dull yellow; legs dark brown, the tarsi yellowish; wings subhyaline, the stigma dark brown.

Male.—Length, excluding rostrum, 8–8.3 mm., rostrum about 1 mm.; wing 8.8 mm.

Female.—Length 11–11.2 mm.; wing 8.5 mm.; ovipositor, tergal valves, 2.1 mm.

Rostrum longer than the head, brown above, darkest near the apex, more yellowish beneath and on the sides; palpi dark brown. Antennæ moderately elongated, the scape brown, the flagellum dark brown; flagellar segments elongate-oval, with long verticils that are longest and most conspicuous on the terminal antennal segments. Head dark brownish black.

The long neck is brown. Pronotal scutum brownish black; scutellum light yellow. Mesonotal prescutum dark

brown, a broad, almost black median area; lateral margins of the sclerite narrowly paler. Pleura dull yellow. Halteres brown, the knobs darker, the base of the stem yellow. Legs with the coxæ dull yellow, the fore coxæ more brownish on the outer face; trochanters dull yellow; remainder of the legs dark brown, the last four tarsal segments and the extreme tips of the metatarsi dull orange-yellow. Wings subhyaline; cell *Sc*, a seam beneath vein *Cu*, and the wing-apex a little darker; stigma elongate-oval, dark brown; veins dark brown. The following veins bear conspicuous macrotrichiae:—*Rs*, apical part of *R*₁, *R*₂₊₃, all of *R*₄₊₅, apical portions of *M*₁₊₂ and *M*₃₊₄; one near mid-length of the last section of *Cu*₁ and a few on *Cu*₂. Venation: *Sc* ending beyond the fork of *Rs*, *Sc*₂ at the tip of *Sc*₁; basal deflection of *R*₄₊₅ about equal to *r-m*; basal deflection of *Cu*₁ at or beyond the fork of *M*.

Abdominal tergites dark brown; sternites yellow, more darkened on the sixth and seventh segments; hypopygium brownish yellow.

The female is similar to the male in most respects, the ovipositor with the valves very long and slender, the tergal valves almost straight, a little upcurved at the tips; sternal valves acicular, the tips with a few long hairs.

Hab. West Africa.

Holotype, ♂, Lolodorf, Cameroun, January 10, 1919 (*J. A. Reis*).

Allotopotype, ♀, January 15, 1919.

Paratopotypes, 10 ♂ ♀, January 9–16, 1919.

Trentepohlia (Mongoma) albilata, sp. n.

Legs with the femora tipped with white; tibiæ with a narrow white basal band, the apices very broadly white; fore femora with three basal bristles, the other femora with a row of from eight to ten small setæ; wings with two or three long curved setæ on the posterior margin of the wing-petiole.

Male (type).—Length 10 mm.; wing 8.7 mm.; fore leg, femur 13.5 mm., tibia 16.8 mm., tarsus 15.2 mm., black band on tibia 5 mm.; hind leg, femur 15 mm., tibia 16 mm., tarsus 13 mm., black band on tibia 5 mm.

Male (series).—Length 9–11 mm.; wing 7–9 mm.

Female (series).—Length about 9.5 mm.; wing 8 mm.

Rostrum yellow; palpi brownish black. Antennæ dark brownish black, pale at the extreme base, moderately elongated; flagellar segments long-oval. Head dark grey along

the eyes, more yellowish on the front and the occipital region.

Pronotum yellow. Mesonotum dark brown; the pre-scutum broadly margined with dull yellow. Pleura dull yellow. Halteres rather short, dark brown, the extreme base more yellowish. Legs with the coxæ yellow, the fore coxæ a little darker; trochanters dull yellow; femora dark brown, the extreme bases a little paler, the tips white, broadest on the fore femora; tibiæ white, with a relatively narrow (5 mm.) black subbasal band, the white apex occupying the apical half or more of the segment; tarsi white, a patch of hairs at the base of the middle and hind metatarsi and the tips of the tarsi more yellowish. The white femoral apex is a trifle broader than the tibial base on the fore legs; the tibial base is much broader than the femoral tip on the middle and hind legs. The legs are armed in both sexes; the fore femora have three long erect bristles, with one or more additional smaller setæ in a group near the base; the middle and hind femora each bears a row of some eight to ten small subequidistant bristles near the base; femora with several long setæ at apex, these a little more slender on the fore femora. Middle and hind metatarsi on the inner face at the base with a longitudinal row of conspicuous orange hairs, these more distinct on the posterior metatarsi. Wings greyish subhyaline, the costal cell more yellow, the subcostal cell more brownish; stigma narrow, oval, brown; extreme tip of the wing indistinctly darker; veins brownish black; the cord and vein *Cu* very narrowly and indistinctly seamed with brownish. Venation: *r* long, more than twice the length of R_{2+3} between it and the fork of the latter; basal deflection of M_{1+2} short, usually less than *m*; outer deflection of M_3 evenly arcuated, long, the inner end of cell M_3 lying far proximad of cells R_5 and M_2 ; basal deflection of Cu_1 at or close to the fork of *M*; fusion of Cu_2 and 1st *A* slight. A group of two or three long curved setæ on the caudal margin of the wing-petiole.

Abdominal tergites dark brown, the basal segment paler laterally; sternites yellowish.

Hab. West Africa.

Holotype, ♂, Lolodorf, Cameroun, January 16, 1919 (*J. A. Reis*).

Allotopotype, ♀, January 15, 1919.

Paratopotypes; 200 ♂ ♀, January 9-16, 1919.

T. fragillima, Westw., the type of the subgenus *Mongoma*, is very insufficiently described by Westwood. The insect is

characterized as being pitchy black, the thorax more dilute; legs brown, with the knees, the tibial tips, and the tarsi white. At the base of the fore femora are two spinules. Specimens from Madagascar that Osten-Sacken later referred, with considerable doubt, to *fragillima* had the entire distal third of the tibiæ white. In the present species the entire distal half of all the legs in both sexes is white.

Trentepohlia (Mongoma) reisi, sp. n.

General coloration brown, more yellowish beneath; femora and tibiæ with the tips white; tarsi white; femora with a series of about a dozen spines near the base; posterior tibiæ with a series of from eight to ten stout setæ; wings nearly hyaline.

Male (type).—Length 8.6 mm.; wing 8 mm.; fore leg, femur 12.5 mm., tibia 16 mm.; hind leg, femur 14.3 mm., tibia 15 mm., tarsus 11 mm.

Male (series).—Length 8.6–9.5 mm.; wing 7.6–9 mm.

Female (series).—Length 10 mm.; wing 8.6.

Rostrum light yellow; palpi dark brownish black. Antennæ moderately long, dark brownish black, the flagellar segments long-oval. Head dark brown, paler on the occiput and underneath on the genæ, which bear a few long curved hairs.

Pronotum dark brown above, yellowish laterally. Mesonotal prescutum yellowish brown, darker brown anteriorly; remainder of mesonotum pale brown. Pleura pale yellow, a little more brownish dorsally. Halteres short, dark brown, the base yellowish. Legs with the coxæ and trochanters yellow; femora dark brown, paler at the base, the tips passing into white; tibiæ brown, the bases indistinctly whitish, the tips passing into white, these about twice as wide as the white femoral tips; tarsi white or pale yellowish white. All the femora with a series of from ten to seventeen short stout black spines near the base, extending in a single row along the ventral face; these spines are slightly variable in number, but are apparently more numerous on the fore femora; femoral tips with a few slender blackish hairs; hind tibiæ near the tip with from eight to ten long, curved, erect, black setæ, five or six of which are grouped on the white tips, the proximal three or four less crowded and located on the brown areas. Wings nearly hyaline, the costal and subcostal cells a little more yellowish; stigma pale brownish yellow; veins pale brown. Venation: similar to *T. albitala*, differing as follows:—cell 1st M_2 shorter and broader;

outer deflection of M_{1+2} long, so that the inner end of cell R_5 is about on a level with cell M_3 ; outer deflection of M_3 short, squarely arcuated to almost angulated; basal deflection of Cu_1 rather far before the fork of M ; fusion of Cu_2 and 1st A rather extensive, about equal to m , vein Cu being strongly bent backward at the point of fusion; cell 2nd A wider.

Abdomen dark brown above, the sternites and hypopygium more yellowish. Male hypopygium with the pleural appendages a little longer than *T. albilata*.

Hab. West Africa.

Holotype, ♂, Lolodorf, Cameroun, January 9, 1919 (*J. A. Reis*).

Allotopotype, ♀, January 10, 1919.

Paratopotypes, 27 ♂ ♀, January 9-15, 1919.

T. reisi is readily told from all other described species of the genus by the curious armature of the femora and the posterior tibiæ. This condition occurs in both sexes.

This interesting fly is dedicated to the collector, Rev. J. A. Reis.

Lecteria triacanthos, sp. n.

Mesonotum yellowish, the prescutum with four fulvous stripes; legs with the femora reddish brown, a narrow white ring beyond mid-length, surrounded on either side by a blackish ring; tibiæ white, brown at the base and apex, a broad black band before mid-length; the three basal tarsal segments yellowish white, tipped with brown; metatarsi with a group of three stout spines at the extreme base; wings broad, subhyaline, heavily banded and dotted with brown and grey.

Male.—Length about 14 mm.; wing 12.7 mm.; hind leg, femur 9 mm., tibia 8.6 mm.

Rostrum and palpi black, sparsely grey pruinose. Antennæ with the basal segment black, the second segment light brown, the flagellum brown; there are only fourteen antennal segments, the first flagellar segment being a fusion of apparently three segments as in *Conosia*; first scapal segment elongate; first flagellar segment oval, greatly narrowed at the base; the following three segments short-cylindrical, the others gradually lengthened into long-cylindrical; the flagellar segments are clothed with a dense white pubescence, longer and more conspicuous on the basal segments, flagellar segments with long verticils, one of each segment being longer than the others, giving to the flagellum a secund appearance, these longest verticils attaining a length

that is nearly equal to half the length of the entire flagellum. Head reddish brown.

Mesonotal prescutum yellowish, with four long bright fulvous stripes; remainder of the mesonotum fulvous, the mid-line of the scutum and the scutellum more yellowish. The mesonotum is densely and minutely setigerous, the punctures black. Pleura brownish. Halteres light brown, the knobs a little darker. Legs with the coxæ and trochanters dull yellow; femora reddish brown, beyond mid-length with a narrow white ring which has a subequal blackish ring on either side, this white mark largest and most distinct on the posterior femora; tibiæ white, the apical quarter pale brownish, the extreme tip black; base of the tibiæ brown, a broad black band before mid-length; three basal tarsal segments yellowish white, black at the tips, palest on the metatarsi, the remaining tarsal segments brown. The legs are clothed with a long, fairly dense, semierect pubescence; metatarsus at the extreme base with a transverse group of three stout black spines. Wings rather broad, subhyaline, with a heavy dotted and banded pattern as follows:—a broad band at the cord and another at the origin of the sector extending across the wing to the margin, ending at the tip of *2nd A*; this pattern does not include the costal cell; the band at the cord is forked at its cephalic end, one branch encircling *Sc*₂, the other the tip of *Sc*₁ and *R*₁; these bands are pale brown, broadly margined with dark brown, to produce an ocellate appearance; similar ocellate markings at the outer end of cell *1st M*₂, the tip of *R*₂, and the fork of *M*₁₊₂; cell *C* yellowish, with about a dozen dark brown dots; remainder of the wing with numerous small pale brownish dots that are larger and more diffuse in the anal cells; veins brown, *C*, *Sc*, and *R* more yellowish. Venation: generally similar to *L. africana*, Alex. (Congo); basal deflection of *R*₄₊₅ shorter and more arcuated basally; cell *1st M*₂ more nearly rectangular, *M*₃ being almost in a line with *M* before the fork of the latter.

Abdominal tergites fulvous, the apical segments indistinctly ringed caudally with silvery grey; hypopygium brown; sternites similar, the lateral margins blackish, the posterior margin pale; eighth sternite black, conspicuously projecting. Male hypopygium with the ninth tergite transversely truncated with a deep U-shaped median notch; pleural appendages densely white pubescent, each at the apex produced into a slender, slightly curved, black point.

Hab. West Africa.

Holotype, ♂, Lolodorf, Cameroun, January 13, 1919 (J. A. Reis).

Tipula setosipennis, sp. n.

Palpi short, brownish black; antennæ of the male moderately elongated, yellow, the apical segments infuscated basally; mesonotum dull yellowish, the prescutum with three brownish-grey stripes that are margined with dark brown; wings grey, streaked longitudinally with brown and subhyaline; apical cells of the wings strongly setulose; male hypopygium yellowish, the sclerites fused into a nearly continuous ring; region of the ninth tergite produced caudad into a broad depressed median lobe.

Male.—Length 17 mm.; wing 15.3 mm.

Female.—Length 18 mm.; wing 15.5 mm.

Frontal prolongation of the head short, light brownish yellow above, dark brown on the sides, the dorsal surface with numerous long black hairs, which are most numerous toward the rather long nasus; mouth-parts and palpi dark brownish black, the latter short. Antennæ of the male elongate, extending about to the base of the abdomen, the basal segments of the flagellum elongate, the terminal segments shortened; antennæ yellow, the terminal segments more infuscated, especially on the slight basal enlargement. Head dark grey, more yellowish on the front and along the inner margin of the eyes; middle of the vertex blackish. Frontal tubercle distinct, bifid by a deep longitudinal impression.

Mesonotal prescutum light brownish yellow, with three brownish-grey stripes that are distinctly margined with black, the median stripe split by a similar black median vitta; scutum with the median area dull yellow, the lobes brownish grey margined with black; scutellum light yellow; postnotum yellowish grey. Pleura dull yellowish; a conspicuous brown blotch on the mesosternum and mesepisternum. Halteres dark brown, the knobs blackish. Legs with the coxæ and trochanters yellowish; femora and tibiæ dull yellow, the tips narrowly dark brownish black; tarsi dark brown, the bases of the metatarsi more yellowish. Wings broad, greyish, longitudinally streaked with subhyaline and brownish; costal area more yellowish; the subhyaline areas include a broad obliterative streak before the cord in the ends of cells *R* and *M*, running through cell 1st *M*₂ to the wing-apex in cell *R*₅; the pale areas include all of cell *R*₅ except the extreme base, the extreme bases of cells *M*₁ and *M*₂, and virtually all of cell 1st *M*₂; the first anal and cubital cells are

largely pale; stigma dark brown; a broad brownish seam along vein *Cu* and narrower ones along the cord; veins dark brown, those of the costal region more yellowish; strong setæ in the apical cells of the wing from *R*₂ to *Cu*₁. Venation: petiole of cell *M*₁ short; *m-cu* long.

Abdomen rather long for the male sex of this genus of flies (about 12 mm.). Basal abdominal segments dull yellowish, segments 3 to 8 more brownish; tergites with a narrow, more or less distinct, dark brown sublateral stripe; lateral margins of the segments pale. Hypopygium yellowish, the sclerites fused into a ring. Region of the ninth tergite produced caudad into a broad depressed median lobe whose posterior margin is gently concave or feebly notched, with numerous minute blackened spicules. Outer pleural appendage narrowed basally, broadened distally, the outer face densely covered with a long pale pubescence and a few long black setæ. Inner pleural appendage with a posterior fleshy pale lobe whose proximal face is provided with long pale setæ, the anterior blade compressed. Region of the ninth sternite profoundly incised beneath on the mid-ventral line. Eighth sternite unarmed, the dorsal margin with a row of about eight black spinous setæ. Ovipositor with the tergal valves acicular, the sternal valves shorter, compressed.

Hab. South Africa.

Holotype, ♂, Pretoria, Transvaal, December 5, 1918 (A. J. T. Janse).

Allotopotype, ♀, January 4, 1919.

Paratopotype, ♂, February 2, 1919.

V.—A new Crab of the Genus *Sesarma* from Basra.

By W. T. CALMAN, D.Sc.

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SPECIMENS of the crab described below have recently been presented to the Museum by Capt. C. L. Boulenger, who obtained them while on service in Mesopotamia. Other specimens from the same locality, and clearly of the same species, have been in the Museum for many years under the name "*Sesarma dehaani*, Milne-Edwards," given to them by Mr. E. J. Miers. A comparison with Japanese and Chinese specimens of *S. dehaani**, however, reveals certain definite, if not very striking, differences, and the Basra specimens are therefore recorded under a new specific name.

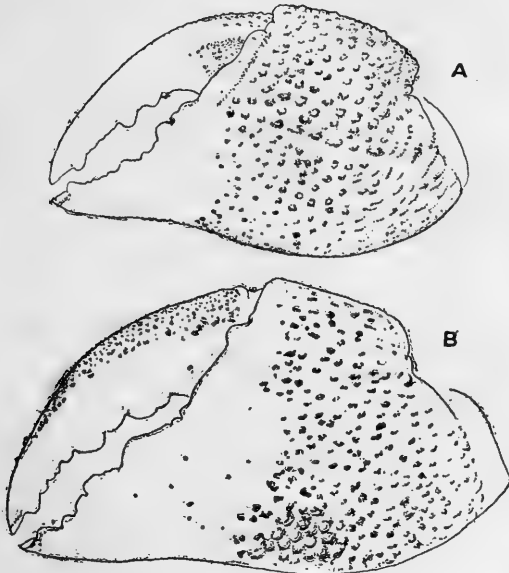
* This species has recently attracted attention as one of the intermediate hosts of the lung-trematode, *Paragonimus westermanni*.

Sesarma (Holometopus) boulengeri, sp. n.

Description.—Closely resembling *S. dehaani*, M.-E., from which it differs in the following characters:—

The carapace, as a rule, is slightly wider in specimens of similar size. The inter-regional grooves on the posterior part of the carapace are rather less deep. The sides of the front are distinctly concave.

The merus of the chelipeds has the anterior margin rather more expanded distally and more coarsely dentate; the distal



A. *Sesarma boulengeri*, male, holotype; Basra. Outer surface of left chela.

B. *Sesarma dehaani*, Milne-Edwards, male; Hong Kong. Outer surface of left chela.

tooth on the upper edge is blunt and indistinct. The inner angle of the carpus—which in *S. dehaani* is rounded or bluntly angled, with sometimes an apical granule—is produced as a small but distinct and acute tooth*. The palm is more inflated, especially in the male; on its outer surface is an obscure row of granules about the middle; above this the granules are larger, becoming less prominent towards the upper margin; below the middle the granules are smaller

* A specimen collected by Major C. Christy, and received since this was written, has the carpal angle of one of the chelipeds blunt; in the other cheliped the angle forms an acute tooth as described above.

and more closely set, but there is no definite group of enlarged granules as in the male of *S. dehaani*. The convex lower margin of the palm becomes gently concave in passing into the lower margin of the immovable finger. The granules forming a row on the inner surface of the palm are large. The upper edge of the immovable finger is distinctly concave and the fingers gape when closed. The dactylus has on its upper surface a row—or, rather, a narrow central band—of tubercles which show a tendency to break up into obliquely transverse groups. In *S. dehaani* the lower margin of the palm passes in a straight line, or with only a very slight concavity, into the lower margin of the immovable finger, and the upper edge of the latter is straight or slightly convex; the fingers meet when closed, and the immovable finger in both sexes is much more broadly triangular than in the new species. The walking-legs are conspicuously less hairy than in *S. dehaani*, the longer hairs being less numerous and always shorter than the width of the segments. The meropodites are, as a rule, less broad than in *S. dehaani*.

The penultimate segment of the abdomen of the male is distinctly more than twice as broad at its anterior or proximal margin as it is long.

Localities. Ashar Creek, Basra; 2 ♂ (including holotype), 2 ♀, collected by Capt. C. L. Boulenger.

Basra; 1 ♂, 1 ♀, collected by L. E. Adams, B.M. Reg. 83. 23 (determined by E. J. Miers as *S. dehaani*).

Measurements of S. boulengeri and S. dehaani.

		Length of carapace in mm.	Ratio of exorbital width to length of carapace = 1.	Ratio of length of meropodite of penultimate leg to width = 1.
<i>S. boulengeri</i> :				
83. 23	♂.	23.0	1.108	1.85
	♀.	21.75	1.183	1.72
Boulenger	♂, holotype.	23.0	1.119	1.91
	♂.	17.75	1.154	1.71
	♀.	22.5	1.133	1.7
	♀.	19.5	1.192	1.69
<i>S. dehaani</i> :				
54. 10, North China.	♀.	21.5	1.104	1.89
	♂.	21.5	1.081	2.15
	♂.	23.0	1.108	2.21
61. 44, Hong Kong.	♂.	10.5	1.238	2.04
	♂.	22.5	1.088	2.11
753, Japan	♂.	27.75	1.045	2.32

Remarks.—The presence of a distinct tooth at the inner angle of the carpus of the chelipeds brings this species,

according to Tesch's key (Zool. Meded. Leiden, iii. 1917, p. 235), into the neighbourhood of *S. eydouxi*, M.-E., and *S. granosimana*, Miers. In the former species, as redescribed by Tesch (*l. c.* p. 150), the upper margin of the palm of the chelipeds is provided with a "distinct, horny-coloured, granulate crest," and the outer surface is very minutely granulated and has a short oblique ridge about the middle. In *S. granosimana*, of which I have examined the two syntypes, the outer surface of the palm is rather coarsely and evenly granulate, its upper margin has a low denticulate crest, the upper margin of the immovable finger is (except for a notch near the base) nearly straight, and the walking-legs have no brushes of short fur on the anterior surface of the carpus and propodus of the first three pairs as they have in *S. dehaani* and *S. bouleengeri*.

The specimens of *S. bouleengeri* presented to the Museum thirty-six years ago were accompanied by a note on the habits of the species by the collector, Mr. Lionel E. Adams, as follows:—"Collected at Basra, 60 miles up the Euphrates, in perfectly fresh water; burrows in the banks of the river and especially in a canal in connexion with the river, where it climbs the fibrous roots of trees laid bare to the extent of 6 or 7 feet at low tide (there being 4 or 5 feet of tide at Basra) by the aid of the large claws. Sometimes they ascend the trunks to the height of 10 feet."

VI.—*The Cirripede Genus Stramentum (Loricula): its History and Structure.* By THOMAS H. WITHERS, F.G.S.

[Plates III. & IV.]

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Introduction.

ALTHOUGH the cirripede generally known as *Loricula* is represented by more specimens approaching completeness than is any other Cretaceous cirripede, still our knowledge of its structure has not greatly advanced since 1851, when Darwin redescribed *Loricula pulchella*, G. B. Sowerby, the first-discovered member of the genus. Particularly does this apply to the number, structure, and homologies of the capitular valves and to the peduncle when complete, on which points there have since been wide differences of opinion.

In 1913 the Geological Department of the British Museum acquired from Mr. H. T. Martin two cirripedes on a piece of chalk, which he had collected in the Niobrara series of Kansas, and which are referable to *Stramentum haworthi*, Logan, sp., a species undoubtedly congeneric with *Loricula pulchella*, G. B. Sowerby. The specimens looked unpromising enough when received, but careful development soon showed certain points of structure which enable us to add materially to our knowledge of this anomalous type. The same structural features had shortly before been discovered in the type-specimens of *Loricula darwini*, and it is on the combined material that the following study of the genus is based.

History.

Of this genus as many as nine species and two varieties have so far been described, and in most cases the species is known by more than one specimen.

The first-discovered species, *Loricula pulchella*, G. B. Sowerby (1843), was founded on a single nearly complete specimen from the Turonian (Middle Chalk) of Cuxton, Kent. It was obtained by the late Mr. N. T. Wetherell, whose collection is now in the Geological Department of the British Museum, and the specimen is registered 59,150. Darwin (1851) gave a masterly description of this specimen in his Monograph.

A few years later the species *L. macadami* was established by Wyville Thomson (1858) for a fine specimen from the Chalk of Antrim, and some obscure fragments of others of a group are said to be scattered through the matrix. This specimen supplements in many ways that of *L. pulchella*, and, although it added much to our knowledge of the structure of the shell, it has not been referred to by any later author*.

In 1878 W. Dames described a single specimen from the Cenomanian (Lower Chalk) of Lebanon, Syria, under the name *L. syriaca*, and the specimen was subsequently figured by Prof. Zittel (1884).

K. A. von Zittel (1884), for a single specimen from the Senonian (Upper Chalk) of Dülmen, Westphalia, founded the species *L. lavissima*. A plaster-cast of this is in the Geological Department of the British Museum, registered 59,713.

* R. Tate quotes the species among a list of fossils, Quart. Journ. Geol. Soc. London, vol. xxi. 1865, p. 30.

Anton Fritsch (1889) described and figured a series of twelve specimens, which he described as varieties of *L. pulchella*, namely *L. pulchella*, var. *gigas*, and *L. pulchella*, var. *minor*. One of them, *L. pulchella*, var. *gigas*, had already been described by Fritsch (1877) as a separate species. The specimens occurred in the Turonian (Middle Chalk) of Weissenberg, Bohemia, and were found attached to examples of the ammonites, *Ammonites peramplus* and *A. wolgari*, no less than seven individuals being attached to a single shell of the latter species.

In the same year (1889) J. F. Whiteaves described a new species under the name *L. canadensis*. It was founded on a very fine specimen collected by Mr. J. B. Tyrrell in the Cretaceous (Fort Benton group), at South Duck River, in Township 34, Range 23 W., Manitoba. Other specimens occurred, for the author stated that "A few isolated capitular plates of *L. canadensis* were also collected by Mr. Tyrrell in 1887, at the Vermilion River, in Township 24, Range 20 W., from Fort Benton Group, or lower part of the series."

S. W. Williston (1897) followed by describing a remarkably complete specimen from the Cretaceous (Niobrara group) of Kansas, under the name *Pollicipes haworthi*. That specimen was subsequently described by W. N. Logan (1897), and together with a second species, *Stramentum tabulatum*, was included in a new genus *Stramentum*.

In 1908 Dr. H. Woodward established the species *L. darwini* on three specimens obtained by Mr. G. E. Dibley in the Turonian (Middle Chalk) *Rhynchonella cuvieri*-zone of Cuxton, near Rochester, Kent, the same locality from which came the holotype of *L. pulchella*. These three specimens were attached to the cast of an ammonite, *Pachydiscus peramplus*, and are now in the Geological Department of the British Museum, registered I. 9130.

A further species, *L. expansa*, Withers (1911), has been described, and the species was founded on two left and three right scutal valves from the Upper Senonian, *Actinocamax quadratus*-zone, East Harnham, near Salisbury, Wilts. Apart from these isolated valves it can be proved that *Loricula* occurs in the Senonian of England, for there is in the Geological Department of the British Museum an example of an oyster that had grown on a *Loricula*, and has thus preserved on its surface a perfect imprint of the greater part of a peduncle. This specimen came from the Senonian (Upper Chalk) of Norwich (Bayfield Coll.), and is registered 42,012.

Material (number of specimens).

In addition to the specimens mentioned above, there is in the Geological Department of the British Museum, registered 59,825, a fragmentary example of *L. pulchella*, which came from the Middle Chalk of Cowslip Pit, near Guildford, Surrey. It consists of about ten rows of the three median series of peduncular plates. At least two, if not three, further fragmentary specimens of *L. pulchella* are in the Brighton Museum (Willett Collection, No. 40), on a piece of chalk from the Middle Chalk of Malling, Kent.

Of *Stramentum haworthi* from the Niobrara Chalk of Kansas, there is in the Geological Department of the British Museum, collected by Mr. H. T. Martin, (1) two comparatively large and almost complete specimens on a small yellowish slab, registered I. 15,945; (2) a large yellowish slab with about nine small individuals (registered In. 18,990), and a larger pinkish slab with remains of at least twenty individuals (registered In. 18,989): in both cases the shells appear to have been attached to some strap-like organism of which only a stain remains, and almost all the specimens consist of one side of the shell with the inner surface uppermost, three or four retaining the scutum, which shows the pit for the adductor muscle.

Altogether the material known to me comprises no less than seventy individuals, and of these quite fifty represent at least one side of the shell in a fairly good state of preservation.

Name.

The name *Loricula* was first given to a cirripede by G. B. Sowerby, junr. (1843). This generic name has been widely accepted, and has been used by Darwin (1851) and every subsequent author on fossil and recent cirripedes. It is the more unfortunate that it should be preoccupied by *Loricula*, Curtis (1833), a genus established for a Hemipterid.

In 1897, W. N. Logan founded the genus *Stramentum* on two species of cirripedes occurring in the Chalk of Kansas. One of these had previously been described by Prof. Williston (1896) under the name *Pollicipes haworthi*, and it is not only because of this, but because it is the first of the two species described by Logan, and is more complete than the second species *S. tabulatum*, that *S. haworthi* is here taken as genotype of the genus *Stramentum*.

There is no room for doubt that the Kansas species, *Stramentum haworthi*, is congeneric with Sowerby's *Loricula pulchella*, and although Logan was evidently unaware that

cirripedes similar to his *Stramentum* had been described from the Cretaceous rocks of other countries, there is no option but to accept his genus *Stramentum*, since the name *Loricula* is preoccupied.

STRAMENTIDÆ, nom. nov.

This is a new name to replace that of *Loriculidæ*, which embraced the genera *Loricula* and *Archæolepas* (see Pilsbry, 1916, p. 14). *Archæolepas* must be removed from here (see p. 79), and for the present might more properly be included in the *Scalpellidæ*. Until the precise structure of the genera *Loriculina* and *Squama* is known, it is impossible to say whether they should be included in the family *Stramentidæ* or not, although it is more convenient to keep them there at present.

Stramentum, W. N. Logan.

1833. Non *Loricula*, Curtis, Entom. Mag. i. p. 197 (Hemipterid).

1843. *Loricula*, G. B. Sowerby, Ann. & Mag. Nat. Hist. vol. xii. p. 260.

1897. *Stramentum*, W. N. Logan, Kansas Univ. Quart. ser. A, Oct. 1897, vol. vi. No. iv. p. 188.

1898. *Stramentum*, W. N. Logan, Univ. Geol. Surv. Kansas, vol. iv., Palæont. pt. viii., Arthr. p. 498.

Diagnosis.—Shell flattened laterally. Capitulum composed of ten valves comprising paired scuta, paired upper latera, paired terga, paired carinal-latera, and a pair of linear valves homologous with the carina in other cirripedes. Peduncle with ten rows of smooth calcareous plates, five on each side, the six inner rows much elongated transversely, and the outer rows short; on their outer edges the plates of the outermost rows meet, but do not alternate with each other.

Genotype.—*S. haworthi*, Williston, sp.

Distribution.—Senonian (Upper Chalk): East Harnham, near Salisbury, Wilts, and Norwich, Norfolk; Dülmen, Westphalia; Kansas, U.S.A. Turonian (Middle Chalk): Cuxton, near Rochester, and Malling, Kent; near Guildford, Surrey; Black Head Bay, co. Antrim, Ireland; Weissenberg, Bohemia; Duck and Riding Mountain District, Manitoba, Canada. Cenomanian (Lower Chalk): Lebanon, Syria.

The following are the described species and varieties:—

Stramentum canadensis, Whiteaves, sp.

— *darwini*, H. Woodward, sp.

- Stramentum expansum*, Withers, sp.
 — *haworthi*, Williston, sp.
 — *lavissimum*, Zittel, sp.
 — *macadami*, Wyville Thomson, sp.
 — *pulchellum*, G. B. Sowerby, jun., sp.
 — —, G. B. Sowerby, sp., var. *gigas*, Fritsch.
 — —, G. B. Sowerby, sp., var. *minor*, Fritsch.
 — *syriacum*, Dames, sp.
 — *tabulatum*, W. N. Logan.

Without an examination of the specimens, it is impossible to deduce from the published descriptions and their inadequate figures whether all of the above are distinct species and varieties. It has, however, been possible to examine the type-material of *S. pulchellum* and *S. darwini*, with the result that no justification appears for considering *S. darwini* to be distinct from *S. pulchellum*. The distinctions given by Dr. H. Woodward are "much greater size and more remarkable capitulum" and "the form of the scutum and the latera." Apart from the fact that all the specimens came from the same horizon and chalk-pit*, what differences are seen in the scutum appear due to the age and degree of development of the valve (see p. 73), and even the two specimens of *L. darwini* differ in this particular. No distinct differences are apparent to me in the latera, and if by "more remarkable capitulum" Dr. Woodward means in the greater obliquity of the summit of the peduncle, it must be pointed out that this is accentuated in that particular specimen merely because the scutum and upper latera have been slightly displaced and pushed down on to the upper scales of the peduncle (see Pl. III. fig. 2). *S. darwini* is therefore regarded here as a synonym of *S. pulchellum*.

With regard to the holotype of *S. macadami*, Prof. Grenville Cole very kindly took considerable trouble to find out for me its whereabouts, and recently informed me that it is preserved in the Belfast Public Art Gallery and Museum. The Curator, Mr. Deane, most kindly lent me the specimen, and an examination of it shows no characters by which it can be separated from *S. pulchellum*. Prof. Thomson stated in his description "One specific distinction is very evident,—the fusion of plates corresponding to the scutum and the scutal latus in the upper rows of the peduncle." I cannot understand this statement for the reason that none of the peduncular plates are fused, but, on the contrary, have precisely the same structure as in the several specimens of

* See G. E. Dibley, 1918, Proc. Geol. Assoc. vol. xxix. pp. 70, 87.

S. pulchellum. A MS. label is on the specimen bearing the words "*Loricula pulchella*," and I can see no characters in the specimen to make one dissent from that determination. *S. macadami* is therefore considered here to be a synonym of *S. pulchellum*.

Measurements.—The largest species appears to be *S. pulchellum*. The holotype has a length of 26.6 mm., its breadth is 15.2 mm., and the length of the scutum is 8.6 mm. This is surpassed by the two specimens (Pl. III. figs. 1, 2) originally described as *S. darwini*, for the original of fig. 1 has a length of 35.2 mm. (incomplete), a breadth of 22 mm., and a scutum 11.4 mm. in length, while the original of fig. 2 has a length of 44 mm., a breadth of 22.4 mm., and a scutum of 13.2 mm. in length and 7.6 mm. in breadth. In the latter specimen the carina is 6.8 mm. long and 2.3 mm. wide. The original of *S. macadami* has a length of 24.6 mm. and a breadth of 12.3 mm.

Of the other species the type of *S. haworthi* is said to have a length of 27 mm. and a breadth of 17 mm., and the type of *S. tabulatum* appears to be somewhat smaller; *S. canadensis* is from 14–15 mm. long and 7 mm. wide; *S. pulchellum* var. *minor* is said to attain a length of 20 mm. and *S. pulchellum*, var. *gigas*, a length of 36 mm.; *S. levissima* has a length of 20 mm.; and *S. syriacum* is said to be one-third the length of *S. levissima*.

Terminology and Number of Valves in the Capitulum.

Darwin had only a single specimen of the genus before him, namely, the holotype of *S. pulchellum*, and while this was nearly complete so far as the peduncle was concerned, it had only three of the capitular valves (see Pl. III. fig. 3). That on the right, owing to its shape and to the direction of its growth-lines, was considered by him to be the scutum and the adjoining plate as the first or upper latus. The remaining valve was called the second or carinal latus, but between that and the upper latus was a hiatus, believed by Darwin to have been filled by a tergum. Besides these valves he included in his restoration a carina and a rostrum, making ten valves in all, for he assumed that the other valves were paired.

The specimen of *S. macadami* figured and described by Wyville Thomson seven years later was more complete in the capitular region, and it included a valve—the tergum—not present in the holotype of *S. pulchellum*, between the upper and carinal latera, as well as two opposing linear

valves adjoining the carinal latus. Adopting Darwin's idea as to the identity of the other valves, Thomson suggested that these linear valves must represent two elements of a carina. An alternative suggestion was that if the capitulum was reversed the linear valve would be a reduced scutum, the second latus a rostral latus, the first latus an upper latus, and the scutum a carinal latus. This latter view was suggested as possible, but further reasons were given for his inclination to follow Darwin's ideas as to the identity of the valves.

Wyville Thomson's views have had no bearing on later discussions, for his paper has been entirely overlooked, and consequently his discovery of the split carina has passed unnoticed. It was only through a book-seller's catalogue that I came across the paper myself, and I then found that the discovery of the split carina in the genus, as now found in the species *S. pulchellum* and *S. haworthi*, was not a new one.

Except that later authors have differed as to the number of valves in the capitulum and as to the precise names of the first or upper latus and the second or carinal latus, Darwin's purely tentative nomenclature has been generally accepted without question. So far has this been the case that no one has attempted to prove the identity of either of the valves. Any doubts, however, are set at rest by the new example of *S. haworthi* (Pl. IV. fig. 2), for in that specimen the valve called the scutum has its inner surface exposed, showing the pit for the adductor muscle, thus proving that this really is the scutum.

Accepting this, it follows that the other valves would represent the upper latus, tergum, and carinal latus, and that the two linear valves would equal the carina of other cirripedes. Consequently the known valves would number ten in all. This is the same number as given by Darwin in his restoration, although the number is made up of different elements, for, apart from the carina being split, he included a rostrum. In none of the known specimens has a rostrum been noticed, and in view of the structure of the carina the improbability of a rostrum in the ordinary sense being present is great. There does not appear to be any differentiation in structure of the uppermost subscutal plates of the peduncle, and since they cannot be regarded as part of the capitular region, a rostrum or valves homologous with it cannot be said to form part of the capitulum of *Stramentum*.

Description of Shell.

Capitulum.—This is small when compared with the size and breadth of the peduncle, its length being about one-fourth that of the shell; evidently the greater part of the animal's body was lodged in the peduncle as in *Lithotrya* and *Ibla*.

Scutum subtriangular in outline, with the tergo-lateral and basal margins nearly straight and almost at right angles to each other; the growth-lines in the lower part of the valve follow the outline of the tergo-lateral and basal margins. The umbo is situated at a variable distance from the apex, and in the more advanced of the Turonian forms is about one-third the distance from the apex; in the Senonian species, *S. haworthi*, the umbo is situated at least one-half the distance from the apex even in quite young valves, and the more advanced forms have the upper half of the valve more developed. From the umbo to the apex runs a depression from which the upper part of the ocludent margin rises up. In the figured specimen of *S. haworthi* and in others on the two slabs there is, on the inner surface, a deep pit for the adductor muscle.

Upper latus almost flat, having the outline of an isosceles triangle, with the scutal margin, which abuts against the tergo-lateral margin of the scutum for its whole length, rather more obliquely inclined and slightly longer than the tergal margin. The valve evidently overlapped the tergum and scutum very slightly by its edges, and the growth-lines are straight and parallel. Darwin said of this valve "The first latus now answers to the upper latus in *Scalpellum*, but it is interposed to quite an unprecedented extent between the scutum and tergum." It is, however, not more so than in the recent *Pollicipes mitella*, or in the later-discovered Cretaceous cirripede *Zeugmatolepas mockleri*, which perhaps is more comparable, since the upper part of the upper latus in *P. mitella* really overlaps the scutum and tergum for the greater part of its extent.

Tergum subtriangular, somewhat convex, with the carino-lateral and the upper ocludent margins slightly rounded, and the basal margin rather more so. The growth-lines are convex, and on the upper ocludent margin curve sharply upwards towards the apex.

Carinal latus obliquely triangular, rather like the upper latus, except that the tergal margin is more obliquely inclined and the basal margin more rounded, the valve being slightly inclined towards the tergum.

Carina.—This valve is of the same length as the carinalatus and the apices of these two valves, together with that of the tergum, form the upper extremity of the capitulum. The valve is narrow, almost linear, nearly flat, about the width of the carinal plates of the peduncle, and there is a corresponding valve on the opposing side of the capitulum. Wyville Thomson has written in his description of *S. macadami*—" . . . this valve must be either one of the valves of a split carina—one of the parietes of a carina in which the tectum is undeveloped; or we must suppose the carina to have been composed of two parietes and a separate tectum, and the tectum to have been lost." In my opinion it is one of the halves of a split carina in which parietes or intraparietes had not been developed, and the valve is of the same type of structure in *S. pulchellum* and *S. haworthi*. A ridge is invariably formed along the median line in the carinal valves of ordinary pedunculate cirripedes, and a modification such as the splitting along this line would not be unexpected. Such a secondary modification is seen in the splitting of the dorsal plate in certain species of the recent Molluscan genus *Pholas*. While such a modification of the carina is quite unique among fossil and recent cirripedes, a somewhat similar modification in the scutum is seen in certain species of the recent genus *Pæcilasma*. The scutum in that genus, as in the closely allied genus *Lepas*, has the umbo situated at the rostral angle, and the growth is entirely upwards. In *Lepas* a ridge is formed on the scutum extending from the umbo to the upper extremity of the valve, and running near and almost parallel to the occludent margin. Essentially in the same position as the ridge in *Lepas*, a suture is formed, which can be observed on both surfaces of the valve in one species of *Pæcilasma*. The development is carried a step further in other species of that genus, for in those the scutum is definitely split into two pieces.

Peduncle.—This is about three times the length of the capitulum, and in its upper part, just below the line of junction, it is rather wider than the capitulum. It is composed of ten rows of smooth calcareous scales, five on each side, forming a most beautiful loricated structure, sharply pointed at its lower extremity. There are as many as twenty-seven scales in a row in one of the specimens from Kansas, but the number naturally depends on the size and age of the individuals (see immature example depicted on Pl. IV. fig. 1 A). The summit of the peduncle is usually somewhat obliquely truncated, being lowest at the rostral end; this is

no doubt due, in some measure, to additional scales being first formed below the carinal and upper lateral valves (see under Growth, p. 77), but also to allow sufficient room for the animal's body.

Of the five rows of scales the three inner series are composed of nearly equal scales, much elongate transversely, and are about as wide as the carinal-latus, upper latus, and scutum, below which valves they are situated, so that the lines of junction of the peduncular scales correspond more or less with those of the capitular plates mentioned. The scales are closely imbricating, the middle series intersecting those on either side; and those two series are again in turn intersected by the outer subcarinal and subscutal scales, which are in line with the middle series; the much smaller outer scales simply meet those on the opposite side of the shell and do not overlap or intersect them in any way. Consequent on this arrangement of the peduncular scales, alternate whorls are formed, one being composed of the large median plates and the small outer subcarinal and subscutal scales, making in all six rows; and above and below whorls are formed of the two large lateral plates, making four rows. The structure and relationship to each other of the peduncle-scales, both of the inner and outer surface, is well shown in the specimens depicted in fig. 2 of Plates III. & IV.

The Shell when complete.—While Darwin erroneously thought that the shell in this genus had a keeled carina and rostrum, he was of the opinion that the lateral valves of the capitulum, as well as the plates of the peduncle, must have been present on both sides of the shell.

With regard to the lateral capitular valves, excepting the carina, decisive proof of their paired nature has been given by Whiteaves, for in the holotype of *S. canadensis* (1889, p. 190, pl. xxvi. figs. 4, 4a) the upper lateral series of valves has been either partially or completely broken away, showing underneath the inner surface of the scutum, upper latus, tergum, and carinal latus. In other specimens figured by Fritsch (1887) and H. Woodward (1908) slight displacement of the valves has shown the inner surface of an underlying scutum. It is therefore certain that the whole of the capitular valves were paired, for, in addition to the lateral valves, the valves homologous with the carina can be shown to be paired, not only in *S. pulchellum*, but in *S. haworthi*. The split carina is very clearly shown in the specimen described as *S. macadami*, for fortunately a slight displacement of the upper plate shows part of the inner surface of the opposing plate along its entire outer margin: it is a pity that

the specimen arrived too late for illustration in this paper, for it shows this character more readily than in the specimen originally figured as *S. darwini* or in *S. haworthi*.

As to the peduncular plates, the only evidence so far given of an opposing series is that the under row of subscutal plates are to be seen projecting from beneath the upper row in the figured example of *S. pulchellum* (Pl. III. fig. 2). One or two of the subcarinal plates can also be seen projecting from beneath the upper series in the same specimen. Dr. Woodward had the chalk removed from beneath that specimen, and did not find any evidence of an opposing series of the three median rows of peduncle-plates. He thereupon suggested that they were not developed on the under side of the peduncle, which was attached to the shell of the ammonite along the margins of the under row of subscutal and carinal plates.

When comparing *S. expansum* with *S. pulchellum* (Withers, 1911, p. 29), attention was incidentally drawn to the fact that certain of the specimens figured by Fritsch and of those described by Woodward, some had the scutum on the right hand and others on the left (see also Pls. III. & IV.). While it was probable from this that the whole of the peduncular plates were developed on both sides of the shell, it was not conclusive proof, since it might have been quite accidental which side of the shell was developed uppermost, in the same way that certain lobsters have the "crushing chela" developed on the right side and others on the left.

The case of the cirripede *Verruca* might also have been mentioned, for in that genus it seems to be quite a chance whether the movable scutum and tergum are developed on the right or left side of the shell.

A detailed examination of one of the specimens described as *S. darwini* (Pl. III. fig. 1 A), not figured by Dr. H. Woodward, was rewarded by the discovery that the plates of the peduncle were actually present on both sides. Some of the subcarinal and carino-lateral plates of the peduncle were broken away near the base of the capitulum, and although nothing but chalk appeared to be there, removal of the chalk revealed the presence of the inner surface of the opposing plates of the subcarinal and carino-lateral series. Further evidence is afforded by the example of *S. haworthi* (Pl. IV. fig. 2), for, although it represents one side of an almost entire shell showing its inner surface, there are in many places preserved *in situ* the peduncular plates of the other side of the shell, especially the series of the carino-lateral plates. Taken together these two specimens conclu-

sively prove that the shell of *Stramentum* was composed of ten vertical series of plates, five on each side of the shell. Since there were no keeled plates to the capitulum, and the subcarinal and subscutal plates of the peduncle did not intersect or overlap each other, the shell could be readily divided along the median line thus formed without destroying any one plate. This is exemplified by the fact that on the two slabs of chalk from Kansas on which about thirty individuals are preserved, no less than twenty-eight of them consist of one side of the shell more or less complete, and show the inner surface. The other side of these shells was probably on the counterpart of the slab, or had floated away after the death of the animal and decomposition of the soft parts. In individual cases one side of the shell might easily be torn away by some animal, as suggested by Darwin.

Growth.—New scales of the peduncle are apparently first formed round its summit towards its carinal end, for, as pointed out by Darwin, there is in the holotype of *S. pulchellum* one more scale under the second latus and one more under the first latus than under the scutum. In the figured specimen referred to *S. darwini* by Dr. Woodward, there appears to be two more scales in both the series than in that under the scutum. One very young example of *S. haworthi* is here figured (Pl. IV. fig. 1 A), measuring 4.2 mm. in length and consisting of twelve plates only to its nearly complete peduncle.

Attachment.—Darwin was of the opinion that in this genus the attachment was probably by one lateral face of the lower part of the peduncle, and was effected either by the overflow of the cementing material from the two central original orifices or by cement poured out of orifices situated on one side of the peduncle. He found no difficulty in the peduncle ending in so fine a point, for he stated that in *Scalpellum vulgare* the peduncle, when carefully dissected from the coralline to which it is attached, is often found to end in a much finer point and to be symmetrically attached to the branch by its narrow rostral margin.

Dr. H. Woodward (1908, pp. 498 *et seq.*), however, considered that the peduncle was attached along the whole extent of the subscutal and subcarinal scales, and that the mode of growth of *Stramentum* was always prone. He concluded, since Darwin mentioned that *S. pulchellum* was found "embedded outside the cast of an ammonite," that "he did not quite realize it was adhering to the shell and parasitic upon the ammonite, as *Coronula balanaris* attaches itself to the skin of the whale, and *Chelonibia testudinaria* and

C. caretta affix themselves to the surface of the turtle today."

Although many specimens have been found attached to ammonites, in no case am I aware that they are attached to the actual shell, the ammonite being represented by a chalk-cast. Whatever the mode of attachment, it cannot be said to be truly comparable to the mode of attachment of *Coronula* or *Chelonibia*. To my mind it is more probable that the shell of *Stramentum* was attached only by the extremity of its peduncle, and was pressed against the side of the ammonite during fossilization. While the Kansas examples of *Stramentum haworthi* on the two slabs in the Geological Department of the British Museum appear to have been attached to a strap-like organism, of which only a stain remains, the type was said by Logan to be attached to a shell of *Ostrea congesta* by the extremity of its peduncle. Dr. H. Woodward appears to have doubted this, but there is a photograph of the type exhibited with the above-mentioned slabs in the British Museum, and this conclusively shows that that specimen, at any rate, was so attached.

Comparison with other Genera and Phylogenetic Position.

The structure of *Stramentum* as now revealed by the new material certainly shows it to be more anomalous than was thought. So far as our knowledge goes, it differs from all other cirripedes, both recent and fossil, in that all the valves of the capitulum are paired, and that the outermost or subcarinal and subscutal rows of peduncular plates do not overlap or intersect each other. The shell could therefore readily be divided along the sutures formed along the carinal and scutal margins. It further differs from all recent cirripedes in the marked disparity in size of the lateral plates of the peduncle as compared with those of the subscutal and subcarinal series. There appears to be a similar disposition of the peduncular plates in the Cretaceous genera *Squama* (Senonian) and *Loriculina* (Senonian). How far these genera are related it is difficult to say, for we know so little of their precise structure. Further investigation may prove *Loriculina* to be congeneric with *Stramentum*, for the presence of a comparatively large rostrum in the figure of the genotype may not be substantiated. *Squama*, which is so far confined to the Kansas chalk and occurs at a slightly lower horizon than *Stramentum haworthi*, is known only from the inadequate figures and descriptions of Logan. When the precise structure of the genus is known it will

probably be found to be quite as interesting as *Stramentum*. In addition to the valves known in the capitulum of *Stramentum*, *Squama* is said to possess a rostrum, subrostrum, and subcarina, but whether these latter valves are keeled or whether they have the same structure as the carina in *Stramentum* is not known.

Stramentum is known in the Cenomanian only by one specimen from Syria, but is comparatively common in the Turonian of Europe. It lingers on to the Senonian in Europe, but is exceedingly rare, while in the Senonian Kansas Chalk of America it is common. We have, therefore, to look in the earlier Cretaceous and Upper Jurassic rocks for the ancestors of *Stramentum*. By some authors *Stramentum* is considered to be a derivative from the Jurassic genus *Archæolepas*, but it must not be overlooked that that genus is not entirely confined to the Jurassic, since one or two species range into the Lower Cretaceous.

Archæolepas has a capitulum of six plates only, consisting of paired scuta, paired terga, and a carina and rostrum of the type seen in the Scalpellidæ (*Scillalepas*), although the carina is much reduced in size. The earliest form, namely, the genotype *Archæolepas redtenbacheri*, is known to me only by figures, which would appear to be unreliable, since they differ in the number of vertical rows of peduncular plates. Zittel's figure is probably more correct and shows five rows, and the disposition of the plates resembles that of *Stramentum* more than any other form of cirripede. There is a close resemblance in the shell of *Archæolepas* (*A. redtenbacheri*) to that of *Stramentum*, and a further point in common is the reduced carina. The general structure of the shell of that early form of *Archæolepas* also points to the probability that, as in *Stramentum*, the greater part of the animal's body was lodged in the peduncle. In this connexion it is interesting that a much more definite peduncle is developed in the Portlandian species *Pollicipes royeri*, which is undoubtedly an *Archæolepas*; and in the Cretaceous (Neocomian) *Archæolepas decora*, the peduncle is well defined and almost twice as long as the capitulum. There appears, therefore, to be some relation in *Archæolepas* between the geological age of the form and the degree of differentiation of the peduncle from the capitulum.

It might well be that *Archæolepas* and *Stramentum* were originally derived from the same stock, but the two forms were certainly well differentiated in the Cretaceous. *Archæolepas* evidently developed into a form with a well-defined peduncle, and there is no doubt that it represents one of the

ancestors of the Scalpellidæ. *Stramentum*, on the other hand, constitutes a highly specialized and aberrant form. Instead of developing a definite peduncle, it specialized in the disposition and arrangement of its plates to form a completely armoured shell. When attached to its object, usually an ammonite, the cirri would not have nearly so much sweep and freedom of movement as in a pedunculate form. The subsequent splitting of the carina, and the non-intersection or overlap of the plates along the outer margins of the shell, was no doubt evolved to obtain that freedom of movement, and this specialization, while giving a temporary advantage, probably led to its extinction under changing conditions; and the fact that the two sides of the shell were so easily parted would render it especially vulnerable to its enemies.

Prof. Gruvel (1905), who has been followed by later authors, has a different conception of the phylogenetic position of *Stramentum* (= *Loricula*). He considers that the first remains of cirripedes are represented by the fossils *Turrilepas*, H. Woodward, and *Plumulites*, Barrande, and that those fossils constitute the complete imbricated covering of a primitive cirripede. The animal may be said to have been enclosed in a scaly cylinder, which afforded protection to the appendages and soft parts. He considered that later the upper row of plates were more specially developed to form the capitulum and that the remaining rows remained undifferentiated and served to form the peduncle. *Loricula* is supposed to represent this second stage, and Prof. Gruvel has given some very convincing figures, which have been reproduced in the text-books, as to the structural relationship of those two forms. He does not refer at all to *Archæolepas* or any other Jurassic cirripede.

Apart from the fact that *Turrilepas* may not be a cirripede, it is quite clear that Prof. Gruvel has misunderstood the structure of the example of *T. wrightianus* figured by Dr. H. Woodward, and on which he based his figure. Instead of *Turrilepas* having a laterally flattened shell with five rows of plates on either side as given in Gruvel's figure (see text-fig. 1 a, b), the shell is subtriangular in transverse section (see text-fig. 1 a') and there are four rows of plates only. In fact, the real structure of the two forms is so fundamentally different that it is difficult to imagine that there can be any relationship between them.

While it is difficult therefore to see how *Turrilepas* could give rise to a form like *Loricula* (text-fig. 2), there is little doubt that certain of the stalked cirripedes were evolved

from other cirripedes in which the capitulum and peduncle were not well defined. This is borne out not only by the postlarval development of certain recent pedunculate cirripedes, but by the forms of *Archæolepas*. Such a modification was no doubt independently developed in other lines of

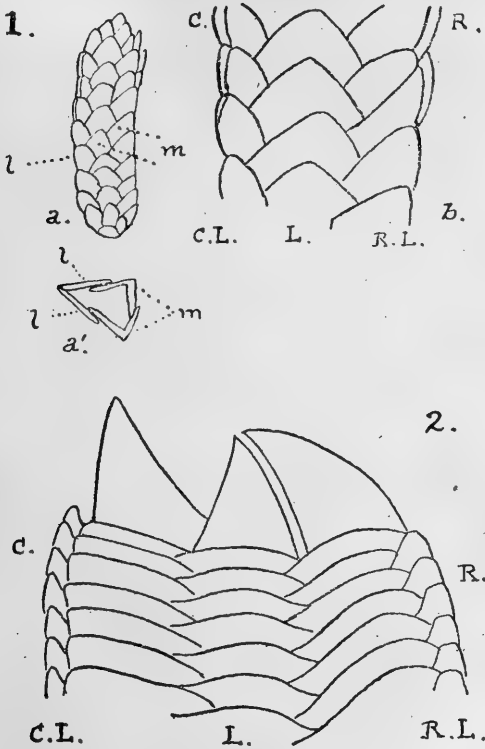


Fig. 1.—*Turrilepas wrightianus*, H. Woodward. *a*, shell viewed from back and left side. *a'*, transverse section of shell: *m*, median plates; *l*, lateral plates. *b*, portion of shell enlarged. (Figs. *a*, *b*, after Gruvel; *a'*, after Withers.)

Fig. 2.—*Stramentum pulchellum*, G. B. Sowerby, Jun., sp., showing mode of imbrication of peduncular scales. (After Gruvel.) C., carinal scales; C.L., carino-lateral scales; L., lateral scales; R.L., rostro-lateral scales; R., rostral scales.

descent. Having arrived at the pedunculated stage, several forms have independently reduced the peduncle and eventually assumed the sessile condition. This has been shown in the case of the Verrucidæ, and there can be no doubt that

the Balanidæ have reached the sessile condition by another route.

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EXPLANATION OF THE PLATES.

PLATE III.

Stramentum pulchellum, G. B. Sowerby, Jun., sp. Turonian (*Rhynchonella cuvieri*-zone): Cuxton, near Rochester, Kent.

Fig. 1. Remains of two individuals with the outer surface of the right side of the shell uppermost. A, represents an incomplete shell showing the greater part of a peduncle with the right scutum (*s*) of the capitulum in position, underneath which can just be seen the edge of the left scutum (*s'*). The remaining capitular plates of the right side, as well as many of the subcarinal and carino-lateral scales of the upper part of the peduncle have been broken away, thus leaving exposed the inner surface of the left tergum (*t'*), left carinal-latus (*cl'*), and about eight of the left carino-lateral scales (*cls'*). B, represents part of the right side of a peduncle, at the base of which can be seen the inner surface of several scales of the left side of the shell. Circa $\times 2$ diam.

Fig. 2. An almost complete shell showing the outer surface of the left side. All the capitular plates—*carina*, *carinal-latus*, *tergum*,

upper latus, and *scutum* are present, and the inner surface of the *right scutum* (*s*) and that of many of the subscutal scales of the peduncle can be seen projecting from beneath the opposing series. Circa $\times 2$ diam.

(Figs. 1 and 2 represent the three syntypes of *Loricula darwini*, H. Woodward, all three shells being much flattened transversely.)

- Fig. 3. A shell (the holotype of *L. pulchella*, G. B. Sowerby, Jun.) with the outer surface of the *left* side uppermost, and showing the *scutum* (*s*'), *upper latus* (*ul*'), and *carinal-latus* (*cl*'), the *carina* and *tergum* being absent from the capitulum. This shell has a much greater transverse convexity than those represented by figs. 1 and 2. Circa $\times 3$ diam.

PLATE IV.

Stramentum haworthi, S. W. Williston, sp. Senonian
(Niobrara series): Kansas, U.S.A.

- Fig. 1. Remains of two immature individuals. A, the *right* side of a shell with the inner surface uppermost, the *carina* only missing of the capitular valves, and the *scutum* (*s*) shows the adductor muscle-pit; the peduncle has only twelve scales. B, the lower part of a peduncle with its inner surface exposed. C, capitular valves probably belonging to B, and consisting of the linear *carina* (*c*), the *right carinal-latus* (*cl*), *left upper latus* showing inner surface, and paired *scuta* (*s*), the *left scutum* being broken and exposing the *right scutum* beneath. Circa $\times 6$ diam.
- Fig. 2. A fine example of a shell lying on its *right* side, and owing to the displacement of the capitular valves both the *left* and *right* valves can be seen, the *right scutum* (*s*) showing the adductor muscle-pit; the peduncle in the main shows the inner surface of the three median series of scales of the *right* side of the shell, except that the whole of the *left carino-lateral* scales (*cls*') are present. Circa $\times 4.5$ diam.
- Fig. 3. A shell with the *right* side uppermost and showing the whole of the capitular valves, the *carina* (*c*) being somewhat incomplete. Circa $\times 4.5$ diam.

VII.—On Indo-Chinese Hymenoptera collected by R. Vitalis de Salvaza.—IV. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Superfamily TENTHREDINOIDEA.

Family Tenthredinidæ.

Subfamily CIMBICINÆ.

Clavellaria (*Euclavellaria*) *marginata*, sp. n.

♀. Fusco-nigra; capite thoraceque obscure nigro-chalceis; propodeo nigro-æneo, apice anguste ochraceo-fasciato; tergitis nigris, opacis, apice anguste ochraceo-fasciatis, sternito apicali

ochraceo; clypeo labroque luteis; genis, mandibulis, apice excepto, antennis articulis quatuor basalibus, scutello, tibiis tarsisque fusco-ferrugineis; pronoto margine postico tegulisque ochraceis; alis subhyalinis, anticis basi et dimidio costali fortiter infuscatis, venis fuscis.

Long. 15 mm.

♀. Clypeus broad and transverse at the apex, not emarginate; labrum large, very broadly rounded at the apex. Antennæ longer than the thorax, the third joint about three times as long as the fourth; fifth as long as the fourth, gradually thickened from the base, and very distinctly separated from the club; sixth joint nearly as broad at the apex as long, not fused into the club; the joints beyond the sixth fused together, about twice as long as broad. Front and vertex closely and finely punctured-rugose; clypeus finely punctured and sparsely clothed with short black hairs; vertical area longer than broad, the lateral grooves only distinct posteriorly. Thorax finely and closely punctured-rugulose; scutellum moderately convex, with a distinct but shallow median groove. Propodeum sparsely punctured, with a strongly raised longitudinal carina which is almost tuberculate at the base. Abdominal tergites opaque, very finely and closely punctured. Third transverse cubital nervure straight, the second oblique.

Hab. Chapa, Tonkin, May 25, 1916.

This seems nearer to the East Siberian species *C. gracilentata*, Mocs., and to the Formosan *C. formosana*, Ensl., than to the two species already described from Tonkin, but is very differently coloured. The club of the antennæ is much more slender than in the European *C. amerinae*, corresponding in this character with the other Oriental species.

Abia vitalisi, sp. n.

♀. Purpurea; mandibulis, palpis, antennis tarsisque nigris; valvulis flavis; alis flavis, anticis cellula cubitali apicali infuscata; venis testaceis, apice fuscis.

Long. 14 mm.

♀. Robust, the whole insect with short black hairs. Front and clypeus closely and finely punctured, vertex much more sparsely punctured, cheeks smooth and shining. Clypeus very feebly emarginate at the apex, almost transverse. Eyes strongly divergent towards the clypeus. Antennæ seven-jointed, third joint slender, a little thickened towards the apex, twice as long as the fourth; fourth and fifth joints subequal

in length, broadened from the base, the fifth about half as broad again at the apex as the fourth, the sixth joint shorter by one-third and half as broad again at the apex as the fifth, seventh joint very stout, nearly as long as the sixth. Vertex with a deep, broad, longitudinal depression reaching to the ocellar region; eyes separated on the vertex by a distance equal to about two-thirds of the length of the third joint of the flagellum. Mesonotum closely and finely punctured; mesopleuræ convex, rather more sparsely punctured; scutellum obliquely sloped anteriorly, closely punctured. Abdomen robust, very closely punctured, the three basal segments with a shallow longitudinal impressed line in the middle; all the segments strongly depressed at the base. Tarsal ungues shallowly bifid at the apex.

Hab. Xieng Khouang, March 18. Described from three females.

The fuscous cloud at the apex of the fore wing is very variable in extent, and in one specimen is wholly absent. The species bears a strong superficial resemblance to the Chinese species *Athermantus imperialis*, Sm., which belongs to the Arginæ.

Subfamily ARGINÆ.

Pampsilota euterpe, sp. n.

♀. Nigro-purpurea; antennis nigris; abdomine ochraceo, propodeo tergitisque secundo tertioque transverse nigro maculatis; sternito apicali extremo apice nigro; alis fusco-violaceis, apice dilutioribus; venis nigris.

Long. 12 mm.

♀. Clypeus shallowly emarginate at the apex, minutely punctured and sparsely clothed with black hairs; frontal sulcus deep and broad, with strong lateral carinæ. Antennæ a little longer than the thorax, clothed with very short black hairs, the third joint thickened to the apex, below with two longitudinal carinæ, above rounded and without distinct carinæ. Vertical area very short and broad, not distinctly defined laterally. Head and thorax shining, almost smooth, the punctures microscopic; the dorsal surface of the thorax clothed with extremely short black hairs; the thorax much broader than the very small head. Abdomen broad, smooth, the vagina short and stout. Wings ample; the third abscissa of the radius about equal to the first and second combined; third transverse cubital nervure rather feebly

curved outwards above the middle; second recurrent nervure interstitial with the second transverse cubital nervure.

Hab. Chapra, Tonkin, May 7-21, 1916.

Differs from the other Oriental species of the genus in the colour of thorax. The black marks on the basal tergites are not constant.

Subfamily *TENTHEDININÆ*.

Tribe *SELANDRIADES*.

Selandria cæruleiceps, Cam.

Selandria cæruleiceps, Cam. Mem. Manchester Lit. & Phil. Soc. xliii. p. 45 (1899). ♀.

Four males from Hanoi, taken in April, differ from the description of the females in having the legs entirely whitish, the base of the coxæ only black, and the tarsi infuscate at the apex. It is possible that these represent a distinct species, but as the difference may only be sexual, I do not think it would be justifiable to treat them as distinct. The costa is thickened before the stigma, so I follow Cameron in placing the species in *Selandria*, and not transferring it to *Stromboceros*, as is done by Konow.

Taxonus varicolor, sp. n.

♀. Nigra; antennis articulis 5 apicalibus, quinto basi infuscato, labro, pronoto, scutello, postscutello maculis tribus parvis, maculaque parva sub alis albis; propodeo, segmentis abdominalibus duobus basalibus pedibusque rufo-testaceis; tibiis posticis apice extremo, metatarsisque posticis, apice excepto, nigris; tarsis posticis, basi nigris, luteis; alis hyalinis, venis nigris, stigmate basi luteo-maculato; alis posticis cellulis medianis clausis nullis. Long. 9 mm.

♀. Clypeus broadly truncate at the apex; head closely and strongly punctured, not narrowed behind the eyes; vertical area broader than long posteriorly, narrowed anteriorly, a smooth shining space on each side of the area. Antennæ shorter than the abdomen, slender, third joint scarcely longer than the fourth, more than half as long again as the fifth, which is as long as the three apical joints combined. Mesothorax rather closely punctured; scutellum flattened, shining, and very sparsely punctured. Hind coxæ broad and long, closely punctured, the hind femora reaching to the apex of the abdomen; hind metatarsus stout, as long as the four apical tarsal joints combined. Second recurrent nervure

received just beyond the second transverse cubital nervure; the transverse nervure of the humeral cell very long and strongly oblique.

Hab. Hué, Annam, February 1915; 1 ♀.

This belongs to the section of the genus in which the cubitellan and discoidellan cells are not closed, the intercubitella and recurrentella being absent. The truncate clypeus and the lengthened hind coxæ are unusual in the genus. In the former character it resembles *T. rufobalteatus*, Cam., described as a *Siobla*, which seems to be its nearest relation.

Beleses atrofemoratus, sp. n.

♀. Testacea; antennis articulis 2-4, mandibulis apice, femoribus posticis, tibiis posticis apice, tarsis posticis, maculaque inter ocellos nigris; tergitis 5-7 in medio infuscatis; alis flavo-hyalinis, tertio apicali leviter infuscatis, stigmatè basi flavo, apice nigro.

Long. 10 mm.

♀. Mandibles broad, bidentate; clypeus short, minutely punctured, very feebly emarginate at the apex, almost transverse. Head closely and rather strongly punctured, not narrowed behind the eyes; vertical area a little broader than long, the lateral grooves well defined. Antennæ tapering to the apex, densely clothed with short hairs, the third and fourth joints subequal. Pubescence of the head and thorax blackish. Thorax sparsely and finely punctured, much more closely and coarsely on the mesopleuræ than on the dorsal surface. Abdomen smooth and shining. Hind metatarsus distinctly less than twice as long as the four apical joints of the hind tarsus combined, the fourth joint asymmetrical, scarcely half as long as the third; tarsal unguis bifid. Hind wing with a closed median cell, but without a closed cubital cell. The basal nervure of the fore wing reaches the costa at the point of origin of the cubitus.

Hab. Chapa, Tonkin, June; Thatom, Laos, September 1915.

Easily distinguished from *B. stigmaticalis*, Cam., and *B. fulvus*, Cam., by the black hind femora.

Tribe TENTHREDINES.

Siobla maxima, sp. n.

♀. Fulva; clypeo labroque flavis; mandibulis apice, mesonoto lateribus maculaque magna triangulari antice, mesosterno, propodeoque in medio nigris; tergitis apicalibus in medio sæpe in-

fuscatis; alis flavo-hyalinis, anticis apice leviter infuscatis, venis nigris.

Long. 17 mm.

♀. Clypeus finely punctured, transverse at the apex, labrum broadly rounded and sparsely covered with pale hairs. Head punctured-rugose, a little swollen behind the eyes; vertical area broader than long, the lateral furrows distinct. Eyes very distinctly convergent towards the clypeus. Antennæ nine-jointed; fourth and fifth joints subequal, combined about equal in length to the third. Thorax rather closely punctured; scutellum strongly convex, obliquely sloped from the base, rather abruptly truncate posteriorly. Propodeum with a longitudinal carina in the middle at the base; the basal tergites smooth, the fourth and two following tergites rather closely punctured on the sides. Hind coxæ rather long; hind femora stout, scarcely reaching to the apex of the abdomen; joints of the hind tarsi distinctly arcuate beneath, the hind metatarsus about equal in length to the four apical tarsal joints combined; tarsal ungues strongly bifid. Humeral cell divided far beyond the middle by a strongly oblique nervure; basal nervure half as far from the base of the cubitus as that is from the base of the radius.

Hab. Chapa, Tonkin, May and June 1916.

This is congeneric with *Siobla mooreana*, Cam., the type of *Siobla*, which belongs to the Tenthredininae, and is allied to *Macrophya*, though well distinguished by the oblique dividing nervure of the humeral cell. The genus is identical with *Encarsioneura*, Konow, which must sink.

Colochelyia fulva, sp. n.

♀. Fulvo-ochracea; flagello, articulis primo toto secundoque basi exceptis, tibiisque tarsisque posticis nigris; mandibulis flavis, apice nigris; clypeo, labro, propodeo, tibiisque tarsisque anticis intermediisque flavis; alis flavis, venis fulvis.

Long. 17 mm.

♀. Head narrower than the thorax; clypeus broadly truncate at the apex; eyes converging moderately towards the clypeus, very narrowly separated from the base of the mandibles; third joint of the antennæ nearly as long as the three following joints combined, the joints beyond the fourth gradually decreasing in length; vertical area half as broad again as long. Head and thorax closely punctured and clothed with very short golden hairs; the vertical area divided by a low longitudinal carina; scutellum strongly

convex, subconical; propodeum smooth and shining, with a median longitudinal carina; abdomen very closely and minutely punctured; mesopleuræ swollen below, but not tuberculate; vagina strongly exerted. Humeral cell of the fore wing divided beyond the middle by an almost perpendicular feebly curved nerve. Third abscissa of the radius twice as long as the second.

Hab. Chapa, Tonkin, May 27, 1916; 1 ♀.

This is nearly allied to *C. magrettii*, Konow, which occurs in the same locality, but differs in the much paler colouring of the thorax and abdomen; in the longitudinal carina of the propodeum, which almost reaches the apex, but in *magrettii* is only represented by a tubercle at the base; in the less strongly swollen mesopleuræ, and in the black antennæ and hind tibiæ and tarsi.

Tenthredella vitalisi, sp. n.

♀. Ochracea; mandibulis apice, antennis, tibiisque tarsisque posticis nigris; mandibulis, clypeo labroque flavis; alis flavis, apice late fuscis; scutello mesopleurisque infra tuberculatis.

♂. Feminae similis.

Long., ♀ 15 mm., ♂ 14 mm.

♀. Clypeus emarginate; labrum long, narrowly rounded at the apex and sparsely punctured. Eyes converging toward the clypeus; antennæ clothed with very short black hairs, the third joint about one-quarter longer than the fourth; frontal sulcus with strongly raised lateral carinæ which are raised into rounded tubercles above the base of the antennæ, and extend posteriorly to the hind ocelli; vertical area broader posteriorly than long, but as long as the anterior breadth, finely and closely punctured and divided by a very shallow longitudinal groove. Thorax finely and closely punctured; scutellum raised into a conical tubercle; the mesopleuræ produced into a large blunt tubercle below, very distinctly carinate behind the tubercle; mesosternum with an acute tubercle on each side before the intermediate coxæ. The fuscous border of the fore wing reaches to the apex of the stigma.

Hab. Chapa, Tonkin, May 27, 1916; 1 ♀. Tong King, Haut Mékong, April 13, 1918; 1 ♂.

This belongs to the group of *T. xanthoptera*, Cam., and may be distinguished from other species of the group by the wholly black antennæ and the wholly ochraceous abdomen.

Superfamily **ICHNEUMONOIDEA.**Family **Braconidæ.**Subfamily *BRACONINÆ.**Medinoschiza laosensis*, sp. n.

♀. Nigra; capite, thorace, pedibus anticis intermediisque, tibiisque tarsisque posticis testaceis; antennis, mandibulis apice, mesonotoque antice lateribusque nigris; alis flavis, apice leviter infumatis, macula magna ante stigmatis basin fusca.

Long. 14 mm., terebræ long. 13 mm.; antennarum, long. 11 mm., 65-articulatis.

♀. Head large, cubical; eyes oval, temples as broad as the eyes; cheeks long, more than half as long as the eyes, slightly concave. Face sparsely and rather finely punctured, sparsely clothed with long brown hairs; vertex and front smooth and shining, the front between the anterior ocellus and the base of the antennæ rather deeply excavated, the concave area not reaching the eyes. Thorax smooth and shining; notauli narrow but distinct; scutellum not separated by a groove from the mesonotum. Median segment shining; with a few small scattered punctures, each bearing a black hair; the sides of the segment and the hind coxæ more closely punctured. First tergite about half as long again as broad, the marginal lateral carinæ very strong, the longitudinal lateral grooves transversely rugulose; the raised median portion with two longitudinal carinæ, the space between them smooth and shining, the space between them and the lateral grooves longitudinally rugulose. Second tergite broadened from the base, twice as broad at the apex as long, irregularly obliquely striated; with a large, smooth, and shining diamond-shaped basal area, from the apex of which a carina runs to the apex of the segment; second suture strongly crenulate; tergites 3-5 smooth and shining, the basal angles of the third with an area separated from the rest of the tergite by a shallow groove. The apical tergites testaceous brown, microscopically punctured, and sparsely clothed with fulvous hairs. Hypopygium pointed, projecting beyond the apical tergite; valvulæ clothed with very short hairs. Legs densely clothed with short hairs; hind metatarsus as long as the three following joints combined; calcaria short, about one-quarter of the length of the hind metatarsus. Radius originating at one-third from the base of the stigma; second abscissa of the radius very long, longer than the third; recurrent nervure interstitial, nervulus very slightly

postfurcal. The fuscous spot on the fore wing occupies the base of the first cubital cell and the upper basal portion of the first discoidal cell.

Hab. Xieng Khouang, Laos, May 13, 1919.

Closely related to the type of this genus, *M. cratocephala*, Cam., from the Solomons, though very different in colour. The form of the head and the distinctly postfurcal nervulus seem to be the chief characters dividing the genus from *Ipobracon*, to which it is very close.

Medinoschiza excerpta, sp. n.

♀. Very similar to *M. laosensis*, but is less robust; the wings are without a fuscous mark; the hind legs and the apical tergites wholly black; the third tergite coarsely rugose on the sides, and the sculpture on the two basal tergites closer.

Long. 11 mm.; terebræ, long. 11 mm.

Hab. Tonkin, May 1917.

I think the colour-differences, combined with the differences in the sculpture of the abdomen, are sufficient to separate this from *laosensis*; but the range of variation in the family is still little understood.

Chaoilta intrudens, Sm., subsp. *nigriscapis*, nov.

♀. Differs from the typical form from Celebes in having the scape entirely black.

Hab. Muong You, Luang Prabang, May 25, 1919; 1 ♀.
Not recorded from any intermediate locality.

Subfamily *EXOTHECINÆ*.

Spinaria attenuata, Westw.

Spinaria attenuata, Westw. Tijdschr. f. Entom. xxv. p. 30 (1882). ♀.

Subsp. *flavostigma*, nov.

♀. Differs from the typical form from Borneo in having the stigma entirely clear yellow, and a large yellow patch below the stigma occupying the whole of the first cubital cell excepting the extreme base.

Hab. Luang Prabang, September 15, 1917.

Subfamily *RHOGADINÆ*.

Megarhogas indochinensis, sp. n.

♀. Testacea; pedibus anticis intermediisque palpisque pallide

flavo-testaceis; alis hyalinis, anticis in medio hic illic fusco leviter suffusis, venis flavo-testaceis; stigmate magno, dimidio basali piceo, dimidio apicali pallide flavo.

Long. 12 mm.; antennarum long. 16 mm.

♀. Eyes large and prominent, widely emarginate in the middle of the inner orbits; ocelli large, narrowly separated from each other; vertex short, narrowed rapidly behind the eyes, the occipital carina feebly arched. Vertex smooth and shining, face closely and rather finely punctured, raised along the median line, cheeks very short; antennæ very long and slender, about 83-jointed; maxillary palpi very long and slender. Notauli deep, minutely crenulate, the mesonotum finely and closely punctured, mesopleuræ rather sparsely punctured. Median segment with a distinct median carina and several lower transverse carinæ on each side, an irregular undulating carina on the lateral margin of the dorsal surface; the sides of the segment finely rugulose, with short strong striæ above. Abdomen finely longitudinally rugulose on the dorsal surface, subpetiolate, the two basal tergites with a strong median longitudinal carina; first tergite broadened from the base, three times as long as its apical breadth, the spiracles situated at about two-fifths from the base, the apical angles produced into a very distinct tubercle on each side; second tergite about twice as long as its apical breadth, about three-quarters of the length of the first segment, second suture strongly crenulate; third tergite as broad at the apex as long, very little more than half as long as the second; fourth and fifth tergites the broadest; terebra very short. Hind calcaria short and curved, shorter than the fourth joint of the hind tarsi. Radius in hind wing strongly upcurved in the middle; first transverse cubital nervure meeting the cubitus at right angles; second abscissa of the radius long, strongly swollen at the base, and distinctly curved on the basal third.

Hab. Muong You, Luang Prabang, November 13; 1 ♀.

Very nearly related to *M. mindanaensis*, Baker, but seems to be paler in colour, the first tergite seems to be somewhat more slender, there is no median carina on the third tergite in the present species, and the hind calcaria seem to be somewhat shorter. *Troporhogas*, Cam. (1905), must, I think, sink as a synonym of this genus.

Subfamily *MACROCENTRINÆ*.

Macrocentrus tricoloratus, sp. n.

♀. Nigra; mandibulis, apice excepto, palpis, clypeo, orbitis, pro-

thorace, tegulis, mesopleuris postice, segmento mediano lateribus, sternitis tribus basalibus, pedibus anticis intermediisque tarsisque posticis pallide flavis; antennis articulis octavo sequentibusque pallide testaceis; tergitis duobus basalibus, tertio dimidio basali, terebra, pedibusque posticis ferrugineis; alis hyalinis, iridescentibus, venis nigris, stigmatate dimidio basali sordide flavo.

Long. 9 mm.; terebræ long. 10 mm.

♀. Antennæ more than 45-jointed, the extremity broken, third joint long, at least as long as the third joint of the maxillary palpi, more than half as long again as the scape. Face broad, finely punctured; eyes parallel; posterior ocelli separated from the eyes by a distance distinctly greater than their diameter. Mesonotum smooth and shining; notauli deep and crenulate; the depressed portion of the mesonotum behind the median lobe irregularly transversely striated. Scutellum sparsely punctured; median segment rugose-reticulate; pleuræ shining, sparsely punctured. Abdomen slender, longer than the head, thorax, and median segment combined, inserted higher than the hind coxæ; the three basal tergites very finely and closely longitudinally striated; the third at the apex and the following segments very distinctly and rather closely punctured, and sparsely clothed with short grey hairs; first tergite about half as long again as the second, very little broader at the apex than at the base; second tergite twice as long as broad; third longer than broad; fourth broader than long. Valvulæ clothed sparsely with short black hairs. Second abscissa of the radius twice as long as the first; second transverse cubital nervure scarcely more than half as long as the first abscissa of the radius. Nervulus slightly postfurcal.

Hab. Xieng Khouang, Laos, April 19, 1919.

Superfamily VESPOIDEA.

Family Psammocharidæ.

Cryptochilus auranticornis, sp. n.

♀. Nigra; nigro-pilosa; antennis aurantiacis; tibiis tarsisque brunneo-ferrugineis; mandibulis in medio, clypeo macula basali, orbitisque fusco-ferrugineis; alis flavis, basi ad nervulam basalem infuscatis, apice extremo leviter infuscatis; venis fulvis, basi nigris.

Long. 32 mm.

♀. Clypeus finely shagreened, with a few large setigerous punctures, broadly truncate at the apex. Antennal tubercles

prominent, rounded; antennæ long, slender at the apex, second joint of the flagellum more than twice as long as the scape. Front finely transversely rugulose, with a shallow median sulcus reaching to the anterior ocellus, vertex microscopically punctured. Head and thorax clothed with black hairs; pronotum widely arched posteriorly, the arch not angled in the middle; scutellum rather strongly convex. Median segment transversely striate; the striæ moderately coarse, but not much elevated, a low blunt tubercle on each side near the basal angles; the posterior slope gradual, not sharply divided from the dorsal surface. Abdomen shining, clothed with minute, close-lying, black hairs; the apical tergite densely clothed with long, stout, dark hairs. Legs long, length of hind tibia 11 mm., of hind metatarsus 8 mm.; hind tibia serrate, tarsal ungues unidentate. Second abscissa of the radius nearly as long as the third; first recurrent nervure received very distinctly before the second transverse cubital nervure; second just beyond one-third from the base of the third cubital cell.

Hab. Than Moi, Tonkin, June 20, 1917; 1 ♀.

This closely resembles superficially *Hemipepsis sycophanta*, Grib., but is a more slender insect and belongs to a different genus. Throughout the larger Psammocharidæ these superficial resemblances between species of different genera from the same locality are common. Whether the tarsal ungues of the male of this species are unidentate or bifid remains to be seen.

Cryptochilus fulvus, sp. n.

♀. Nigra; capite, prothorace, mesonoto, scutello, postscutello, abdomine segmentis tertio apice, quarto, quinto, sextoque, pedibusque aurantiacis; coxis intermediis posticisque nigris; alis flavis, margine apicali anguste fuscis; unguiculis unidentatis.

♂. Feminæ similis; fronte, coxis anticis, trochanteribus, femoribusque intermediis posticisque basi nigris; unguiculis bifidis.

Long., ♀ 15-20, ♂ 13 mm.

♀. Clypeus broadly subtruncate at the apex; labrum broadly truncate. Frontal prominence well developed, forming a bilobed projection between the antennæ; second joint of the flagellum about half as long again as the scape. Pronotum with an indistinct longitudinal sulcus in the middle, broadly and shallowly arched posteriorly; the head and dorsal surface of the thorax rather sparsely clothed with short close-lying golden hairs. Median segment very closely transversely rugose-striate, truncate posteriorly, the posterior

truncation not sharply divided from the dorsal surface. Abdomen shining, very finely coriaceous, with scattered punctures; the apical segment densely clothed with coarse golden hairs. The transverse groove near the base of the second sternite is almost straight. Hind tibiæ strongly serrate. Second abscissa of the radius longer than the third, the first and fourth about equal. First recurrent nervure received at about four-fifths from the base of the second cubital cell, second distinctly before the middle of the third cubital cell. Cubitus of the hind wing originating distinctly beyond the transverse median nervure.

♂. Clypeus narrower than in the female, the eyes converging below, not parallel as in the female. Hind tibiæ spined, not serrate. Seventh tergite broadly subtruncate at the apex.

Hab. Vien Than, May and June 1915; also from Mergui and Middle Tenasserim (*Bingham*).

This is the species figured by Bingham (*Journ. Bombay Nat. Hist. Soc.* 1895) as *Sphex flava* of Fabricius; but it does not correspond to the description, several of the apical segments being fulvous in this species, only one in *flava*. I feel confident that Dahlbom was right in his identification of *flava* after consulting the Fabrician collection. Probably the type was in that collection, as Fabricius makes no statement to the contrary. But Fabricius evidently had a very confused idea of his own species, as a specimen identified by him as *flava* in the Banksian collection is a female with bifid tarsal unguis, and from his description of a variety in *Ent. Syst.* I suspect that he has also confused *Batozonus unifasciatus*, Sm., with *flava*. Bingham, in 'Fauna of British India' (1897), after examining the specimen labelled *flava* in the Banksian Collection, still regarded this species as an extreme variety of *flava*. But he cannot have noticed the tarsal unguis. In the same work Bingham rightly sinks *Priocnemis humbertianus*, Sauss., as a synonym of *flava*, though it is undoubtedly distinct from the specimen in the Banksian Collection. As the matter stands, I consider we have three species which have been confused by Bingham under *flava*:—

1. *Cryptochilus flavus*, Fabr.

Sphex flava, Fabr. *Syst. Ent.* p. 352 (1775).

Priocnemis flavus, Dahlb. *Hym. Europ.* i. p. 457 (1845).

Priocnemis humbertianus, Sauss. *Reise de Novara, Zool.* ii. p. 63 (1867).

♀♂.

In this species the tarsal unguis are unidentate in both sexes.

2. *Cryptochilus falsus*, sp. n.

Described above. Tarsal ungues unidentate in the female, bifid in the male.

3. *Cyphononyx peregrinus*, Sm, ab. *disjunctus*, n.

♀ ♂. Differs from the typical *peregrinus* in the colour of the wings, which are yellow, with a narrow apical fuscous margin, not fusco-violaceous entirely as in the typical form. The tarsal ungues are bifid in both sexes. This is the prevalent form in Western India, but occurs with the typical form in Sikkim. I have taken it in Ceylon, and its range also extends to China and Pegu, though in Further India and the Indo-Malayan region the dark-winged form is dominant. The genitalia of a Western yellow-winged male differ slightly from those of a Burmese dark-winged male, but the difference is so slight that I do not think it would be justifiable to treat it as a separate species. This is the *Sphex flava* of the Banksian Collection.

Cryptosalius tonkinensis, sp. n.

♀. Nigra; femoribus posticis ferrugineis, apice nigris; tergitis 4 basalibus fasciis utrinque apicalibus argenteo-sericeis; alis fusco-hyalinis, venis fuscis.

Long. 15 mm.

♀. Clypeus short and broad, truncate at the apex; labrum exposed, broadly truncate at the apex. Antennæ stout, about as long as the head, thorax, and median segment combined, not tapering much to the apex, the second and third joints of the flagellum subequal. Front feebly convex, with a short impressed longitudinal line, which does not reach halfway to the anterior ocellus; the frontal prominence above the antennæ rather narrowly rounded at the apex. Eyes reaching to the base of the mandibles, temples obsolete. Head and thorax opaque, rather sparsely punctured, with very minute close punctures between the larger punctures. Pronotum short, no longer than the scutellum, rounded at the anterior angles, the posterior margin very broadly and feebly arched. Median segment broader than long, obliquely sloped posteriorly, the apical half of the dorsal surface strongly transversely striate, a deep sulcus from base to apex, the basal half delicately transversely rugulose. Tarsal ungues bifid; hind tibiæ almost smooth, with a few minute spines. Second and third abscissæ of the radius subequal in one specimen, in another the third distinctly the longer; second

recurrent nervure joining the cubitus at right angles at the middle of the third cubital cell.

Hab. Chapa, Tonkin, May and June 1916.

This has the third cubital cell longer than in *C. rava*, Bingham, and the pronotum distinctly shorter, but is certainly congeneric. The genus is very near *Lissocnemis*, Kohl., but differs in the absence of the mark at the base of the discoidal cell which is present in *Lissocnemis* as in *Hemipepsis*. To *Lissocnemis* must be assigned the Indian *Salius brevipennis*, Cameron.

VIII.—*Sur quelques Trechinæ* [Coleoptera, Carabidæ] du British Museum. Par R. JEANNEL.

I. ESPÈCES AMÉRICAINES.

Genre CNIDES, Motschoulský.

Cnides, Motschoulsky, 1862, Études entom. xi. p. 38 (génotype: *C. rostratus*, Motsch.).

Dans la diagnose du genre *Cnides* par Motschoulsky, se trouvent des erreurs grossières concernant la forme du labre et du menton. Mais malgré cela, les caractères assez extraordinaires du genre sont suffisamment indiqués pour permettre de conserver le nom donné par Motschoulsky. Putzeys, dans sa "Monographie" (Stett. ent. Zeit. 1870), range d'abord *Cnides* parmi les sous-genres de *Trechus*, Clairv. (p. 9), mais plus loin, à propos de l'espèce *T. rostratus*, Motsch., il paraît plutôt rejeter entièrement cette coupe (p. 189).

En réalité, comme l'avait observé Motschoulsky, *Cnides* se rapproche davantage des *Perileptus* que des *Trechus*. Comme chez les premiers la strie suturale n'est pas récurrente et le quatrième article des tarsi porte une expansion lamelleuse ventrale; mais chez *Cnides* les palpes ne sont pas subulés.

Diagnose.—Tête avec des sillons frontaux arqués, complets; yeux glabres. Labre transverse, échancré; labium non soudé, avec sa dent médiane saillante, bifide. Dernier article des palpes conique, mais un peu plus grêle que le précédent. Pronotum à angles postérieurs saillants. Élytres sans bourrelet basal; strie suturale toujours entière, souvent seule indiquée, très rapprochée de la suture à la base, s'en écartant fortement au milieu. À l'apex il n'existe pas de bourrelet apical, la strie suturale se continue par la gouttière

marginale et il n'existe pas trace de crosses à l'extrémité des stries. Tibias antérieurs droits; carénés sur leur face externe. Tarses à quatrième article pourvu d'une expansion lamelleuse ventrale atteignant le sommet de l'onychium.

Pour le reste semblable à *Trechus*, Clairv.

Le genre *Cnides* renferme les trois espèces citées ci-dessous des collections du British Museum et une quatrième espèce : *C. angustatus*, Solier, 1849, Gay, Hist. Chili, Zool. iv. p. 155 (*Trechus*).

Cnides rostratus, Motschoulsky, 1862, Études entomologiques, xi. p. 40 (types : forêts de l'isthme de Panama); Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 189.

Colombie : Cali, 3 ♀ (coll. Fry). L'espèce est encore connue du Vénézuéla (coll. Chaudoir).

Cnides monolcus, Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 191 (type : Chili).

Chili : Valparaiso (*Germain*).

Cnides rugosifrons, sp. n.

Long. 4 mm.

Peu convexe, avec l'avant corps court et très étroit, les élytres larges et parallèles. Coloration brun de poix brillant, avec les palpes, les antennes, les épipleures du pronotum et des élytres rougeâtres, les pattes testacées pâles. Téguments glabres, finement alutacés et mats sur la tête et le pronotum.

Tête plus large que longue, à sillons frontaux très divergents en avant, rapprochés l'un de l'autre à la partie antérieure du vertex, puis s'écartant dans de profondes fossettes; un point enfoncé sur le milieu du vertex; front très rugueux, irrégulièrement plissé entre les sillons et les yeux. Yeux très saillants, convexes, deux à trois fois plus longs que les tempes. Antennes atteignant le tiers basal des élytres; l'article II. est aussi long que la moitié du III., nettement plus court que le IV.; les articles apicaux sont cylindriques, presque trois fois aussi longs que larges.

Pronotum très petit, plus étroit que la tête, à peine transverse; sa base un peu plus étroite que le sommet. Côtés peu arqués en avant, sinués en arrière avant les angles postérieurs qui sont droits, vifs, acérés. Disque peu convexe, avec une ligne médiane sulciforme, approfondie en coup de gouge devant la base; base bisinuée; gouttière marginale

très étroite ; fossettes basales arrondies, larges, profondes, rugueuses, contiguës à la base.

Élytres deux fois aussi larges que le prothorax, peu convexes, tronqués à la base et au sommet ; épaules très saillantes, formant presque un angle droit. Gouttière marginale très étroite à l'épaule, élargie devant la série ombiliquée. Striole juxtascutellaire distincte ; les deux premières stries sont entières, la troisième est effacée à la base, la quatrième n'est guère visible que dans son quart basal.

Métasternum deux fois long comme le pilier de la hanche postérieure. Segments ventraux lisses. Pattes grêles et courtes.

Chétotaxie.—Lignes orbitaires à peu près parallèles. Le premier pore discal de l'élytre se trouve sur la troisième strie, au quart basal.

Chili : Quillota, un exemplaire (*H. Sadler*, nov. 1896).

Genre *TRECHUS*, Clairville.

Trechus politus, Brullé, 1842, Voyage d'A. d'Orbigny dans l'Amér. mér. vi. 2^e partie, p. 43 (type : Valparaiso [Mus. Paris]) ; Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 167.

Var. *æneus*, Motschoulsky (*Trechisibus æneus*), 1862, Études entom. xi. p. 67 (type : Chili).

Trechus lævissimus, Putzeys, 1870, l. c. p. 169 (type : Chili).

Trechus proximus, Putzeys, 1870, l. c. p. 169 (type : Santiago du Chili).

Le *Trechus politus*, Solier (1849, Gay, Hist. Chili, Zool. iv. p. 154), est différent du *T. politus*, Brullé, et doit porter le nom de *T. depressicollis*, Putzeys.

Il est certain que le *Trechisibus æneus*, Motsch., est identique au *Trechus lævissimus*, Putzeys. Le genre *Trechisibus* doit être rejeté car les caractères sur lesquels il est fondé sont purement imaginaires (Putzeys, 1870, l. c. p. 169), mais le nom spécifique *æneus*, Motsch., ayant la priorité, doit être conservé à la place de celui de *lævissimus*, Putz. Il doit caractériser une forme de grande taille à grands yeux et à élytres amples, mais entre laquelle et la forme *politus* typique s'observent tous les intermédiaires. Quant au *T. proximus*, Putz., ce n'est qu'une forme extrême à yeux encore plus développés.

Chili : nombreux exemplaires (*Mathew, Germain, C. C. Reed*).

Trechus depressicollis, Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 47 (types: Chili [coll. Chaudoir]).

Trechus politus, Solier, 1849, Gay, Hist. Chili, Zool. iv. p. 154, nec Brullé.

Trechus politus nigripennis, Solier, 1849, l. c. p. 154.

Trechus solieri, C. C. Reed, 1874, Catal. Ins. Chili, p. 12.

Trechus scapularis, Putzeys, 1870, l. c. p. 170 (types: Chili [coll. Chaudoir]).

Trechus axillaris, Putzeys, 1870, l. c. p. 171 (types: Chili [coll. Chaudoir]).

T. politus, Solier, n'est pas la même espèce que le *T. politus*, Brullé, le premier ayant des stries distinctes, le second étant lisse; c'est pourquoi C. C. Reed a proposé le nom de *solieri* pour l'espèce de Solier qu'il croyait inédite. Mais il n'est pas douteux que c'est la même espèce que Putzeys avait décrite dans sa Monographie sous les noms de *depressicollis*, *scapularis*, *axillaris*. Il m'a été impossible de voir les types des trois espèces de Putzeys qui se trouvent chez M. R. Oberthür, mais la confrontation des descriptions avec la longue série d'exemplaires appartenant au British Museum, prouve sans aucun doute qu'il s'agit d'une seule espèce très variable, tant par la forme que par la coloration.

Chili: Valparaiso (C. Darwin); Santiago (C. C. Reed, Germain).

Un exemplaire typique, c'est à dire à stries développés, est étiqueté "Chili: Juan Fernandez (Germain)"; il provient vraisemblablement des îles Juan Fernandez qui se trouvent à 800 km. env. au large de Valparaiso. Il est intéressant de rencontrer dans ces îles du Pacifique une espèce typique du continent.

Trechus parvicollis, Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 170 (type: Chili [coll. Chaudoir]).

Chili: Valparaiso (Germain).

Trechus hololissus, Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 153 (type: Santiago [coll. Putzeys]).

Chili: Santiago (Germain).

Trechus australis, sp. n.

Long. 4.6 mm.

Forme générale épaisse, peu convexe, élargie en arrière. Coloration brun de poix brillant, avec les palpes, les antennes, les pattes, les épipleures du pronotum et des élytres, le

dessous de la tête et du thorax, la base des élytres, la suture et le bord externe rougeâtres. Téguments glabres, lisses.

Tête à peu près aussi large que longue, à sillons frontaux réguliers très écartés l'un de l'autre ; le front porte quelques rides obliques entre l'œil et le sillon. Yeux saillants, à peu près deux fois aussi longs que les tempes. Antennes épaisses et courtes, atteignant le quart basal de l'élytre ; l'article II. est nettement plus court que le IV. Labre particulièrement court et transverse.

Pronotum transverse, plus large que la tête, sa base aussi large que le sommet. Angles antérieurs légèrement saillants ; côtés arqués régulièrement dans les deux tiers antérieurs, à peine sinués avant les angles postérieurs ; ceux-ci obtus, mais vifs et saillants ; base à peine saillante. Disque assez convexe ; gouttière marginale large, élargie vers le tiers moyen ; fossettes basales larges et profondes.

Élytres oblongs, courts, élargis après le milieu ; épaules transverses, arrondies ; gouttière marginale large, rétrécie en arrière ; disque peu convexe, mais non déprimé. Il existe des traces de stries plus ou moins visibles, surtout des deux premières. Pas d'ailes.

Métasternum environ trois fois aussi long que le pilier de la hanche postérieure.

Pattes robustes. Tibias antérieurs non carénés sur leur face externe.

Œdeagus court, très arqué, à pointe mousse ; le sac interne est armé d'écaillés à sa partie apicale.

Chétotaxie.—Lignes orbitaires divergentes en avant. Pores du pronotum comme chez *T. politus*. Série discale de l'élytre de trois soies sur la 3^e strie ; les deux pores antérieurs sont très grands.

Cette espèce se place auprès du *T. politus* dont elle a les tibias antérieurs lisses ; elle diffère notablement des espèces fuégiennes *T. antarcticus*, Dej., et *T. hornensis*, Fairm., qui appartiennent à un autre groupe.

Chili, colonie de Magellan : environs de Punta-Arenas, plusieurs exemplaires étiquetés à tort "*T. wienckei*, Rouss." (*Walker*).

Trechus patagonicus, sp. n.

Long. 4.5 mm.

Forme du *T. australis*, mais plus déprimé, plus élargi en arrière. Même coloration. Téguments glabres et lisses.

Tête un peu plus large que longue, à sillons frontaux réguliers, très distants l'un de l'autre ; front couvert de rides

obliques, presque rugueux entre l'œil et le sillon. Yeux, antennes et labre comme chez *T. australis*.

Pronotum légèrement transverse, à peine plus large que la tête, la base plus étroite que le sommet. Côtés assez arqués dans les deux tiers antérieurs, puis faiblement rétrécis et sinués avant les angles postérieurs qui sont vifs, saillants; base légèrement saillante. Disque assez convexe; gouttière marginale large, égale; fossettes basales, larges et profondes.

Élytres amples, fortement élargis après le milieu. Les angles huméraux sont transverses, saillants, arrondis; la gouttière marginale est très large; le disque est déprimé, largement aplati. Strie suturale et deuxième strie bien distinctes; des traces des stries suivants; toutes sont fines, superficielles, légèrement ponctuées.

Métasternum et pattes comme chez *T. australis*.

Chétotaxie.—Mêmes caractères que chez *T. australis*; les pores discaux de l'élytre sont très grands, fovéolés.

République argentine: Patagonie, rio de Santa Cruz, deux exemplaires (*C. Darwin*).

Trechus obscuricornis, Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 32 (types: Chili [coll. Chaudoir]).

Chili: Santiago (*Germain*).

Trechus ruficollis, Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 31 (types: Chili [coll. Chaudoir]).

Chili: Santiago (*Germain*).

Trechus chloroticus, Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 19 (types: Chili [coll. Chaudoir]).

Chili: Santiago, un exemplaire (*Germain*).

Trechus hornensis, Fairmaire, 1885, Ann. Soc. ent. Fr. p. 41 (types: Baie-Orange [Mus. Paris]); 1888, Miss. scientif. Cap Horn, vi., Ins. p. 22.

Trechus wienckei, Rousseau, 1900, Ann. Soc. Ent. Belg. xlv. p. 108 (types: île des États [Mus. Bruxelles]); 1906, Exp. antarct. Belge, Zool., Coléopt. p. 20, pl. i. figs. 2, 6.

L'identité du *T. wienckei* avec le *T. hornensis*, Fairm., ressort clairement de la lecture de la diagnose de E. Rousseau et de l'examen de la figure qu'il donne de son *T. wienckei*.

Ile L'Hermitte, près de l'île du Cap Horn, plusieurs exemplaires (*C. Darwin*).

T. hornensis est encore connu de la Terre de Feu et de l'île des États.

Trechus antarcticus, Dejean, 1831, Spec. v. p. 26 (type : îles Malouines [coll. Chaudoir]); Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 152; Rousseau, 1906, Exp. antarct. Belge, Zool., Coléopt. p. 20.

Iles Malouines ou Falkland isl. (*C. Darwin*).

Espèce antarctique, se retrouvant aussi à la Terre de Feu.

Trechus micans, Leconte, 1848, Ann. Lyc. Nat. Hist. N. York, iv. p. 414 (type : Lac Supérieur).

Trechus fulvus, Leconte, 1848, l. c. p. 415, nec Dejean.

Trechus rubens, G. H. Horn, 1875, Trans. Amer. Entom. Soc. Philadelphie, v. p. 131, nec Fabricius; G. H. Horn, 1882, Bull. Brooklyn. Entom. Soc. v. p. 48; Ch. Schaeffer, 1901, Bull. Amer. Mus. Nat. xiv. p. 209, pl. xxviii. fig. 1.

Trechus canadensis, Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 160 (types : Saint-Pierre et Miquelon).

La synonymie des *Trechus* de l'Amérique du Nord a été établie d'une façon totalement erronée par Ch. Schaeffer (1901, l. c. p. 209).

Trechus rubens, G. H. Horn, est d'abord absolument différent du *T. rubens*, Fabricius, propre à l'Europe septentrionale et qui n'existe pas en Amérique.

D'autre part la lecture des descriptions de G. H. Horn et de Leconte ne peut laisser aucun doute sur l'identité du *T. rubens*, Horn, avec le *T. micans*, Leconte, espèce bien caractérisée par sa forme générale et la striation de ses élytres. On ne s'explique pas par suite de quelle confusion Ch. Schaeffer a pu supposer que le *T. micans*, Leconte, soit synonyme du *T. chalybæus*, Dej., auquel il ne ressemble en aucune façon.

Enfin *T. fulvus*, Leconte, est un *T. micans* immature et l'identité du *T. canadensis*, Putz., avec le *T. micans*, Leconte, ressort de la comparaison de co-types de Putzeys avec une riche série de *T. micans* provenant de toutes les contrées de l'Amérique du Nord.

Canada : Hudson Bay ; New Carlton house, dans le district Saskatchewan.

États Unis d'Amérique : Colorado, West Cliffs (*A. Cockerel*, 1884).

Trechus chalybæus, Dejean, 1831, Spec. v. p. 17 (type : Unalashka); Mannerheim, 1843, Bull. Soc. Impér. Nat. Moscou, xvi. p. 215; Putzeys, 1870, Stett. ent. Zeit.

xxx. p. 161; G. H. Horn, 1875, Trans. Amer. Ent. Soc. Philadelphie, v. p. 131; 1882, Bull. Brooklyn Entom. Soc. v. p. 48; Ch. Schaeffer, 1901, Bull. Amer. Mus. Nat. Hist. xiv. p. 209, pl. xxviii. fig. 2 (*pars*); 1915, Journ. Entom. Soc. New York, xxiii. p. 48.

Trechus californicus, Motschoulsky, 1845, Bull. Soc. Impér. Nat. Moscou, xviii. p. 347 (type: Californie [Mus. Paris]).

États Unis d'Amérique: Arizona (*Morrison*).

Ch. Schaeffer (1901, *l. c.* p. 211) indique pour cette espèce une distribution géographique inexacte. Les citations de l'Alaska, de la Colombie Britannique, de Californie, de l'Oregon, du Colorado s'appliquent bien au *T. chalybæus*, mais celles du Lac Supérieur, du New Hampshire et du New Jersey concernent le *T. micans*. W. S. Blatchley (1910, Ill. Descr. Catal. Coleopt. Indiana, p. 87) cite encore *T. chalybæus* de l'Indiana, mais cette provenance reste douteuse.

Trechus ovipennis, Motschoulsky, 1845, Bull. Soc. Impér. Nat. Moscou, xviii. p. 348 (type: Californie); Mannerheim, 1852, Bull. Soc. Impér. Nat. Moscou, xxv. p. 299; G. H. Horn, 1875, Trans. Amer. Ent. Soc. Philadelphie, v. p. 131; 1882, Bull. Brooklyn Entom. Soc. v. p. 48; Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 40; Ch. Schaeffer, 1901, Bull. Amer. Mus. Nat. Hist. xiv. p. 209, pl. xxviii. fig. 3.

Trechus lævigatus, Leconte, 1863, Smiths. Miscell. Coll. vi. p. 14.

Unalashka: fjord Masset, dans l'île de la reine Charlotte, nombreux exemplaires.
Californie (*Edwards*).

Trechus aztec, sp. n.

Long. 2·8 mm.

Forme peu convexe. Coloration noir de poix brillant, avec le labre, les palpes, les antennes, les pattes testacées, le bord antérieur du front, les angles antérieurs du pronotum, la base des élytres, la suture et la périphérie, le dessous du corps rougeâtre. Téguments glabres, finement alutacés sur la tête.

Tête à peu près aussi large que longue; les sillons frontaux réguliers, divergents en avant, rapprochés l'un de l'autre sur le vertex où la distance qui les sépare est environ la moitié de la distance entre l'œil et le sillon. Yeux peu saillants, plus courts que les tempes. Antennes atteignant à peu près

le quart basal de l'élytre; l'article II. est plus long que le IV.; les articles terminaux sont ovoïdes, une fois et demie aussi longs que larges. Dent du menton saillante, à pointes larges et déhiscentes; labium non soudé.

Pronotum ample, transverse, plus large que la tête, sa base presque aussi large que le sommet. Côtés peu arqués en avant, obliques, presque rectilignes dans le tiers moyen, redressés en arrière; angles postérieurs droits, non relevés; base sensiblement rectiligne, à peine échancrée. Disque peu convexe, avec une impression transverse postérieure bien indiquée; gouttière marginale large; fossettes basales peu profondes, bien isolées de la gouttière marginale; elles occupent le quart de la base.

Élytres ovales, peu convexes, à épaules saillantes; gouttière marginale légèrement infléchie sur la base vers l'origine de la 5^e strie, large, régulière. Stries distinctes, superficielles, bien tracées jusqu'à l'apex. Méta sternum plus court que le pilier de la hanche postérieure. Segments ventraux lisses.

Pattes courtes et robustes. Tibias antérieurs sillonnés au côté externe.

Œdeagus très grand, très arqué, avec la partie basale renflée, la partie apicale infléchie du côté dorsal et recourbée en bec à l'extrémité.

Chétotaxie.—Lignes orbitaires divergentes en avant. Série discale de l'élytre formée par trois soies sur la 3^e strie, le pore antérieur au quart basal, le médian un peu après le milieu.

Cette petite espèce appartient au groupe des *Trechus* vrais; elle se place à côté des espèces nord-américaines comme *T. hydropticus*, Horn.

Mexique: plusieurs exemplaires étiquetés "Mexico" (*Truqui*, coll. Fry).

TRECHUS, subgen. PARATRECHUS, nov.

Les espèces de ce groupe présentent tous les caractères des vrais *Trechus*, mais se distinguent par les caractères suivants, très particuliers:

Labium soudé au submentum sans qu'il existe trace de suture. Élytres avec un ou deux pores sétigères fovéiformes sur la 5^e strie, sans pores sétigères sur la 3^e strie. Œdeagus pourvu d'un organe apical.

Génotype: *Trechus mexicanus*, Putz.

Ce groupe de *Trechus* est spécial à l'Amérique centrale. Aux *T. mexicanus*, Putz., et *T. coarctatus*, Bates, déjà connus, il faut ajouter deux espèces nouvelles bien caractérisées, mais

qui cependant ont été confondues par H. W. Bates avec le *T. mexicanus* dans la 'Biologia Centrali-Americana.'

Trechus (Paratrechus) mexicanus, Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 33 (type: Mexique (Sallé)); H. W. Bates, 1882, Biol. Centr.-Amer., Col. i. p. 136.

T. mexicanus, Putz., est une espèce de grande taille (5·5 à 5·8 mm.) ; la 5^e strie de l'élytre porte deux gros pores sétigères, l'un au quart basal, l'autre au tiers apical. Le lobe médian de l'œdeagus a son extrémité apicale aplatie, mousse, simple.

Mexique: Puebla (coll. Sallé); Mexico (*Truqui*); Orizaba (coll. Sallé).

Ce sont les exemplaires cités par H. W. Bates dans la 'Biologia Centrali-Americana'; ceux qu'il cite d'Oaxaca se rapportent au *T. hoegei*, ceux de Totonicapam au *T. bifoveatus*, tous deux décrits ci-dessous.

Trechus (Paratrechus) hoegei, sp. n.

Cette espèce a tout à fait l'aspect extérieur de grands exemplaires de *T. mexicanus*; il n'est pas possible de définir des caractères morphologiques particuliers à l'une et l'autre espèces, toutes deux étant fort variables. Mais *T. hoegei* se distingue aisément par les caractères suivants :

Œdeagus long et grêle, comme celui de *T. mexicanus*, mais le sommet du lobe médian se termine par un renflement sensoriel en forme de champignon. Un seul pore sétigère sur la 5^e strie, au quart basal; le deuxième pore fait défaut.

Mexique: Oaxaca (*Hoege*), cinq exemplaires cités par H. W. Bates sous le nom de *T. mexicanus*.

Trechus (Paratrechus) bifoveatus, sp. n.

Long. 4 mm.

Forme peu convexe rappelant en petit celle du *T. mexicanus*, Putz. Coloration noir de poix brillant avec les palpes, les antennes, les pattes, les pièces sternales rougeâtres. Teguments glabres, lisses.

Tête petite, arrondie, à peu près aussi longue que large; les sillons frontaux réguliers, profonds, divergents en avant, rapprochés l'un de l'autre sur le vertex; l'espace qui les sépare est la moitié de l'espace qui sépare l'œil du sillon. Yeux petits, peu saillants, plus courts que les tempes. Antennes courtes, atteignant à peine le quart basal de l'élytre;

l'article II. est aussi long que le III., plus long que le IV. ; les articles apicaux sont ovalaires, environ une fois et demie aussi longs que larges. Dent du menton très saillants. Labium soudé.

Pronotum ample, bien plus large que la tête, à peine transverse, sa base presque aussi large que le sommet. Côtés fortement arrondis dans les trois quarts antérieurs brusquement sinués en arrière, puis droits et parallèles avant les angles postérieurs ; ceux-ci droits, vifs ; base rectiligne. Disque peu convexe, avec une impression transverse postérieure profonde ; gouttière marginale très large ; fossettes basales profondes, lisses.

Élytres ovalaires, un peu élargis après le milieu ; épaules saillantes ; gouttière marginale commençant à l'angle huméral même, en face de la racine de la 5^e strie ; la gouttière est large dans toute sa longueur. Disque assez convexe ; toutes les stries sont distinctes quoique superficielles ; elles s'effacent dans la région humérale. Méta sternum à peu près aussi long que le pilier postérieur.

Pattes robustes ; les tibias antérieurs sont sillonnés au côté externe.

Cedeagus petit, grêle, avec la partie basale renflée, la partie apicale épaissie et terminée par un organe en champignon infléchi sur la face ventrale et hérissé d'organes sensoriels.

Chétotaxie.—Lignes orbitaires à peine divergentes en avant. Pores du pronotum normaux. Pas de pores sur la 3^e strie, sauf le pore apical, mais un gros pore fovéiforme au cinquième basal de la 5^e strie, c'est à dire près de l'épaule.

Guatemala : Totonicapam, alt. 1000 m. (*Champion*), quatre exemplaires cités par H. W. Bates sous le nom de *T. mexicanus*, dans la 'Biologia Centrali-Americana.'

II. ESPÈCES ASIATIQUES.

Genre PERILEPTUS, Schaum.

Perileptus japonicus, H. W. Bates, 1873, Trans. Entom. Soc. London, p. 296 (type : Hiogo).

Chine : Hong-Kong (coll. Walker).

Ile Célèbes (*Wallace*).

Japon : Niigata, dans le Nippon septentrional (*G. Lewis*, 1881) ; Kobé-Hiogo, dans le Nippon méridional (*G. Lewis*, 1881) ; mont Daïsen ou Oyama, dans le Nippon méridional (*G. Lewis*, 1881).

Genre TRECHUS, Clairville.

Trechus championi, sp. n.

Long. 4.3 mm.

Ailé. Peu convexe. Noir brillant avec le dessous du corps brunâtre, les palpes, les antennes et les pattes testacé rougeâtre. Téguments glabres, lisses.

Tête un peu plus large que longue, à sillons frontaux réguliers, divergents en avant, anguleux sur le vertex; la distance qui les sépare sur le vertex est plus courte que celle qui sépare l'œil du sillon. Yeux convexes, trois fois aussi longs que les tempes. Antennes atteignant le tiers basal des élytres; l'article II. est plus court que le III., lui-même aussi long que le IV.; articles apicaux ovalaires, épais; dernier article plus long que l'avant dernier. Dent du menton saillante, carrée, à peine bifide; labium non soudé.

Pronotum bien plus large que la tête, à peine moins large que la base des élytres, fortement transverse; sa base un peu plus étroite que le sommet. Côtés très arrondis en avant, obliques en arrière, faiblement sinués avant les angles postérieurs; ceux-ci obtus, mais vifs; base rectiligne. Disque assez convexe, avec une ligne médiane bien tracée; la dépression transverse postérieure profonde et rugueuse; fossettes basales larges, profondes, obliques; gouttière marginale large, se réfléchissant anguleusement en avant sur les côtés du bord antérieur.

Élytres oblongs, convexes, élargis après le milieu; épaules saillantes; gouttière marginale large, commençant à la racine de la 5^e strie. Toutes les stries sont distinctes, les quatre premières profondes, les autres superficielles; premiers interstries convexes, les autres plans. La carène apicale se termine brusquement en avant, sans atteindre l'extrémité postérieure de la 5^e strie; les 3^e et 4^e stries, anastomosées à leur extrémité apicale, ne s'unissent pas à la 2^e strie.

Métasternum deux fois aussi long que le pilier postérieur. Segments ventraux lisses.

Pattes robustes; les tibias antérieurs sont sillonnés au côté externe.

Cedeagus assez gros, peu arqué, à base non renflée, avec l'orifice basal très largement échancré; extrémité apicale aplatie, recourbée en bec au sommet. Styles latéraux petits et grêles. Sac interne avec une grosse pièce chitineuse exsertile.

Chétotaxie. — Lignes orbitaires convergentes en avant. Pore pronotal postérieur bien développé et placé sur l'angle. Série discale de trois pores sur la 3^e strie, l'antérieur au quart basal, le médian bien après le milieu.

Cette espèce semble voisine du *T. indicus*, Putz., que je ne connais pas, mais qui paraît présenter le même pronotum transverse, la même structure de la carène apicale et les mêmes caractères chétotaxiques ; d'après sa description *T. indicus* diffère du *T. championi* par sa coloration testacée, sa dent du menton courte et nettement bifide, les angles postérieurs de son prothorax aigus.

Cette intéressante espèce m'a été aimablement communiquée par Mr. H. E. Andrewes, qui m'a laissé le soin de la décrire. Elle paraît répandue dans les régions subalpines du versant méridional de l'Himalaya. Je la connais des localités suivantes :

Inde, Prov. Kumaon : Nainital (*H. G. Champion*, sept. 1918), huit exemplaires (types) (coll. G. C. Champion) ; West Almora, Diva (*H. G. Champion*, oct. 1918), deux exemplaires (coll. G. C. Champion).

British Sikkim : Gopaldhara, près de Darjeeling, entre 1500 et 2000 m. (*H. Stevens*, avril 1914), trois exemplaires (coll. H. E. Andrewes).

Le Muséum de Paris possède deux exemplaires de cette espèce étiquetés "Sikkim (*Harmand*)."

Trechus chinensis, sp. n.

Long. 3·8 mm.

Ailé ou biachyptère. Très convexe. Coloration roux très brillant, avec les antennes, les pièces buccales et les pattes testacées. Téguments glabres et lisses.

Tête petite, étroite, déprimée, avec les sillons frontaux profonds, peu arqués, assez distants l'un de l'autre sur le vertex. Yeux très gros, saillants, environ six à sept fois aussi longs que les tempes. Antennes atteignant presque le milieu des élytres, fines ; l'article V. est à peu près quatre fois aussi long que large ; l'article II. est environ aussi long que le IV. ; les articles X. et XI. sont plus épais que les précédents, le XI. plus long que le X. Pièces buccales peu saillantes. Labre transverse, à bord libre régulièrement arqué. Palpes maxillaires courts, l'avant dernier article glabre, le dernier conique. Dent du menton saillante, arrondie, ni impressionnée ni bifide, au moins à l'examen direct, à sec. Labium non soudé.

Pronotum ample, transverse, plus large que la tête, sa base à peu près de même largeur que le sommet ; côtés arqués en avant, non sinués en arrière ; angles postérieurs obtus, mais vifs ; base rectiligne. Disque du pronotum régulier, modérément convexe, avec une ligne médiane à peine indiquée ; gouttière marginale élargie en arrière ; fossettes basales obsolètes.

Écusson très grand, semicirculaire. Élytres oblongs, très convexes, plus larges que le pronotum. Angles huméraux saillants; gouttière marginale commençant à la racine de la 5^e strie, élargie dans la région humérale. Le bord marginal est sinué en arrière à la terminaison des épipleures. La carène apicale est bien marquée. Striole juxtascutellaire relativement longue. Stries superficielles, mais très fortement et régulièrement ponctuées, effacées à la base et au sommet; la strie suturale seule atteint la base et le sommet; la deuxième strie reste parallèle à la suture jusqu'au sommet, sans trace de crosse ni de déviation; les sixième et septième stries sont réduites à quelques vestiges de points.

Métasternum à peu près de même longueur que le pilier de la hanche postérieure. Pattes courtes; les tibias antérieurs sont lisses, non sillonnés sur leur face externe. Pas d'expansion membraneuse sous-tarsale.

Les trois exemplaires connus sont des femelles.

Chétotaxie.—Lignes orbitaires convergentes en avant. Pores pronotaux normaux. Série discale sur la 3^e strie; série ombiliquée régulière. À l'apex le pore externe est au même niveau que le pore de la 2^e strie.

Cette espèce est tout à fait isolée et ne peut être comparée à aucune des espèces connues.

Chine: Haï-ning, dans la prov. Tché-Kiang (coll. Walker), trois exemplaires.

III. ESPÈCES NÉO-ZÉLANDAISES.

Trechus maori, sp. n.

Long. 5.5 à 5.8 mm.

Peu convexe, élargi en arrière. Coloration testacé rougeâtre brillant, avec les palpes, les antennes et les pattes plus clairs. Téguments glabres, finement alutacés sur la tête.

Tête un peu plus longue que large, suborbiculaire, très déprimée sur le disque; sillons frontaux divergents en avant, profonds et lisses; la distance qui les sépare sur le vertex est plus courte que celle qui sépare l'œil du sillon. Rebord latéral du front effacé en avant des yeux; les tubercules antennaires sont très saillants. Yeux peu convexes, plus courts que les tempes qui sont saillantes, arrondies, nettement séparées du cou. Antennes grêles, atteignant le milieu des élytres; l'article II., très court, n'est pas plus long que la moitié du III.; le IV. est plus long que le II., plus court que le III., les articles suivants sont légèrement élargis, aplatis, tous un peu plus larges au sommet qu'à la base. Labre deux fois aussi large que long, échancré. Palpes glabres, à dernier

article un peu plus long que le précédent. Labium soudé ; sa dent saillante, bifide ; languette carrée.

Pronotum un peu plus large que la tête, un peu plus long que large, plus étroit à la base qu'au sommet. Bord antérieur échancré ; côtés fortement arrondis en avant, puis obliques et profondément sinués en arrière, un peu plus étroits au niveau du fond de la sinuosité qu'aux angles postérieurs ; ceux-ci aigus, vifs, saillants en dehors ; base rectiligne. Disque très peu convexe, surtout en arrière, sa ligne médiane faiblement tracée. Gouttière marginale étroite et régulière ; fossettes basales petites, peu profondes, un peu rugueuses.

Élytres amples, ovales, peu convexes. Épaules à peine indiquées ; le bord huméral est très oblique. Gouttière marginale étroite et régulière, commençant à la racine de la 5^e strie. Toutes les stries sont visibles, profondes, indistinctement ponctuées ; intervalles un peu convexes. Strie suturale réfléchie sur la marge apicale et la carène apicale qui est large avec un sillon interne s'atténuant peu à peu vers l'extrémité de la 5^e strie ; 2^e, 3^e et 4^e stries effacées au sommet.

Métasternum plus court que le pilier de la hanche postérieure. Pas d'ailes. Segments ventraux lisses.

Pattes grêles ; les tibias antérieurs sont droits, sillonnés sur leur face externe. Quatrième article des tarsi portant au bord apical de la face ventrale une apophyse carrée, surmontée d'une large expansion membraneuse atteignant le sommet de l'onychium.

Édeagus petit, très peu arqué, terminé par une pointe mousse. Styles latéraux munis de quatre soies apicales ; sac interne armé d'épines.

Chétotaxie.—Lignes orbitaires divergentes en avant. Pore antérieur du pronotum très petit, sans soie ; il se trouve au tiers antérieur de la gouttière ; pore postérieur absent. Série discale de l'élytre sur la 3^e strie ; le pore basal se trouve au tiers basal de la strie, le deuxième pore un peu après le milieu. Série ombiliquée régulière. À l'apex le pore de la 2^e strie se trouve très éloigné du sommet, bien avant la crosse de la 2^e strie ; le pore apical est très petit ; cette disposition des pores apicaux rappelle celle du *T. obscuricornis*, Putz., du Chili.

Cette belle espèce se distingue de toutes les autres espèces connues du genre par son labium soudé et la forme de ses tarsi.

Nouvelle-Zélande : Greymouth, sur la côte nord-ouest de l'île du Sud (*Helms*, coll. Sharp), quatre exemplaires.

IX.—*Descriptions and Records of Bees.*—LXXXVIII.

By T. D. A. COCKERELL, University of Colorado.

Eucera notata, Lepeletier.

Tangier, Marocco. From Queensland Museum.

Eucera nigrilabris, Lep. (*terminalis*, Sm.).

Ras-el-Ma, Algeria. (Queensland Museum.)

The male cannot be recognised by Friese's key, as he places it in the group with the abdominal hair all grey, which is by no means true of *nigrilabris*. Also from Ras-el-Ma are *E. collaris*, Dours, and *E. eucnemidea*, Dours.

Centris obscuriventris, Friese.

"Guyane, Maroni." From Queensland Museum.

Anthophora urbana, Cresson.

Santa Fé, New Mexico, Aug. 3 (*Cockerell*).

Anthophora flavicollis, Gerst.

Dimbroko, French W. Africa. From Queensland Museum.

Anthophora atroalba, Lepeletier.

♂.—Length about 14 mm., anterior wing 9·3 mm.

Black, with abundant erect hair, not forming distinct bands on abdomen; malar space very short, but distinct; pale yellow marks as follows:—labrum (except basal spots), large triangular mark on clypeus (its sides concave, its upper end pointed), small lateral face-marks (ploughshare-shaped, with a linear extension along orbits to level of middle of supraclypeal area), a narrow transverse supraclypeal band, and broad band on front of scape; mandibles bidentate, entirely black; third antennal joint as long as the next three together; hair of head and thorax pale, yellowish grey on thorax above (the effect rather olivaceous), black hair in middle of mesothorax and on vertex, not conspicuous; face with long white hair, but black at sides; sides of thorax posteriorly with brown-black hair; tegulæ black. Wings hyaline, apical margin faintly brownish. Legs black, with black and white hair; middle basitarsi with a very broad

dense circular fringe of hair, mainly black, but white apically, the hairs longest on posterior side; apical joint of middle tarsi simple, except for a thin outstanding tuft of hair on one side; hind femora and tibiæ with brown-black hair, but the basitarsi with a very conspicuous tuft of pure white hair at end, and the three middle tarsal joints with white hair; hind basitarsi not toothed; first two segments of abdomen with long hair like that on thorax above; the others with long erect black hair, but some white hair laterally.

The specimen described is from Tunis (Le Moul, Queensland Museum).

A male from Bône, Algeria, differs conspicuously in that the apical yellow band of clypeus is very broad, reaching the lateral face-marks, and forming a right-angle with the vertical clypeal mark. One from Tangier, Marocco, is more like the Tunis example. It would be difficult to recognise this insect from the brief account of the male in Friese's '*Apidae Europææ*,' and in his table it seems to run nearest to *A. balearica*, Friese. I therefore give a new description. Lepeletier gave the localities as Oran and the Canary Is. Oran must be considered the type-locality; the Canary Is. material was doubtless *A. alluaudi*, Pérez.

Anthophora nigrocincta, Lepeletier.

Anthophora robusta, Klug.

Both from Ras-el-Ma, Algeria. (Queensland Museum.)

A *Tetralonia ruficollis*, Brullé, comes from the same locality, and a *T. lucasi*, Gribodo, from Tunis.

Anthophora disrupta, sp. n.

♀.—Length about 17 mm.

Like *A. atrocincta*, Lep., except that the appressed rufous pile of the abdomen covers all of the second segment except the extreme base, the pale markings of the head are yellower, the vertical band on clypeus is narrow (not wedge-shaped), and the clypeus is not so high. It may deserve to rank only as a subspecies.

Olokemeji, Ibadan, Nigeria (from Le Moul). Received from Queensland Museum.

Crocisa interrupta, Vachal, comes from the same locality. Also from this locality are four species of *Trigona*, separable thus:—

Extremely minute, length hardly over 2 mm.;	
face without yellow or white markings . .	<i>T. gribodoi</i> , Magr.
Considerably larger	1.

- | | |
|--|-------------------------------|
| 1. Face and front pruinose, but without light markings; base of antennæ red..... | <i>T. tescorum</i> , Ckll. |
| Face with light markings..... | 2. |
| 2. Larger; clypeus pale | <i>T. nebulata</i> , Smith. |
| Smaller; clypeus with a yellow hat-shaped mark..... | <i>T. lendliana</i> , Friese. |

Trigona trochanterica, sp. n.

Worker.—Length 6 mm.

Robust, black, the abdomen dark reddish, more distinctly reddened at sides of second segment, fifth segment with a red patch on each side, and apex pale dull red, with scattered short black hairs; venter clear red. Legs black, with last tarsal joint on each red, and the trochanters for the most part bright ferruginous. Head very large and broad; mandibles black, with an obscure red mark in middle; malar space well developed; face with a greyish-olivaceous pruinosity; scape long, black except at extreme base; flagellum dark reddish, with the first joint black, and the very short second one pale reddish beneath; front entirely dull; vertex with stiff black hair; mesothorax dull, with short fulvous tomentum anteriorly and posteriorly, densest posteriorly; tubercles and the region behind them with fulvous tomentum; scutellum prominent, shining anteriorly, and with short black hair; tegulæ dull ferruginous. Wings yellowish, nervures and stigma ferruginous; hind tibiæ extremely broad, excavated on outer side.

Sandakan, Borneo (*Baker*).

Nearest to *T. erythrogaster*, Cam., but thorax with pale hair. It is superficially like *T. itama*, Ckll., but quite different by the dull front, &c. The red trochanters are peculiar; in *T. nitidiventris*, Sm., the coxæ are similarly coloured.

Trigona fuscibasis, sp. n.

Worker.—Length about 5 mm., anterior wing 6 mm.

Head, thorax, and legs black, with the clypeus (except upper margin), supraclypeal area, labrum, mandibles, and the long scape ferruginous; flagellum ferruginous, dusky above; mesothorax dark chestnut-red; anterior femora and basitarsi in front, small joints of their tarsi and of the others more or less, ferruginous; head broad; face and front with olivaceous pruinescence; head and thorax polished and shining; sides of thorax with brownish tomentum; scutellum with black hair; tegulæ clear ferruginous. Wings dark

fuliginous as far as level of the orange-ferruginous stigma, beyond that milky-white; hind tibiæ fringed with black hair. Abdomen shining dark reddish brown, the apical half blackened, venter pallid towards base.

Sandakan, Borneo (*Baker*, 9964).

Known from *T. apicalis*, Smith, by the black legs. The shiny head and thorax separate it from *T. collina*, Smith.

The distribution of *Trigona* in the Malay region is very extraordinary. From the Philippines we know only three species. Of these, two are from Palawan only. Borneo, on the other hand, has 25 species. More species are known from Penang than from the whole Philippine group. In Borneo, the species appear to be largely confined to limited areas; thus among the numerous species from Sandakan are none of the nine described from Borneo by Cameron. The deficiency of species in the Philippines cannot well be due to lack of material, as Messrs. Baker and McGregor have sent me large collections from those islands. That the Philippine bees are really fairly well known is shown by the fact that a fine collection from Panay, whence no bees had previously come, contained only two new things, a species of *Nomia* and a variety or race of *Megachile*.

Trigona rufibasalis, Cockerell, variety *a*.

Scape red only at base.

Sandakan, Borneo (*Baker*).

Trigona scintillans, sp. n.

Worker.—Length about 3 mm., anterior wing 2·8 mm.

Head, thorax, and abdomen shining black, not hairy; the face with a little pale hair at sides, but not canescent; labrum and mandibles bright ferruginous; scape pale ferruginous in front, flagellum dark; tegulæ very dark reddish. Wings hyaline, stigma and nervures dilute sepia. Legs black, the small joints of tarsi ferruginous. Abdomen broad.

Sandakan, Borneo (*Baker*).

Differs from *T. erythrostroma*, Cam., by the smaller size and the stigma not black. Easily known from *T. atomella*, Ckll., by the narrower head and non-canescant face.

Melipona flavolineata, Friese.

“Guyane, Maroni.” From Queensland Museum.

Trigona clavipes (Fabr.) comes from the same locality.

Euryglossa halictina, sp. n.

♀.—Length about 8 mm.

Only moderately robust, the thorax appearing small in comparison with the abdomen; black, the head and thorax with thin pale hair, the hind margins of the first four abdominal segments narrowly dusky-testaceous; antennæ entirely black; clypeus shining, with sparse rather weak punctures; front and vertex dull; mesothorax dull, with extremely minute punctures; scutellum little more shining, with a depressed median line; tegulæ fuscous basally, with broad testaceous margins. Wings suffused with fuliginous, stigma and nervures fuscous. Legs black. Abdomen with little hair, moderately shining, impunctate.

Bridport, Tasmania, Oct. 26–30, 1913 (*F. M. Littler*, 2560).

Nearest to *E. fasciatella*, Ckll., but the head is not nearly so broad. It looks like a species of *Halictus*. The abdomen is longer and narrower than in *E. subsericea*, Ckll.

Lithurgus scabrosus (Smith).

Yule Island, S.E. Papua, 1915. (Queensland Museum.)

It is presumably this species which Friese has reported from New Guinea as *L. atratus*, Smith.

Dianthidium truncatiforme, Cockerell.

N. Djole, Gabon. (Queensland Museum.)

Megachile lachesis, Smith.

Kaimana, Dutch New Guinea (*H. Elgner*). From Queensland Museum.

Megachile saigonensis, sp. n.

♀.—Length about 14.5 mm.

Agrees with Bingham's description of *M. amputata*, Smith, except as follows:—apical abdominal segments finely punctured all over, not smooth at base; no fulvous fasciæ on abdomen beyond third segment; ventral scopa cream-coloured on first two segments and middle of third and fourth, but broadly black at sides of third and fourth, and black on last two segments; antennæ entirely black. The wings are yellowish smoky, with a small dark cloud beyond

end of marginal cell. Legs red, but hind tarsi black, the basitarsus very broad.

Saigon, Cochin China (from Le Moutl). Received from Queensland Museum.

This is probably a subspecies of Bingham's *M. amputata*, having the clypeus with a median smooth band, slightly depressed, and the mandibles with a subapical fossa. The original *M. amputata*, Smith, from Sarawak, though similar in appearance, was described as having the clypeus keeled, and is related to *M. harrisoni*, Ckll., from Sumatra, and *M. ferruginea*, Friese, from Siam. *M. fulvofasciata*, Rads., from Sikkim, which Bingham placed as a doubtful synonym of *amputata*, is only 10 mm. long, with whitish scopa.

Nomada penangensis, sp. n.

♀.—Length about 4 mm.

Ferruginous, with the front (except a broad red band on each side) and ocellar region black. Abdomen highly polished, without yellow spots, the first two segments broadly dusky apically, the third and fourth darkened all over, but the apex light red; face and pleura with thin pure white hair; mandibles simple; scape testaceous in front; flagellum dark; second antennal joint about half as long as third, third about as long as fourth; mesothorax densely punctured, clear red all over; tegulæ ferruginous. Wings hyaline with dusky apex, nervures and stigma dark; b. n. going a little basad of t.-m.; second t.-c. lacking on right side of type, but the opposite wing has three submarginal cells. The antennæ are quite long, reaching the metathorax.

Island of Penang (*Baker*, 9968).

Resembles some of the Philippine species, but separated by the small size, combined with dark front and entirely red mesothorax. It is especially close to *N. attrita*, Ckll., from Mindanao, and were not the localities so far apart it might be thought a mere variety.

Parasphecodes infrahirtus, sp. n.

♂ (type).—Length about 7.5 mm.

Entirely black, except that the apical half of clypeus (angularly produced in middle above) is cream-colour, the mandibles are fairly red at apex, and the tarsi are dusky ferruginous apically. Head broader than long; face and clypeus roughened, not polished; antennæ long, the flagellum submoniliform; head and thorax with thin long

white hair, but vertex with fuscous hair; mesothorax elevated and gibbous in front, dull anteriorly, polished on disc, with strong scattered punctures; scutellum polished, very sparsely punctured in middle; area of metathorax semilunar, sharply defined, with numerous longitudinal rugæ. Wings slightly dusky, stigma piceous, nervures sepia; second submarginal cell variable in width; hind tibiæ and tarsi with shining white hair on inner side. Abdomen rather short, polished, with the punctures excessively minute, and no hair-bands or patches on dorsal surface; on the ventral side there is a broad band of white tomentum across the middle of the abdomen.

♀.—Length fully 8 mm.

More robust, the broad face wholly black; mesothorax strongly and closely punctured on disc, but scutellum with two large polished impunctate areas; middle and hind tibiæ and tarsi brownish.

Launceston, Tasmania, Sept. 19, 1916 (*F. M. Littler*), two males. The female was taken at Launceston, April 18, 1916.

Much smaller than *P. dissimulator*, Ckll., which it resembles in many respects. The male has a very strong superficial resemblance to *Halictus spenceri*, Ckll.

X.—*A new Shrew and Two new Foxes from Asia Minor and Palestine.* By OLDFIELD THOMAS.

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IN working out some mammals obtained by Major Maurice Portal during the Palestine campaign, and presented by him to the National Museum, I have found the three following forms to need special names:—

Crocidura portali, sp. n.

Most nearly allied to the Central Asiatic species *C. ilensis*; widely different from the European forms of the genus.

Size small, though not excessively so. General colour clear pale grey, rather paler than "drab-grey" if the darker tips to the hairs are included, but it may be better described as "pale drab-grey" overlaid with the fine brown hair-tips which slightly darken it. Under surface creamy white, the

hairs slaty at base, but the slaty quite hidden by the whitish tips, so that the colour is not a mixed slaty and white, as is more usual in shrews; line of demarcation on sides fairly well marked. Hands and feet white. Tail greyish white above, white below, with a fair number of the usual longer bristles.

Skull very like that of *C. ilensis* in its small size and short muzzle. Teeth about as in that species, the incisors less prominent than in *C. russula*.

Dimensions of the type (measured on skin):—

Head and body 57 mm.; tail 35; hind foot 12·5; ear 9.

Skull: condylo-incisive length 17·5; basal length 15·5; greatest breadth 8·3; front of i^1 to back of m^3 7·8; front of p^4 to back of m^3 4·5; tip of i^1 to tip of p^4 4; back of i^1 to front of p^4 1·8; breadth of palate across m^2 5·6.

Hab. Ramleh, S.E. of Jaffa, Palestine.

Type. Adult skin and skull. B.M. no. 19. 4. 11. 9. Collected and presented by Major Maurice Portal.

This pretty little grey shrew has clearly nothing to do with the *C. russula* group, of which a local form—*C. r. judaica*—was described recently. *C. russula* has a much longer muzzle, with larger and more dominant incisors, while in the present form the incisors are comparatively small. *C. ilensis*, a species described by Miller from a specimen now in the British Museum, seems really its nearest ally, and of this, besides the type, we have a considerable series from Djarkent (*Rückbeil*) and Samarkand (*Carruthers*). These, however, all have shorter tails and are of a decidedly darker grey, not unlike that of European *C. russula*.

On the other hand, there have recently been received from Baluchistan, collected by Col. Ernest Hotson, four shrews very similar in proportions to *C. portali*, and, while rather variable in colour, averaging much lighter than *C. ilensis*, one of them, in fact, being of precisely the same pale grey as the type of *C. portali*. These specimens perhaps indicate that this pale shrew will be found to extend right across Persia, but until that country is better explored, this cannot be definitely asserted.

Of older known species none seems to enter into question, as they are mostly larger—at least as large as *C. russula*,—the only doubtful one being *Sorex gmelini*, Pallas, from “Hyrcania,” the country on the S.E. coast of the Caspian Sea. It, however, would seem to be more strongly drabby, *i. e.* as in *russula* and *ilensis*, while its generally insufficient

description has already induced Dr. Saturnin to say that it should be put aside as indeterminable.

No shrew like this is known from Egypt, *C. olivieri* being twice as large, while *C. religiosa* is far smaller and belongs to a wholly different group.

Vulpes vulpes anatolica, subsp. n.

Darker and duller coloured than other foxes of S.E. Asia, the upper surface a more or less muddy reddish brown. Central line of nape and withers washed with blackish. Middle of back (saddle) dull cinnamon-rufous, the usual whitish subterminal rings on the hairs only appearing on the rump. Under surface washed with dull whitish, the hairs broadly slaty basally, the chin and throat blackish slaty. Back of ears deep black. Pale shoulder-patches dull buffy, not conspicuous. Fore legs deep fulvous or blackish, feet fulvous with greyish metacarpal patch. Hind legs dull smoky fulvous, a line down inner side whitish; feet paler fulvous on top, with a darker patch on metatarsus, inner sides buffy whitish. Upper surface of tail dull rufous (nearest to "orange-cinnamon"); under surface pale buffy, with the hairs of the subterminal part washed with black; the extreme end dull white, not forming a conspicuous white tassel.

Dimensions of the type (measured on skin):—

Head and body 650 mm.; tail 335; hind foot 132.

Skull: greatest length 138; condylo-basal length 126; zygomatic breadth 71; nasals 49; interorbital breadth 25; breadth across postorbital processes 31; breadth of brain-case 45.5; height of brain-case from between bullæ 38.5; palatal length 69; length of p^1 on outer edge 12.6; combined length of m^1 and m^2 14; breadth of m^1 11.2.

A male skull, older than the type, measures 134 mm. in condylo-basal length.

Hab. Asia Minor. Type from Smyrna, a second specimen from Marash.

Type. Young adult female (fully developed, but the basilar suture not closed). B.M. no. 6. 10. 16. 2. Original number 57. Collected and presented by W. Griffith Blackler, Esq.

This is a dull-coloured fox, markedly different in general tone from the light-coloured foxes, more or less of a desert type, found to the east and south of its habitat.

It was first obtained by Mr. C. G. Danford, who brought from Marash the skin referred to in P. Z. S. 1880, p. 53. That skin, however, had no skull, and I have therefore taken as type the specimen from Smyrna presented by Mr. Blackler.

Vulpes vulpes palæstina, subsp.-n.

A greyish fox, much greyer than the rufous foxes of Egypt.

The body broadly greyish along the sides, the grey even in some cases extending on the back to the nearly complete suppression of the rufous. Under surface variable, buffy or whitish, with blackish bases to the hairs. Backs of ears deep black. Sides of neck, shoulders, and hips all greyish, the hairs with whitish subterminal rings. Fore legs greyish rufous, varying to fulvous, feet pale fulvous. Hind legs also smoky greyish, the upper surface of the feet buffy, rarely fulvous, their inner sides paler. Tail above buffy washed with blackish, the tip prominently white.

Skull rather smaller than in *V. v. anatolica*, about as in *ægyptiaca*.

Dimensions of the type (measured on the skin):—

Head and body 610 mm.; tail 330; hind foot 123.

Skull: greatest length 125·5; condylo-basal length 123; zygomatic breadth 66·3; nasals 43·5; interorbital breadth 23·2; breadth across postorbital processes 31; breadth of brain-case 44·5; height of brain-case from between bullæ 38; palatal length 62; length of p^4 on outer edge 12·2; combined length of m^1 and m^2 13·5; breadth of m^1 11·4.

Hab. Palestine. Type from Ramleh, near Jaffa. Other specimens from Mt. Lebanon.

Type. Adult female. B.M. no. 19. 4. 11. 8. Collected November 1918, and presented by Major Maurice Portal.

The Palestine fox, although it no doubt grades southwards into that of Egypt (*V. v. ægyptiaca*, Sonnini), is on the average so very much greyer, especially on the sides and limbs, that it should apparently have a special subspecific name. Besides the specimen from Ramleh sent home by Major Portal, the Museum possesses three others from Mt. Lebanon, presented in 1894 by Mr. Saleem Baroodi.

XI.—*Descriptions of Two new Frogs from Brazil.*

By G. A. BOULENGER, F.R.S., F.Z.S.

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THE frogs here described form part of a collection made by Prof. J. P. Hill, F.R.S., at or near Theresopolis during the Percy Sladen Expedition to Brazil in 1913, and the types have been presented to the British Museum by the Trustees of the Percy Sladen Fund.

Leptodactylus pumilio, sp. n.

Tongue oval, entire. Vomerine teeth in short transverse series close together behind the level of the choanæ. Head as long as broad; snout rounded, scarcely projecting beyond the lower jaw, a little longer than the eye; canthus rostralis obtuse; loreal region very oblique, concave; nostril nearer the tip of the snout than the eye; interorbital space much broader than the upper eyelid; tympanum hidden. Fingers with swollen tips, first a little shorter than second, which is one-half the length of third; subarticular tubercles strong. Toes with the tips dilated into small discs, which are longer than broad; no dermal border; subarticular tubercles moderately large, moderately prominent; two small, feebly prominent metatarsal tubercles. The tibio-tarsal articulation reaches the eye; tibia half the length of head and body, as long as the foot. Skin smooth, shiny. Dark brown above, with ill-defined darker spots on the head and body, and cross-bands on the limbs; brownish white beneath, speckled and vermiculate with dark brown.

From snout to vent 20 mm.

A single female specimen.

In the dilated tips of the toes this small frog is related to *L. hylædactylus*, Cope, *L. discodactylus*, Blgr., *L. pulcher*, Blgr., and *L. mantipus*, Blgr., but differs from all of them in the hidden tympanum.

Hyla hilli, sp. n.

Tongue round, entire and slightly free behind. Vomerine teeth in short U-shaped series on round bases, close together between the rather small choanæ. Head small, a little broader than long, feebly depressed; snout rounded, scarcely projecting beyond the mouth, as long as the orbit; no canthus rostralis; loreal region feebly oblique, slightly concave; nostril nearer the tip of the snout than the eye, which is rather small; interorbital space as broad as the upper eyelid; tympanum very distinct, $\frac{2}{3}$ the diameter of the eye. Fingers rather short, $\frac{1}{3}$ -webbed, the discs moderately large, a little smaller than the tympanum; no distinct rudiment of pollex. Toes rather short, entirely webbed, the discs nearly as large as those of the fingers. The tibio-tarsal articulation reaches the shoulder; heels overlapping when the limbs are folded at right angles to the body; tibia a little less than $\frac{1}{2}$ the length of head and body. Skin smooth above, with a few very small warts on the head; large flat granules on the throat, on the belly, and on the proximal half of the lower surface of the

thighs. Reddish brown above, with dark brown dots and the following principal blackish markings:—a blotch capping the tip of the snout, a curved band from the nostril to the eye, a cross-band between the eyes, a vertical bar below the anterior third of the eye, a temporal band, two oblique bands (one behind the other) on each side of the body, and cross-bands on the limbs; upper lip behind the black vertical bar, flanks, and lower parts white; a black crescent at the axil and another at the groin; back of thighs colourless, black-edged above.

From snout to vent 33 mm.

A single female species.

This frog, remarkable for its very short hind limbs, appears to be related to *H. melanargyrea*, Cope, from Mato Grosso, which differs in the tibio-tarsal articulation reaching the eye, as well as in other respects.

XII.—*Protoscolex latus*, a new "Worm" from Lower Ludlow Beds. By F. A. BATHER, F.R.S.

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THE genus *Protoscolex* was founded by E. O. Ulrich in July 1878 (Journ. Cincinnati Soc. Nat. Hist. i. p. 89). Since the paper is rare, his generic diagnosis may be quoted in full:—

"Body ranging from a medium to a great length, of nearly uniform width throughout its length; body divided transversely by more or less narrow, simple or papillated segments. Anterior and posterior ends obtusely pointed, and, probably because the specimens are fossil, are not distinguishable from each other. No setæ or appendages of any kind."

This was followed by the description of four species—*P. covingtonensis* (the genotype), *P. ornatus*, *P. tenuis*, and *P. simplex*. All were found south of Covington, Kentucky, associated with the polyzoa now known as *Arthrostylus tenuis* (James) and *Arthropora shafferi* (Meek), also with *Serpulites dissolutus*, Billings. The stratum is now referred to the Economy formation in the Eden series, that is, Lower Cincinnati, just above the horizon of the Utica shale.

One other species has since been described, namely, *P. magnus*, by Miller and Faber in July 1892 (*op. cit.* xv. p. 83). This was found in the Fulton formation of the Eden series, corresponding to Utica shale, in Cincinnati.

The American horizons are near the top of the Ordovician, and correspond approximately to our Lower Ashgillian.

The original generic diagnosis is expressed in vague terms, and needs interpretation with aid of the figures and descriptions of the species. The actual length observed varies from $1\frac{1}{8}$ inch (say, 28 mm.), as in a young *P. covingtonensis*, to 6 inches (say, 152 mm.) in an example of *P. tenuis*. The actual width observed in the compressed fossils varies from "one fourth of a line" (say, 0.5 mm.), in the smallest *P. tenuis*, to about 2 mm., as seen in the figure of *P. simplex*.

Owing to the incompleteness of most of the specimens, the ratio of width to length cannot be calculated with certainty. It is, however, possible to calculate the relative height of the segments, on the basis of such measurements as are provided, though these are not very precise:—

	Absolute height of segment.	Ratio to width.
<i>P. magnus</i>	0.12	10/100
<i>P. ornatus</i>	0.23	12/100
<i>P. covingtonensis</i>	0.15	15/100
<i>P. simplex</i>	0.5	33/100
<i>P. tenuis</i>	0.5	50/100

The nature of the segmentation is not clear. Ulrich's figure of *P. simplex* (*op. cit.* pl. iv. fig. 4) probably represents the "complete individual" mentioned on p. 91. This has a length of about 19 mm., a greatest width of 2.7 mm., and tapers rapidly at each end. The drawing shows thirty-two segments, and, since the specimen is bent round so that one end almost approaches the other, these segments are lower on the inner side of the curve than on its outer, and the draughtsman has represented them as imbricating. This important feature is not alluded to in the text, nor is it suggested or mentioned under any other species. It would, of course, be particularly obvious in a form with the high and well-marked segments of *P. simplex*.

The segments are papillate in *P. ornatus* and *P. magnus*; in all other species, including the genotype, they are described as smooth. In *P. ornatus* the papillæ form either one row in the median line of a segment or one row near each border of a segment. Ulrich's enlarged figure 1b shows about twelve papillæ in each row, all closely set; that means about twenty-five in the complete circle of each segment. In *P. magnus* "each segment is ornamented with a single row of six or eight papillæ" (*i. e.*, twelve to sixteen in the complete circle).

We pass now to the first record of the genus from this side of the Atlantic, and the first occurrence outside the Ordovician.

Protoscolex latus, sp. n.

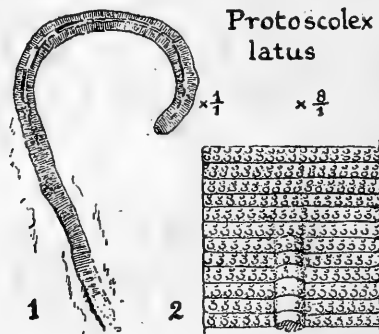
Diagnosis.—Segments bear each one or two rows of papillæ, of which not more than twenty are visible on one side of the compressed fossil. Spaces between papillæ not less than the diameter of a papilla. Height of a segment about 0.25 mm. Width of specimen about 3 mm. Ratio of segment-height to width 8/100.

Holotype.—A specimen collected by Dr. H. L. Hawkins, and presented by him to the British Museum: Geol. Dept. A. 1946.

Horizon.—Lower Ludlow, just above the Starfish bed.

Locality.—Martin's Shell, below Mocktree, near Leintwardine, Herefordshire.

This specimen (fig. 1) presents many features of interest other than those due to its remoteness in time and space from the species previously described. It is preserved in counterpart as two imprints, but some of the substance of the integument remains here and there as round calcified knobs, apparently where the wall was thickened by papillæ. The chemical composition of these knobs is unknown, and may be due to petrification of a chitinoid substance.



The specimen lies in a curve shaped like the head of a 2. Its outline is not very clear-cut as seen under a lens. The diameter is about 3 mm. in the upper part of the ascending stem of the 2; towards the end of the curve it lessens gradually to 2.3 mm., then suddenly tapers or rounds off like the end of an earthworm. Towards the lower end of the stem of the 2 the width gradually lessens to 2 mm., and then the fossil seems to fade away into the matrix, both outline

and ornament becoming obscure. The total length is 69 mm. (about $2\frac{3}{4}$ inches). It is thus seen that, though the length is no greater than the mean length of the American specimens, the absolute width is half as much again as in the widest of them; hence the trivial name proposed.

The segments (fig. 2) are not very convex, but they are separated by well-defined grooves, and—as a rule, at any rate—each bears two lines of papillæ. This at first sight gives the appearance of two segments, but the median groove between the lines of papillæ is less marked than that between the segments. In each segment it is frequently the case that one line of papillæ is stouter than the other, so that there is an appearance of alternately large and small segments, much as in a crinoid stem with alternating columnals. If the feebler line of papillæ became still slighter or were pushed under the next segment, then the appearance would be that of equal segments each with a single line of papillæ. Such is actually the appearance towards the ends of the specimen, which therefore in this respect agrees with *P. ornatus*. In *P. magnus* only one line of papillæ to the segment has been observed throughout.

No definite arrangement of the papillæ in longitudinal series, either linear or alternating, is immediately obvious; but where the segments are least disturbed and the papillæ most orderly there is a suggestion of oblique lineation, and this would probably be plainer if the two lines of papillæ were of equal strength.

Where the segments are clearly seen, and the two lines of papillæ fully developed, about four segments occupy 1 mm., so that the height of twelve segments equals the width of the specimen, *i. e.*, a ratio about 8/100. The absolute height of the segments agrees fairly with that stated for *P. ornatus*, but the relative height is less than that of any species, the next in order being *P. magnus*. The total number of segments in the individual is about 275. Correlated with the greater width of the specimen is the increased number of papillæ in a line—namely, from eighteen to twenty on one side of the compressed tube, which is half as many again as in *P. ornatus*, three times as many as in *P. magnus*.

The most noteworthy feature of this specimen is a thickening along the median line, extending through the whole curved head of the 2 to within 2.5 mm. of its end, and reaching down the stem to a point about 23 mm. from the other end. On the imprint, in each counterpart, this thickening appears as a groove, about 0.5 mm. wide, and of roughly semicircular section. In some places the bottom of

the groove is relatively smooth, in other places the segmental markings and papillæ are clearly seen to run across it. The apposition of these two grooves would form a tunnel of circular section; but before the sandstone was split open this tunnel was filled with a hardened mud of very fine grain and a pale grey colour. The appearance is most easily explained by regarding it as the gut of a mud-eating worm; the muddy core, of which considerable stretches are retained in one or the other counterpart, is the remains of the animal's last meal; the smooth lining of the groove, occasionally preserved, is the thin wall of the gut; the groove itself, seen as a ridge in a wax squeeze, represents the outer skin of the animal raised in a fold over the full gut (fig. 2). As a rule, the core is marked by slight constrictions into segments corresponding with those of the integument, and perhaps due to pressure from the inturned walls of the segments. The surface between the segmental constrictions may be smooth or marked by elevations corresponding with the papillæ of the integument. In some places the calcified substance of the papillæ is still attached to these segments of the gut, instead of to the outer skin. There are occasional slight longitudinal ridges, indicating folds in the wall of the partly-filled gut, due to pressure.

The gut itself was not confined to the region of the fossil now marked by a groove or its core, for a darker tract indicates its former extension down the stem of the 2, though it is impossible to say how far it went.

This gut-structure has not been mentioned as occurring in any Ordovician species, but Ulrich's figure of *P. simplex* shows a dark line or groove down the middle, and there is some slight suggestion of the same marking in the complete figure of *P. ornatus*. The importance of the gut lies in its confirmation of the view that these fossils were worms of some kind. The apparent tapering towards each end, as observed in many of the specimens, indicates that they were free-moving forms; unfortunately no distinction between the ends has yet been detected.

Hitherto the opinion as to the systematic position of *Protoscolex* may be expressed in the words of Miller and Faber (1892). After giving reasons, drawn chiefly from the mineral character and state of preservation, against the fossils being crinoid stems (some of which in many respects they so closely resemble), they add:—"We have no evidence to offer to show that they represent the tubes of Annelida, but probably

they do, and as we cannot class them anywhere else, we leave them where others have placed them."

The question remains: What sort of "Annelida"? Most fossil worms are referred to the Chætopoda. But if they are not Tubicola, then they should show chætæ or parapodia, and one would expect some cephalization or other differentiation into body-regions, such as occurs even in the somewhat similar Capitellidæ. The fossil called *Protoscolex* is not a tube either built or secreted, but must be the imprint of the actual integument. It shows no trace of chætæ or parapodia, and there is no other reason for referring it to the Polychæta. Whether the segmentation is complete or whether it is confined to the integument cannot at present be decided; the segmented appearance of the gut is capable of both interpretations. The straight simplicity of the gut excludes the Gephyrea, some of which present a superficial resemblance in the distribution of epidermal papillæ, and in a tendency to calcification as expressed in the calcareous plates of some Sipunculids. My colleague, Mr. H. A. Baylis, has tentatively suggested comparison with a Nematode, and tells me that two genera of recent Nematoda have backwardly-pointing spines on the hinder edge of the cuticular rings. That, however, is no great resemblance, and the creatures in question are parasitic. *Protoscolex* also bears some likeness to millepedes; but none of the fossils has shown any trace of appendages, and the segmentation is much closer than in any known millepede.

It is to the Oligochæta that *Protoscolex* presents the strongest resemblance. The general shape, the close and undifferentiated annulation, and the long simple gut are all suggestive of that order. The apparent absence of a clitellum is by no means fatal, for that structure is less differentiated in the lower Oligochæta, is very slightly developed in the primitive *Moniligaster*, and in most aquatic Oligochæta appears only periodically. Therefore in *Protoscolex* it may not have reached such a stage of evolution as to be discernible in the fossils, or the animals may have perished out of the breeding-season. The very fine setæ of the Oligochæta would, of course, be invisible in any fossil of this kind and size. It is, however, legitimate to suggest that the papillæ of certain species stood in some relation to setæ: either they bore one apiece, or they represent the incipient stages of setæ. In the adult of modern oligochætes the setæ are chitinoid rods embedded in invaginations of the epidermis; but they first appear as small cones of chitinoid substance, growing first at

their apices or free ends. If *Protoscolex* was setiferous, it follows that the setæ were disposed as in the Perichætidæ, and this is what one would expect. The double rows of papillæ may be compared with the secondary annulation occasionally found in modern forms, and so present no difficulty.

It may be objected that the Oligochæta, especially the group to which the Perichætidæ belong, are normally terrestrial or, at most, inhabitants of fresh water. There is, however, à priori reason to suppose that terrestrial oligochætes were derived from aquatic, and ultimately marine, forms. The primitive *Phreoryctes* lives both in water and on land. It is among the Microdrili, with less pronounced clitellum, that most aquatic species are found. Thus, some of the Tubificidæ (e. g., *Clitellio* and *Vermicululus*) and various Enchytræids are marine or littoral. Among the Megadrili there are, at any rate, three marine genera—*Pontodrilus*, *Acanthodrilus*, and *Pontoscolex*.

The rarity of Oligochæta among fossils may be explained as due to their softness and easy decomposition. The hypothetical primitive forms of marine habitat would probably have been less easily preserved than the familiar earthworm. The palæontologist has to rely on an occasional lucky chance, such as the blow that for the first time exposed a *Protoscolex* in the long-exploited beds of the Lower Ludlow formation. So soon as the Oligochæta took to fresh waters, swamps, and the land, their opportunities of leaving an imperishable record were further restricted.

The only fossils that anyone has hitherto proposed to refer to the Oligochæta are "fünf braune Abdrücke, welche höchst wahrscheinlich den Ringelwürmern angehören," found in the *Noeggerathia* beds of the Coal Measures near Rakowitz, Bohemia, and described as *Pronaidites carbonarius* by J. Kušta (1888, Sitz.-ber. böhmisch. Gesell. Wissensch., Math.-nat. Cl., Jahrg. 1887, p. 561, pl. fig. 1). The length is a little over 10 cm., diameter 0.5 mm. to at most 2 mm., segments (in the holotype, which is 1.5 mm. wide) about 0.5 mm. high. All specimens are bent, curved, or even twisted. The side-contours are not very sharp. Towards one end of the holotype a canal runs down the middle of the body; its width is not stated, and it does not appear in the figure.

In all the given details *Pronaidites* agrees with *Protoscolex*, and the measurements of the segments are the same as in *Protoscolex simplex*. Papillæ are not mentioned, but neither are they recorded for *Protoscolex simplex*, *P. tenuis*, or the genotype *P. covingtonensis*. The reference of *Pronaidites carbonarius* to *Protoscolex* is therefore inevitable.

It is, however, to be noted that, whereas the Ordovician and Silurian species of *Protoscolex* are associated with marine organisms in deposits of admittedly marine origin, *Protoscolex carbonarius* is associated with various arachnids, insects, and a millepede, in a deposit of presumably fresh-water, or possibly brackish-water, origin.

Beddard (1895, Monogr. Oligochæta, p. 9) says of *Pro-naidites* that "it is not by any means convincingly an Oligochæt." At the same time he brings forward no counter-arguments, except in so far as he seems to suggest that, if it were, then it would support the view that Oligochæta were derived from the Polychæta by way of such forms as the Tubificidæ—a view with which he disagrees. Beddard's argument in the paragraph quoted depends on the distribution of the setæ, but he can have known nothing about the setæ of *P. carbonarius*, and must therefore have connected it with the Tubificidæ simply on account of its habitat. If, however, the papillæ of other species of *Protoscolex* justify the conclusion that the setæ were arranged as in Perichætidæ, then the question assumes a totally different aspect.

Beddard's own view is that the perichætous arrangement of setæ is the primitive one, and for this view *Protoscolex* does seem to furnish that palæontological evidence the absence of which he deplored. So far as the known structure of *Protoscolex* permits of a decision, there is no reason why the genus should not be referred to the Perichætidæ. It might, however, be too hazardous an inference to suppose that this family of recent earthworms had true representatives in the Ordovician sea, and it is more probable that *Protoscolex* was nearer to the hypothetical Archichætopod from which the Phreoryctidæ, Moniligastridæ, Enchytræidæ, and Perichætidæ originated. It is already a good way removed from anything that could be called an Archannelid.

Fortunately it has been possible to submit this instructive specimen of *Protoscolex latus* to Dr. Beddard and to Professor Seitaro Goto of Tokyo, and each has independently expressed the opinion that it closely resembles a modern perichætid. The preceding speculations have therefore the sanction of good authority. At the same time they are speculations; other interpretations are possible, and it may be safest to summarize only the certain facts in the following

Revised Diagnosis of Protoscolex.

A worm-like marine organism, probably cylindrical, tapering rapidly at each end; length from about 25 mm. to 150 mm.; width in the compressed fossil from 0.5 to 3 mm.

Body flexible, covered with a stout cuticle, divided into from 200 to 300 equal segments, which are often (? always) papillate, but bear no appendages or visible setæ. Gut simple, straight, apparently slightly segmented (traced from within 2.5 mm. of one end to within 20 mm. of the other end in an individual 69 mm. long).

The species herein discussed are :—

- P. magnus*, Miller & Faber. Upper Ordovician, Fulton Formation, Cincinnati.
P. covingtonensis, Ulrich (genotype). Upper Ordovician, Eden Formation, Kentucky.
P. ornatus, Ulrich. Upper Ordovician, Eden Formation, Kentucky.
P. tenuis, Ulrich. " " " " "
P. simplex, Ulrich. " " " " "
P. latus, sp. n. Upper Silurian, Lower Ludlow, Herefordshire.
P. carbonarius (Kůsta, sub *Pronaidites*). Upper Carboniferous, *Noeggerathia* beds, Bohemia.

XIII.—On a new Commensal Prawn.

By L. A. BORRADAILE, M.A.

A SHORT time ago I received, by the kindness of Mr. W. L. Schmitt, of the United States National Museum, four specimens, one an ovigerous female, of a new member of the ubiquitous subfamily Pontoninæ. They were collected at Beaufort, N.C., where they are said to be abundant on the "sea-feathers" close to the Island. The following diagnosis sets forth the distinguishing features of the species to which they belong :—

Periclimenes beaufortensis, sp. n.

Diagnosis.—Body rather stout, not compressed; rostrum about $\frac{3}{4}$ length of carapace, almost or quite reaching end of first joint of antennular stalk, straight, slender, very sharp-pointed, without teeth, but with a low crest above in its hinder part; antennal, but not hepatic or supraorbital, spines present; cornea subhemispherical, of moderate size; antennule with well-developed spines at base and at end of first joint, third joint about one-third length of first, second about two-thirds length of third, inner flagellum about half as long

again as stalk, outer flagellum very slightly longer than inner, its thickened part rather more than a third of its whole length, cleft less than halfway; antennal scale broad, considerably outreaching antennular stalk, rather acutely pointed, with the spine of the outer edge set back about a quarter of the length from the end, antennal stalk reaching end of first joint of antennular; second and third maxillipeds without exopodites; third maxillipeds moderately slender, reaching a little beyond origin of antennal scale; legs of first pair a little outreaching antennal scale, with wrist very slightly shorter than hand, and fingers straight, simple, sharp-edged, and sharp-pointed, bearing a few bristles at the end; legs of second pair unequal, the larger reaching nearly as far as the antennular flagella, with long, almost rectangular palm, a little swollen towards the base, simple fingers, not quite half length of palm, bearing a few hairs at the tips, wrist simple, unarmed, about half length of fingers, arm simple, unarmed, about three-quarters length of palm; walking-legs stout, subequal, the first pair reaching nearly to the end of the first chelipeds, unarmed save for a movable spine near end of each propodite and some stout bristles, with a swelling on the underside of the meropodite near its distal end, and a slight projection of the base of the dactylopodite, which is short, stout, and rather strongly hooked; sixth abdominal segment longer than fourth and fifth together, about as long as telson; endopodites of uropods a little longer than telson, shorter than exopodites; telson tapering, truncate, with the intermediate pair of terminal spines very strong.

Colour in life "almost transparent except the ovigerous females, which are pigmented according to the gorgonian on which they live, orange, lemon-yellow, or almost red."

Length .5-7 mm.

Type-specimens in the U.S. National Museum.

The affinities of the species are not very clear. Its simplicity of form and the almost complete absence of spines from its rostrum, trunk, and limbs seem to point to a relationship with *P. aurantiacus* (Dana), 1852, and, if this suspicion be confirmed, we have in *P. beaufortensis* a second member of the subgenus *Ensiger*; but until more is known about *P. aurantiacus* nothing can be said with confidence upon the subject.

XIV.—*A Description of the Copepod *Cylindropsyllus brevicornis*, Van Douwe, and of a new Species of *D'Arcythompsonia*, Scott.* By ROBERT GURNEY, M.A.

[Plates V.-VII.]

CYLINDROPSYLLUS BREVICORNIS was first described by Van Douwe from two male specimens taken in brackish water at Greifswald, and a single female was found by Brehm in 1914 in a collection made in fresh water at Sebenico in Dalmatia. In neither case did the material permit of the publication of a full description, and as I have had the opportunity of examining a number of specimens, and have come to the conclusion that a new genus should be formed for its reception, I think it advisable to give a further account of it with figures.

HORSIELLA, gen. nov.

Body vermiform, the abdomen not distinct from the thorax. Genital segment partly or wholly divided into two. First pair of antennæ short, with few joints. Second pair three-jointed, without external ramus. Mandible without external ramus. Maxillipedes absent. Swimming-legs alike in both sexes, the internal rami of two and the external of three joints. Fifth pair of legs minute, one-jointed.

A comparison of the single representative of this genus with *Cylindropsyllus* shows very striking differences in structure, particularly with regard to the swimming-legs, *HorsIELla* approaching in this respect more nearly to the genera *Leptocaris* and *D'Arcythompsonia*. It differs from these two genera and also from *Cylindropsyllus* in the absence of the external ramus of the second pair of antennæ and of the mandibles, and in the absence of the maxillipedes.

HorsIELla brevicornis (Van Douwe). (Pls. V. & VI.)

Cylindropsyllus brevicornis, Van Douwe, Zool. Anz. xxviii. 1905, p. 437; Brehm, Zool. Anz. xliii. 1914, p. 337.

Shape of body cylindrical and vermiform, as in *Cylindropsyllus*; the first segment of the thorax marked off from the head by a slight dorsal groove extending partly down the sides. Integument thin and without markings. The genital segment is completely separated into two in the male, but in the female the line of division does not extend across the ventral surface. The fifth abdominal segment is twice as

long as the preceding segment in the female. Anal operculum not prominent, and without spines. The furcal rami are twice as long as they are broad, with a large apical seta which is nearly one-third the length of the body. All the segments of the body are smooth, without spines, but there are groups of exceedingly minute cilia on the ventral side of the abdominal segments (Pl. V. fig. 1) and a pair of minute setæ on the dorsal margin of each (Pl. V. fig. 3).

The first antenna (Pl. VI. fig. 1) of the female is short and consists of five joints, the first two being thicker than the remainder and forming a distinct basal part. The third and fourth joints are short, the fourth bearing a thick æsthete extending far beyond the end of the antenna. The distal joint is as long as the third and fourth combined, and armed at its apex with two setæ and an æsthete, the latter springing from the same base as one of the setæ. In the male the antenna is not geniculated and appears to be composed of two joints only, since the two basal joints are fused, and the remaining joints are only partially distinct. Viewed from above, the last three joints appear completely fused, the long æsthete springing from the edge of a peculiar notch, which probably serves as a hook for grasping the female (Pl. VI. figs. 11, 12).

The second antenna is the same in both sexes and consists of three joints (Pl. VI. figs. 2, 3). The second joint bears two small setæ in place of the external ramus, which is absent. I have seen one specimen in which this joint, in both limbs, bore a long blunt-pointed seta (Pl. VI. fig. 3). The distal joint is armed with five or six strong claws and a pair of setæ which spring from the same basis. One of these setæ has a bifurcated tip, and in some specimens there appears to be a hyaline prolongation with a bead at the end similar to the æsthetes of the antennæ of *Cladocera*.

The mouth-parts (text-fig. 1) consist, as in *Cylindropsyllus*, of three pairs of appendages only, the maxillipedes being absent. In *C. lævis* there are a pair of minute triangular plates behind the second pair of maxillæ which, as Prof. Sars suggests, may represent the maxillipedes, but there is no trace of them in *Horsiella*. The mandible consists of a large quadrangular base and a slender chewing part with three or four blunt teeth, no trace of an external ramus being found. The first maxilla has a two-jointed palp and a single broad terminal lobe armed with three teeth and a few spines. The second maxilla is two-jointed, the basal part bearing, in place of the usual setigerous lobes, a single finger-like process with a comb of minute hook-like spines. The second

joint carries two large spines reaching forward nearly to the mouth.

The mouth-parts are overhung by a large anterior lip with a toothed edge. I have not been able to detect the presence of a bilobed posterior lip as shown by Prof. Sars in *C. laevis*, but there is a delicate flap or epistome bounding the mouth anteriorly and fringed with short cilia.

The first four pairs of legs are of approximately the same structure in both sexes, consisting of an external branch of three joints and an inner two-jointed branch as long as the first two joints of the outer branch. The first pair (Pl. VI. fig. 4) is the shortest, and the succeeding pairs increase somewhat in length, the fourth being considerably longer than the first pair. The external branches of all legs are alike, except that the third and fourth pair bear an additional seta on the apical joint. The internal branch of the first pair is alike in both sexes. The first joint bears a long seta with a blunt point fringed with cilia, which, in its normal position, is directed forward, reaching nearly to the mouth. The distal joint bears a spine and a long seta. In the female the internal branches of the remaining swimming-legs are alike, but differ from the first pair in having the long sensory seta upon the base of the second joint and in having two apical setæ (Pl. VI. figs. 5, 6). In the male the apical setæ are as in the female, but, in place of the long basal seta of the second joint, the second and third legs have a peculiar sharply-pointed spine with a small barb (Pl. VI. fig. 9). The basal seta of the fourth leg is similar to that of the female, but longer and very much stouter (Pl. VI. fig. 10).

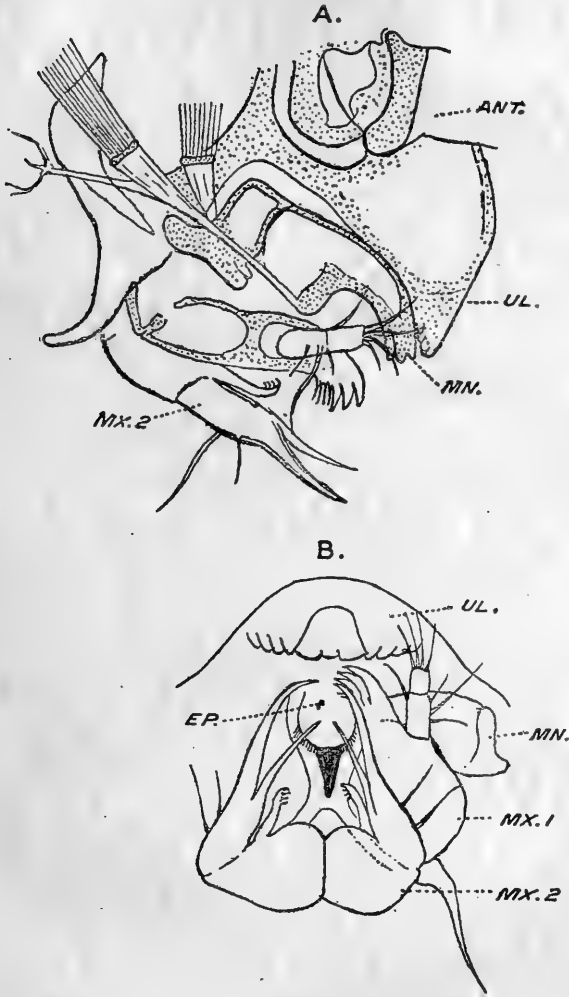
The fifth pair of legs in both sexes are minute knobs bearing two short spines in the female and four in the male (Pl. VI. figs. 7, 8).

I have not seen any female bearing egg-sacs, but on one occasion a female which had been kept alive for a few days was found to be carrying a single egg attached to the genital segment by a slender stalk. The egg was soon burst and flattened by the movements of the animal under the cover-glass.

Length. Female .56 to .65 mm.; male .6 mm.

I owe the discovery of this species to Mr. D. J. Scourfield, who suggested to me that the submerged parts of dead *Scirpus* and *Typha* might harbour peculiar Entomostraca. The first specimen met with was found on July 14, 1919, in a small piece of dead *Typha* floating in Hickling Broad, and by squeezing such decayed stems, I have found that it is not

Fig. 1.



Mouth-parts: A, side view; B, ventral view.

UL., upper lip; *EP.*, epistome; *MN.*, mandible; *MX. 1*, first maxilla; *MX. 2*, second maxilla.

uncommon in Hickling Broad and Horsey Mere where the water is slightly brackish*. It is probably widely distributed in the Norfolk Broads District wherever there is a trace of salt in the water, since I have also found it in Barton Broad and in the River Ant below Irstead. It also occurs in Calthorpe Broad, which is a very small Broad, not connected with the river, in which the water is, I believe, quite fresh. I have failed to find it in Sutton, South Walsham, and Ranworth Broads.

Mr. Scourfield has sent me a sketch of an Harpacticid found by him at Littlehampton this year which undoubtedly belongs to this species, so that it is probable that it is generally distributed in brackish water wherever the vegetation provides a suitable habitat. I have found it in the decaying leaves of *Sparganium ramosum* and *Scirpus lacustris*, but it seems to prefer to live under the leaf-sheaths of the dead stems of *Typha angustifolia*. I have not hitherto been able to make any observations on its life-history, since I have only once seen an egg-bearing female and have met with only two immature individuals, both of these being in late Cyclopid stages. It seems probable that the eggs are not carried in egg-sacs, but are laid freely, and that possibly reproduction is mainly confined to the spring or early summer. Against this supposition is the fact that the males always have developed spermatophores in the vas deferens.

D'Arcythompsonia scotti, sp. n. (Pl. VII.)

Body similar in shape to *D. fairliensis*, Scott, with soft cuticle without markings. The anal operculum of the female is scarcely prominent and somewhat pointed, while that of the male, as in *D. fairliensis*, is deeply cleft and projects as a pair of conspicuous hooks (Pl. VII. fig. 10). The furcal rami in both sexes are tapering, not contracted at the end as in *D. fairliensis*, with a single large terminal seta which is not jointed as it is in *Cylindropsyllus levis*. The second abdominal segment of the male has a median sucker-like projection on the dorsal surface, which appears to be crowned with a striated horseshoe-shaped membrane (Pl. VII. fig. 11).

The first antenna in both sexes consists of six joints, with no marked division between basal and distal parts, the large aesthete being borne by the third joint in the female and by the fourth in the male. In the latter the fourth joint

* The salinity is very variable, ranging from about 40 to over 70 grains of chlorine as chlorides per gallon.

is much dilated and deeply notched. The second antenna is three-jointed, the third joint bearing six strong spines and a single long spine-like seta (Pl. VII. fig. 1). The external ramus is reduced to a small knob bearing a single seta. The mouth-parts are as in *D. fairliensis*, consisting of mandibles, two pairs of maxillæ, and a pair of maxillipedes. The mandible bears a one-jointed palp with two setæ (Pl. VII. fig. 2). The maxillipedes are well developed and appear to agree with those of *D. fairliensis*, as figured by Prof. Sars.

The swimming-legs are almost the same in both sexes, and are less slender than in *D. fairliensis*. In the first pair (Pl. VII. fig. 3) the second basal joint bears a strong spine on its inner angle, which is absent from the succeeding legs. In the male (Pl. VII. fig. 4) this spine is curved and slightly barbed. The internal rami of all legs are two-jointed, nearly as long as the external branch, but they differ somewhat in the different legs in respect of the setæ borne by them. The internal rami of the third and fourth pairs of legs of the male differ from those of the female in having the inner spine of the second joint considerably longer, and in having a long spine springing from the middle of the first joint of the fourth leg in space of a short apical spine.

The fifth pair of legs are the same in both sexes, consisting of small knobs bearing each a small lateral seta and three terminal setæ of which the middle one is very small (Pl. VII. fig. 12).

Length. Female 1.15 and 1.3 mm. ; male 1.2 and 1.45 mm.

The specimens described above form part of the Norman Collection in the British Museum (Natural History), and are labelled "*Cylindropsyllus lævis*, E. Loch Tarbert, Loch Fyne, 1886, T. Scott." (B.M. nos. 45248-252). I have to express my thanks to Dr. W. T. Calman and the authorities of the Museum for allowing me to examine them.

The species differs from *D. fairliensis* in the form of the furcal rami of the female, in the structure of the antennæ, and in certain details of the length and arrangement of the setæ of the swimming-legs.

EXPLANATION OF THE PLATES.

PLATE V.

Horsietta brevicornis (Van Douwe).

- Fig.* 1. Female, ventral view.
Fig. 2. Male, dorsal view.
Fig. 3. Male, lateral view.

PLATE VI.

Horsiella brevicornis (Van Douwe).

- Fig. 1. First antenna of female.
 Fig. 2. Second antenna of female, seen from the inside (the setæ of the second joint are seen through).
 Fig. 3. Second antenna of female, from outside.
 Fig. 4. First leg of female.
 Fig. 5. Second leg of female.
 Fig. 6. Fourth leg of female.
 Fig. 7. Fifth pair of legs of female.
 Fig. 8. Fifth pair of legs of male.
 Fig. 9. Internal ramus of second leg of male.
 Fig. 10. Internal ramus of fourth leg of male.
 Fig. 11. First antenna of male from the side.
 Fig. 12. First antenna of male—last two joints seen from inside.

PLATE VII.

D'Arcythompsonia scotti, sp. n.

- Fig. 1. Second antenna of male.
 Fig. 2. Mandible palp.
 Fig. 3. First leg of female.
 Fig. 4. First leg of male (rather more magnified).
 Fig. 5. Fourth leg of female.
 Fig. 6. Last two joints of external branch of third leg of female.
 Fig. 7. Second leg of male.
 Fig. 8. Fourth leg of male.
 Fig. 9. Last abdominal segment and furca of female.
 Fig. 10. Operculum and furcal ramus of male.
 Fig. 11. Protuberance of dorsal side of second abdominal segment of male. Seen from side.
 Fig. 12. Fifth leg of female.
 Fig. 13. Second leg of female.

XV.—*The Generic Positions of "Mus" nigricauda, Thos., and woosnami, Schwann.* By OLDFIELD THOMAS.

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WHEN dividing, some years ago*, the African members of what is now called *Rattus* into subgenera, I only dealt with the large and prominent groups of species, leaving isolated forms for further consideration. My attention has now, however, been called to a species which was one of the first I ever described †, "*Mus nigricauda*," based on a single Namaqualand specimen that has more recently been reinforced by a number collected by Dr. Ansorge and Mr.

* Ann. & Mag. N. H. (8) xvi. p. 477 (1915).

† P. Z. S. 1882, p. 266, pl. xiv. fig. 1.

Woosnam, so that we are now enabled to make a better study of the animal. In addition, excellent notes on the habits have been made by Mr. Heller, who obtained in East Africa his "*Thomomys loringi*," a form undoubtedly—as Mr. Hollister has shown*—very closely allied to *nigricauda*.

On using my key to the subgenera, one finds that it is with *Æthomys* alone that *nigricauda* needs comparison, and on making this I come to the conclusion that its specializations for an arboreal life are, undoubtedly, of sufficient importance to render it worthy of superspecific distinction. Moreover, since there is complete discontinuity, I think it most convenient to make a genus for it, rather than a subgenus of *Rattus*.

This may be called:—

THALLOMYS, gen. nov.

Genotype, *Thalomys nigricauda* (*Mus nigricauda*, Thos.).

Other forms described: *loringi*, Hell.; *kalaharicus*, Dollm.

External form modified in the way usual in arboreal forms, *i. e.* with the feet comparatively shortened, with large pads and comparatively long fifth digits, and with the tail profusely pencilled throughout, quite different from the nearly naked tail of *Æthomys* and other terrestrial rats, while even the blackish line through the eyes so characteristic of many arboreal rodents is here again present. Mammæ 0—2=4.

Skull essentially as in *Æthomys*, the bullæ unusually large.

Upper molars with the cusps high and well marked, the valleys on each side of the middle row of cusps deep and well defined, and the middle cusps themselves markedly narrower and more prominent than in *Æthomys*, *i. e.* nearly circular instead of transversely oblong.

Lower molars with an approach to that peculiar condition which is found at its maximum in *Mylomys* and certain other genera, the cusps high and very sharply defined, their wearing surfaces pointing forwards, and the median valley along the tooth-row very sharp and deep. Almost no trace present of median posterior supplementary cusps.

These characters, and especially those of the lower molars, seem to justify the generic distinction of the group, while the hairy tail separates it from its allies in exactly the same way, and for the same reasons, as *Nyctomys* and *Rhipidomys* are distinguished in America from other Vesper-rats, and in

* Bull. U.S. Nat. Mus. no. 99, p. 69 (1919).

Asia *Pithechirus*, *Hapalomys*, and many others from the terrestrial forms found there.

A second species formerly put in *Mus* is the curious white-tailed *M. woosnami*, Schwann*, of Bechuanaland, which is even more decidedly different from any *Rattus* than is *Thallomys nigricauda*. Its unusual proportions, with the tail only about equal to the length of the body without the head, the entire absence of supraorbital ridges, and the structure of the molars, of which m^1 is greatly reduced and simplified, all testify to its being an animal which could not by any possible stretch of the genus be nowadays put in *Rattus*. Nor is any other genus more nearly related to it, though there is about it a certain superficial resemblance to *Succostomus* which a closer study soon shows to be deceptive.

As Mr. Schwann has given a full description of the distinctive characters, with figure of the animal, I do not propose to redescribe it, but simply suggest for it the name derived from its general pallor and white tail of

OCHROMYS, gen. nov.

Genotype, *Ochromys woosnami* (*Mus woosnami*, Schwann).

XVI.—*A new Taphozous from the Sudan.*
By OLDFIELD THOMAS.

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AMONG a number of small mammals collected in the Sudan by Major J. Stevenson Hamilton, and sent to the British Museum for determination by the Wellcome Research Laboratories, Khartoum, there occurs a specimen of the following new bat, which I have great pleasure in naming in honour of its discoverer:—

Taphozous hamiltoni, sp. n.

A fairly large species of the group with a naked gular patch in the female—a pouch therefore probably present in the male.

* P. Z. S. 1906, p. 108, pl. vi. (animal).

Size rather smaller than in *hildegardææ*, decidedly larger than in *sudani*. General external appearance as to colour and distribution of fur much about as in *perforatus* and its allies. Fur covering, but restricted to, the body, short; hairs of back barely 3 mm. in length. Colour above dark sepia-brown, the extreme tips of the hairs lighter, their bases white; below similar, but paler, the light tips being longer. Throat with a sharply defined naked patch, no doubt indicating that the male has a gular pouch.

Skull broad and stout, much more heavily built than that of *T. sudani*, and approaching that of the large *T. nudiventris*, though its muzzle is conspicuously shorter than in that animal and is without the great projection forward of the incisors. Forehead broad and flat, little hollowed out, the rise of the brain-case behind it not nearly so great as in *sudani*. Postorbital processes well developed, short. Brain-case broad, more parallel-sided, less oval, than in *sudani*. Mesopterygoid fossa penetrating the palate to the level of the hinder edge of m^2 . Basial pits broadly triangular, not very deep.

Teeth as usual, rather stout and heavy throughout, breadth across canines greater than in other species of the same size.

Dimensions of the type:—

Forearm (c.) 66 mm.*

Head and body 80; tail 35; third metacarpal 60.

Skull: condyle to front of canines 22; zygomatic breadth 15; interorbital breadth 7.3; intertemporal breadth 5; breadth of brain-case 11.2; mastoid breadth 13; palato-sinual length 6.2; postpalatal length 11.2; basial pits, length 3, combined breadth 5. Teeth: front of canine to back of m^3 9.7; front of p^4 to back of m^2 6.5.

Hab. Mongalla, Sudan.

Type. Adult female. B.M. no. 19. 12. 18. 1. No. 118 of the Stevenson Hamilton collection. Collected 13th June, 1918. Presented to the National Museum by the Wellcome Research Laboratories.

It is difficult to say to which of the older-known species this *Taphozous* is most nearly allied. Its skull is much stouter than that of *perforatus*, *sudani*, and their allies, while, of course, the widely different fur-distribution of *nudiventris* and the peculiar colour of *mauritanus* at once separate those forms from it. *T. hildegardææ* has a much narrower and

* The proximal end of each forearm has been lost, and the length is estimated from that of the third metacarpal, usually rather more than one-tenth shorter.

more slender skull, and no naked gular patch in the female. It is to be hoped that male specimens will shortly be obtained, so that the pouch-structure in that sex can be observed.

Major Stevenson Hamilton states that the specimen was captured in the verandah of his house.

XVII.—*A new Marmoset from the Peruvian Amazons.*
By OLDFIELD THOMAS.

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Leontocebus mounseyi, sp. n.

Closely allied to *L. apiculatus*, Thos.*, with which it agrees in all essential characters, but distinguished by the following points:—Terminal ticking of nape-hairs commencing rather further forward, on the hairs between the ears instead of further down the neck. Dorsal marbling rather more coarsely conspicuous. Fur of under surface, including groins and inner sides of thighs, longer and denser, and the hairs all with distinct blackish bases instead of being wholly reddish. Upper side of hands and feet rather more prominently grizzled with fulvous. Tail, beyond its basal reddish-mixed inch, abruptly deep black, without any trace of the more extensive fulvous grizzling for three or four inches which forms so marked a characteristic of *L. apiculatus*.

Dimensions of the type (measured in flesh):—

Head and body 175 mm.; tail 300; hind foot 58; ear 24.

Skull: gnathion to occiput 46.

Hab. Rio Pacaya, opposite Sapote, Lower Ucayali. Alt. 250 feet.

Type. Adult male. B.M. no. 20.1.9.1. Original number 2. Collected 25th July, 1912, by Mr. J. J. Mounsey. One specimen.

Of the various characters above noted, the most marked is the difference in the extension of the grizzling of the base of the tail—a character quite constant in other species and one that seems certainly to justify the distinction of the Pacaya marmoset.

* *Ann. & Mag. Nat. Hist.* (7) xiv. p. 190 (1904); *Elliot, Primates*, i. p. 204 (1913).

XVIII.—*Note on Two new Species of Fossil Tortoises.* By
C. W. ANDREWS, D.Sc., F.R.S. (British Museum, Natural
History).

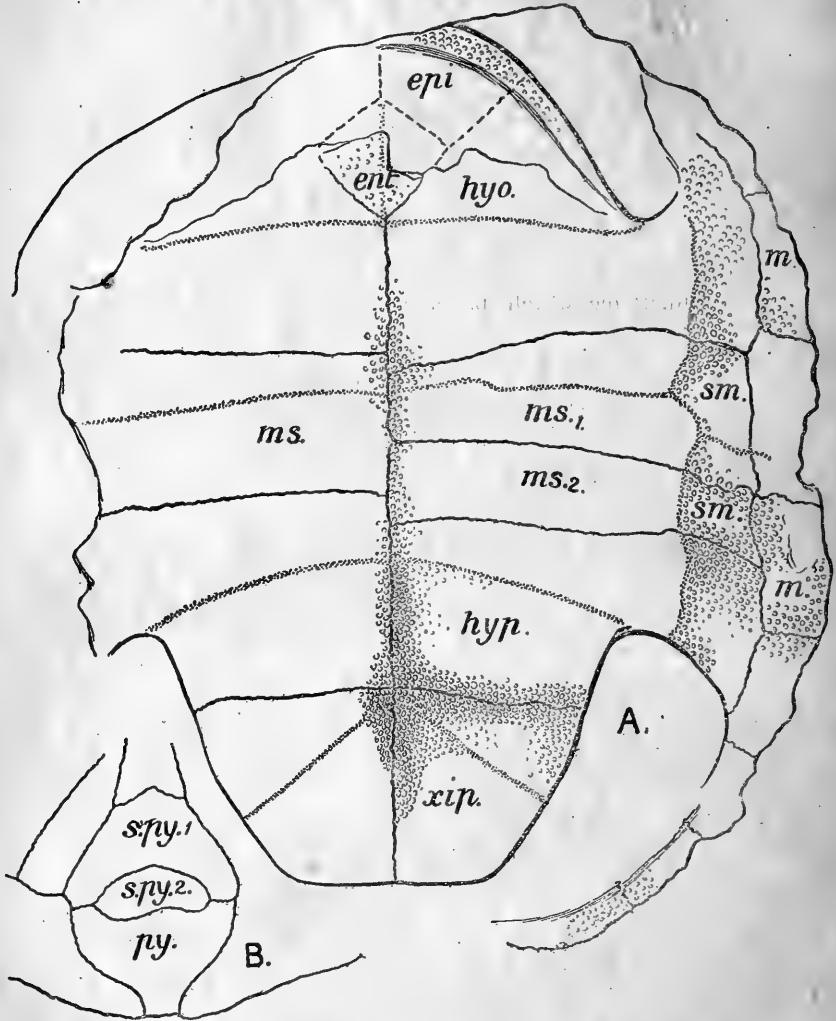
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THE first of the two specimens which form the subject of the present note is an internal cast of the shell of a rather large Pleurodiran tortoise, with some of the carapace and plastron still adhering to it. It is from the Upper Greensand of Melbury Down, near Shaftesbury, Dorset, and it is said to have been used for some years for blocking a gate open, a circumstance which probably accounts for the broken condition of the marginal portion of the shell. The specimen then passed into the collection of late Mr. John Rutter, and was presented to the British Museum by Mr. Clarence E. Rutter in 1915.

Most of the carapace has been lost, and is represented only by the natural cast of its inner surface. The parts preserved are two or three costal bones on the right side, perhaps some neurals, the pygal, the supra-pygal or supra-pygals, and the six posterior marginals much broken at the edges. Portions of the posterior costals are present on the left side, and there are a few other adherent portions of bone of no importance.

The plastron is, on the whole, beautifully preserved, only the front of the anterior lobe being missing, the epiplastrals, the front of the entoplastral, and parts of the hyo-plastral being represented by the impressions of their upper surface only. The bridge uniting the carapace and plastron is well preserved on the left side, but on the right most of it is represented by the impressions of the bones only. The plates of the carapace and plastron, together with the infilling mass of matrix, probably give a pretty accurate idea of the true form of the shell, which was strongly arched from side to side and to a rather less degree from before backwards. The length of the shell was approximately 580 mm. (the front part of the cast is somewhat incomplete). The width is roughly 470 mm.; the height is about 220 mm.; the length of the bridge is 225 mm. The plates all bear a strongly developed ornament consisting of round or oval tubercles, often flat at the top and sometimes with a small depression in the middle. They measure from one to four millimetres across and are most strongly developed on the bridge and the lateral portions of the plastron. In spite of this strong sculpture horny scutes were present, at least on the plastron,

Fig. 1.



Trachydermochelys rutteri. A, plastron; B, posterior end of carapace.

ent., entoplastron; *epl.*, epiplastron; *hyo.*, hyoplastron; *hyp.*, hypoplastron; *m.*, marginals; *ms.*, mesoplastron of left side; *ms. 1*, *ms. 2*, mesoplastra of right side, *py.*, pygal; *sm.*, submarginals; *s.py. 1*, *s.py. 2*, suprapygals; *xip.*, xiphoplastral. About $\frac{1}{4}$ nat. size. The whole surface is covered with sculpture, but this has only been drawn where most strongly developed.

where the sulci marking their boundaries are well defined. The whole shell was very massive, some of the plastral plates measuring upwards of 13 mm. in thickness.

The arrangement of the plates will be best understood from the figures. There seems to have been a pygal of peculiar form, narrowing towards the margin of the shell (fig. 1, B) : it is represented in part by its impression only, but the sutures can be followed. The lower supra-pygal is a small well-defined bone, crescentic in outline, with the concavity downwards. The nature of the bone above is doubtful, the sutures in this region being obscure and cracks numerous : it may be a second supra-pygal or the posterior pair of costals uniting in the middle line. If this last interpretation is correct, the animal possessed at least nine pairs of costals—a quite exceptional condition. The marginals were very massively constructed : all preserved are much broken at the edges. The plastron (fig. 1, A) is chiefly remarkable for the presence of two mesoplastrals on the left side, while there is only one on the right. This reduplication of the plastral element is interesting, because it may indicate a tendency to revert to an earlier condition in which the number of paired elements in the plastron was greater than in later forms. The posterior lobe narrows gradually backwards from the bridge, and its posterior end is slightly notched. The anterior lobe is broadly rounded ; the form of the epiplastrals cannot be clearly determined, but it can be seen that their upper border was thickened, rounded, and covered with the characteristic sculpture. The entoplastron is incomplete, but was probably lozenge-shaped. The hyoplastra are incomplete in front. The single mesoplastron on the right side is very wide, almost as wide as the two occurring on the other side taken together. On both sides the mesoplastra widen out towards the bridge, this being particularly marked in the anterior one on the left side. The form of the hypo- and xiphiplastra present no special peculiarities. The grooves marking the outline of the horny scutes are well marked on the plastral surface, but could not be seen on what remains of the carapace. The boundary between the humeral and pectoral scutes crosses just behind the posterior angle of the entoplastron, that between the pectorals and abdominals is on the mesoplastra. The grooves between the femoral and anal scutes slope strongly backwards, and are confined to the xiphiplastra. On the bridge there were three or four sub-marginal scutes. The presence of the horny scutes on a shell in which the sculpture is so strongly developed seems remarkable.

The precise systematic position of this chelonian is not certain, but it must belong either to the Amphichelydia or to the Pleurodira. It may be referred to the genus *Trachydermochelys*, founded by Seeley* for the reception of some scutes from the Cambridge Greensand, possessing a nearly identical type of sculpture, their specific name being *T. phlyctænus*; the species has never been properly described and figured, and Lydekker † has suggested that these scutes may actually belong to species of *Rhinochelys*. This, however, is by no means certain, and I therefore prefer to employ the name *Trachydermochelys* given to the sculptured scutes. In the Cambridge Greensand species the sculpture is considerably finer than in the present specimen, which, moreover, is from a different horizon: for these reasons I propose to refer it to a new species, for which the name *Trachydermochelys rutteri* is proposed.

A Chelonian shell from the Upper Greensand of the Isle of Wight was described by Owen (quoted by C. Parkinson) in the Quart. Journ. Geol. Soc. vol. xxxvii. 1881, p. 370, and was made the type of a new genus and species under the name *Plastremys lata*. This specimen is R. 48 of the British Museum collection. The only character mentioned by Owen is the absence of the mesoplastral elements, and this is an error; the promised further description never appeared. In 1889, Lydekker (Catal. Foss. Rept. Brit. Mus. pt. iii. p. 195) referred this specimen to his genus *Hylæochelys*, repeating the statement that mesoplastra are absent. Re-examination of the shell, however, shows that not only were these elements present but that they were large, and that a sculpture similar to that of *Trachodermochelys*, though not so strongly marked, was present in the region of the bridge, the rest of the shell so far as known being smooth. It seems almost certain that this specimen represents another species of *Trachydermochelys*, the name of which would be *Trachydermochelys lata*, Owen, sp.

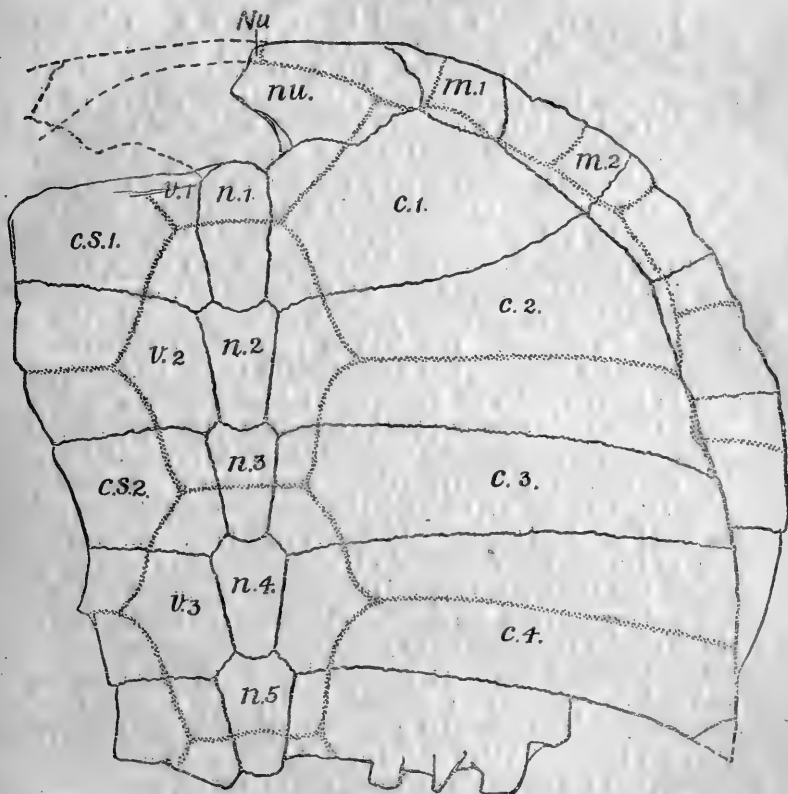
The second specimen here described is part of the carapace of a tortoise from the Barton Clay at the foot of Highcliff, near Christchurch, Hants. It is preserved in the Museum of Practical Geology, Jermyn Street (No. 20497). The parts of the shell present are: the right half of the nuchal bone, the five anterior marginals, the five anterior neurals, the four anterior costals, and part of the fifth on the right side, while

* 'Index to Aves etc. in the Cambridge Museum,' pp. xix & 33 (1869). These specimens have never been properly figured or described.

† Lydekker, Catal. Foss. Rept. Brit. Mus. pt. 3, p. 182.

on the left only the upper ends of these bones are present. The length in the middle line of the portion preserved is 385 mm., probably rather more than half the length of the whole shell, which, therefore, was of considerable size. The width measured at the level of the third neural was

Fig. 2.



Patanemys bartonensis. Anterior portion of carapace.

c. 1-4, costal bones; c.s. 1-2, costal shields; m. 1-2, marginals; n. 1-5, neural bones; nu., nuchal bone; Nu., nuchal shield; v., vertebral shields. $\frac{1}{4}$ nat. size.

about 634 mm.; but this is probably an exaggeration, owing to the flattening that has been undergone, although perhaps the convexity of the carapace was never very great.

The general arrangement of the bones and scutes is shown in fig. 2.

The nuchal was very wide (about 230 mm.), while its length in the middle line was only about 67 mm. It seems to have had a small median prominence on either side, of which its border is slightly concave. Its form is peculiar, and I have been unable to find any other nuchal similar to it. The neural bones are long and narrow. The first is four-sided, the long lateral borders being slightly convex; the posterior end is bluntly pointed to fit into a notch in the front border of the second. This latter, together with the other neurals preserved, has a short anterior lateral border and a long posterior one; the posterior end in all is rounded and fits into a concave anterior border of the bone behind. The anterior costal is roughly triangular in outline, its outer border occupies exactly the length of the first two marginal bones. The second costal is about 70 mm. wide at its inner end, but widens out to about double this before it joins the marginals. The third costal, on the other hand, which is about the same width at its inner end, narrows to about half this at its outer end. The fourth costal widens out like the second. The fifth is only partly preserved. This alternate widening and narrowing of the costal bones is seen in many species of *Testudo*, but here the form of the neurals and their relations to the costals is quite different.

The grooves marking the outlines of the horny shield are well marked. There may, perhaps, have been a very small nuchal shield; the first marginal shield, in correlation with the great width of the nuchal bone, is very long from side to side and narrow. The form of the costal and marginal shields and their relations to the underlying bones will be best understood from the figure. The shape and arrangement of the shields are much as in *Emys*.

This specimen has been compared with any other forms with which relationship seemed likely, but differs very considerably from all. Its chief distinguishing characteristics are the great width of the nuchal bone, the long narrow neurals, and the alternate widening and narrowing of the costals. I propose to refer this specimen to a new genus, *Patanemys*, the specific name being *Patanemys bartonensis*, sp. n. It seems to belong to the family Emydidæ.

XIX.—Notes on the Ichneumonidæ in the British Museum.—

III. On a new Tasmanian Species. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Platylabus altitudinis, sp. n.

♀. Nigra; mandibulis in medio, palpis, antennis articulis 8 basalibus, pedibusque, coxis exceptis, ferrugineis; trochanteri-

bus intermediis posticisque supra nigris; antennis articulis 9-15 albidis; orbitis internis supra anguste, pronoto linea angulis posticis, mesopleuris linea horizontali sub alis anticis, scutello macula magna, segmento mediano macula utrinque angulis posticis, tergitisque duobus basalibus fascia apicali angusta flavis; alis subhyalinis, stigmatibus venisque fuscis.

♂. Femine similis; mandibulis basi, clypeo, facie, orbitis, supra interruptis, scapo subtus, propleuris antice, postscutello linea transversa, tergitoque tertio fascia apicali insuper flavis; antennis articulis duobus basalibus ferrugineis, 3-11 ferrugineis, supra fuscis, 12-19 pallide ferrugineis, 20-22 fuscis, subtus ferrugineis, 23-38 nigris.

Long., ♀ 10 mm., ♂ 10 mm.

♀. Third joint of antennæ longer than the fourth by more than one-third, fifth and sixth subequal, a little shorter than the fourth, the antennæ 37-jointed; clypeus transverse at the apex, narrowly impunctate at the apex, punctate on the basal two-thirds; face punctate; vertex and front almost smooth, very shallowly punctured; supra-antennal foveæ smooth and moderately deep. Face much broader than long, almost flat; cheeks about one-third as long as the eyes. Thorax opaque, closely punctured; pleuræ rather more strongly punctured and slightly rugulose. Scutellum more sparsely punctured and less opaque, the lateral carinæ extending beyond the middle. Basal area of the median segment transverse, narrowed posteriorly; areola transverse, widened posteriorly, the sides slightly curved outwards, less distinctly punctured than the basal area; the posterior and the postero-intermedial areas confluent, with numerous short rugæ springing from the sides and converging medially, but not meeting; middle of these areas shining, irregularly rugulose; postero-external area defined, rugulose; external and dentiparal areas confluent, external portion punctate, dentiparal rugulose and produced into a rather blunt tooth; spiracles elliptical; spiracular area anterior to the spiracle punctured, posteriorly rugose-reticulate with punctures intermingled; lateral and juxta-coxal areæ coarsely punctured. Petiole almost impunctate, with a shallow, ill-defined supra-spiracular sulcus on each side. Second tergite subopaque, very finely punctured, smoother towards base and apex, not quite as long as its apical breadth; gastrocœli shallow; the remaining tergites almost smooth. Areolet very narrow on the radius.

Hab. Mt. Wellington, Tasmania, 2300 ft., January to April, 1913 (*Turner*); type, a ♀ in B.M.

The abdomen of the male is more strongly punctured, especially on the second and third tergites.

XX.—*A new Cichlid Fish of the Genus Limnochromis from Lake Tanganyika.* By C. TATE REGAN, M.A., F.R.S.

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Limnochromis otostigma, sp. n.

Pelmatochromis auritus (part.), Bouleng. Cat. Afr. Fish. iii. p. 415 (1915).

Depth of body 3 to $3\frac{1}{2}$ in the length, length of head 3 to $3\frac{1}{3}$. Snout as long as or shorter than diameter of eye, which is 3 to $3\frac{1}{2}$ in length of head, greater than præorbital depth; interorbital width 4 to $4\frac{1}{2}$ in length of head. Jaws equal anteriorly; maxillary extending nearly to below middle of eye; teeth small, in 2 or 3 series. 4 or 5 series of scales on cheek. 11 or 12 gill-rakers on lower part of anterior arch. A more or less distinct papillose pad on each side in front of the upper pharyngeals. Lower pharyngeal a triangular plate with doubly convex posterior edge and with a long anterior blade; teeth all slender. Dorsal XV (XVI) 9–10; last spine $\frac{1}{2}$ length of head. Anal III 8–9. Pectoral as long as head, extending to origin of anal. Caudal rounded. Caudal peduncle $1\frac{1}{3}$ as long as deep. 35 or 36 scales in a longitudinal series, 5 or 6 from first dorsal spine to lateral line. Olive-brown, with oblique cross-bars of silvery white; a blue-black opercular spot; fins greyish.

Lake Tanganyika.

Seven specimens, measuring up to 100 mm. in total length.

L. auritus is often a little deeper (depth $2\frac{1}{2}$ to 3 in the length) and has the mouth a little smaller (maxillary to below anterior $\frac{1}{3}$ of eye), and the spinous dorsal, with 16 or 17 spines, a little lower; also the silvery-white cross-bars on the body are absent, but the vertical fins have pale spots and dark stripes. The most notable external difference between the two species is in the form of the caudal fin, rounded in *L. otostigma* and emarginate in *L. auritus*; this is not due to age, but is evident when examples of the same size are compared. Another important difference is that in *L. auritus* the lower pharyngeal has no distinct anterior blade and that a few teeth in the middle near its posterior edge are rather stout and blunt.

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THE ANNALS

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[NINTH SERIES.]

No. 26. FEBRUARY 1920.

XXI.—*Further Notes on the Fabrician Types of Heteromera (Coleoptera) in the Banks Collection.* By K. G. BLAIR, B.Sc., F.E.S.

(Published by permission of the Trustees of the British Museum.)

IN the 'Annals' for May 1914 (ser. 8, vol. xiii. pp. 482-490) I published notes on the Fabrician types of Tenebrionidæ in the above collection. The present paper supplements these with notes on the types belonging to other families of the Heteromeros series.

A few species not included in the Heteromera that were placed by Fabricius in the genus *Cistela* are also noted, with a brief indication of their true systematic position. Where no comment is added the species may be taken as being generally well known and correctly identified.

Family Alleculidæ (*Cistelidæ*).

1. *Lobopoda lurida*.

Helops luridus, Fab. Syst. Ent. 1775, p. 258. Brazilia.

I have not been able to identify this with any other described species, and as the name appears to have been dropped from recent catalogues a redescription of the species may be of value:—

Elongate-ovate, moderately nitid, dark reddish brown
Ann. & Mag. N. Hist. Ser. 9. Vol. v. 11

with a not very dense clothing of depressed fulvous hairs; eyes separated by a space about equal to the length of the second joint of the antennæ; thorax strongly transverse, with a shallow median impression gradually evanescent in front, and a moderately strong basal impression on each side, the surface rather closely but not deeply punctured; elytra gradually narrowed from just behind the shoulders, deeply punctate-striate, the punctures much smaller behind the middle, intervals convex, finely not very densely asperately punctate. Length 10 mm.

The species is closely allied to *L. puncticollis*, Champ., from Guatemala, from which it differs in having the eyes less closely approximate and the punctures of the elytral striæ coarser. The British Museum possesses specimens from Pernambuco, Bahia, Espirito Santo, and Rio de Janeiro.

2. *Homotrysis rufipes*.

Helops rufipes, Fab. Syst. Ent. p. 258. Nova Hollandia.

Homotrysis (Allecula) angusticollis, Boh. Res. Eugén. 1858, p. 100.

The synonymy has been established by Mr. H. J. Carter on specimens compared with the type of *Helops rufipes*, Fabr. This is another name that seems to have disappeared from recent catalogues.

3. *Lystronychus equestris*.

Helops equestris, Fab. Syst. Ent. p. 257. Brazil.

The type is defective, wanting the head and thorax, but the elytra of this well-known species are amply distinctive.

4. *Heliotaurus ruficollis*.

Cistela ruficollis, Fab. Spec. Ins. i. 1781, p. 147. Lusitania.

? *Heliotaurus sanguinicollis*, Reitt. Verh. Nat. Ver. Brünn. xlv. 1906, p. 143.

The type is a ♀, and is rather doubtfully identical with *H. ruficollis* of Reitter's 'Bestimmungstabellen.' The elytral epipleura are not turned upwards, but are vertical as in *H. sanguinicollis*, Reitt.

5. *Prionychus ater*.

Helops ater, Fab. Syst. Ent. 1775, p. 258. Lipsia.

No collection is definitely specified as containing the type, but the specimen in the Banks Collection bears a label with the above reference, and may, in default of any individual with a better claim, be taken as the type.

Family Lagriidæ.

6. *Lagria glabrata* (*hirta*, L.).

Lagria glabrata, Fab. Syst. Ent. p. 125. Anglia.

Though stated to be in Mus. Dom. Banks, the type is not now to be found in this Collection.

Olivier expresses doubt whether his *L. glabrata* (Encycl. Méth. vii. 1792, p. 446) is identical with that of Fabricus, a fact that suggests that the type was even then not to be found in the Banks Collection, to which this author is known to have had access. Seidlitz (Naturgesch. der Insekt. Deutschl. v. 2, 1898, p. 350) considered, no doubt correctly, that *L. glabrata*, Fab., was merely a rubbed specimen of *L. hirta*, L., and Borchmann in Junk's Catalogue places it as a synonym of this species.

In any case, the name *glabrata* is occupied in the genus *Lagria* from 1775, and is consequently not available for Olivier's species (1792). The name of the latter should, therefore, be changed to *L. rugosula*, Rosenh., its first available synonym.

7. *Lagria villosa*.

Lagria villosa, Fab. Spec. Ins. i. p. 160. Cap. bon. Spei.

A well-known species widely distributed in Africa.

8. *Lagria tomentosa*.

Lagria tomentosa, Fab. Syst. Ent. 1775, p. 125. Nova Hollandia.

Lagria pulchrivaria, Lea, Trans. Roy. Soc. S. Austral. xli. 1917, p. 175.

The type is defective, with the basal joint of only one antenna left. It is apparently a ♀ of the species recently described by Lea as *L. pulchrivaria* from Queensland and New South Wales.

Mr. Champion has long since pointed out (Trans. Ent. Soc. 1895, p. 229) that the species from Western Australia, commonly known as *L. tomentosa*, Fab. (*L. æneoviolacea*, Champ.), does not agree with this type.

9. *Eutrapela elongata*.

Crioceris elongata, Fab. Syst. Ins. i. 1781, p. 156. Cap. bon. Spei.

Crioceris elongata, Fab. Ent. Syst. i. 2, 1792, p. 11.

Helodes elongata, Fab. Syst. Eleuth. i. 1801, p. 470.

Chrysomela unifasciata, De Geer, Mém. vii. 1778, p. 664, pl. 49, figs: 18-19.

Helodes porrecta, Fab. Syst. Eleuth. i. 1801, p. 470.

Eutrapela vittata, Illig. (Dej. Cat. 1837).

Reference to Fabricius's earliest description is omitted from both Gemminger and Harold's Catalogue and that of Borchmann, so that the name is made to date from 1792.

The species is generally erroneously determined in collections. The type is a ♂, with greenish-black thorax, legs, and antennæ. The ♀, with these parts testaceous, was later described by Fabricius as *H. porrecta*, which is identical with *Chrysomela unifasciata*, De Geer.

The name *E. elongata*, Fab., must therefore be sunk as a synonym of *E. unifasciata*, De G., and for the species usually known by it a new name must be found. *E. longa*, Gmel. (1788), which appears in the Catalogues as a synonym, is probably only a *lapsus calami*, and in any case the description refers definitely to the Fabrician species, so that the name is not available for *E. elongata*, auctt. (nec Fab.).

From specimens now in the British Museum from Dejean's Collection it is evident that the mistake had arisen at least as early as his Catalogue (1837), and I now propose the name *dejeani*, nom. nov., for the species that appears there and in later Catalogues as *E. elongata*, Fab.

Both species are black with a greenish-metallic tint and a broad flavous vitta along the disc of each elytron*; they are readily distinguished as follows:—

Vitta embracing the 5th, 6th, and 7th intervals, but not extending beyond them except near the base, where it is suddenly expanded to reach the margin; punctures of median row on each interval as large as those of the striæ.—*dejeani*, nom. nov. [= *elongata*, auctt. (nec Fab.)].

Vitta embracing the whole of the 4th interval and encroaching slightly upon the 3rd and 5th; punctures of median rows on each interval distinctly smaller than those of the striæ.—*unifasciata*, De G. [= *elongata*, F. = *longa*, Gmel. = *porrecta*, Fab. = *vittata*, Illig. (Dej. Cat.)].

Family Melandryidæ.

10. *Stenotrachelus aeneus*.

Lagria aenea, Fab. Syst. Ent. p. 124. In Insulis Americæ.

The habitat is evidently erroneous, the species being holarctic in distribution.

* N.B.—*E. unifasciata*, De G., is sexually dimorphic, as noted above.

11. *Melandrya serrata* (*caraboides*, L.).

Helops serratus, Fab. Syst. Ent. p. 257. Angliæ.

No collection is specified as containing the type, but this individual may provisionally be taken as such. Its identity with "*Chrysomela*" *caraboides*, L., was recognised by Fabricius in his later works.

Family *Ædemeridæ*.12. *Thelyphassa lineata*.

Lagria lineata, Fab. Syst. Ent. p. 124. Nova Zelandia.

Dryops lineata, Fab. Syst. Eleuth. ii. p. 68.

Selenopselaphus lineatus, Fab., Gemm. & Har. Cat. p. 2168.

Sessinia lineata, Fab., Schenklin in Junk's Coleopt. Cat. pars 65, 1915, p. 33.

The type is a ♀. It is curious that Pascoe, when characterising the genus *Thelyphassa*, should not have recognised the close affinity between this species and his *T. diaphana*. He had himself, only six months previously, removed it from *Selenopalpus* (*Selenopselaphus*) to *Sessinia*.

It may be noted that *S. longicornis*, Broun, and *S. strigipennis*, White, should also be placed in *Thelyphassa*.

13. *Selenopalpus cyaneus*.

Lagria cyanea, Fab. Syst. Ent. p. 125. Nova Hollandia.

Dryops cyanea, Fab. Syst. Eleuth. ii. p. 68.

Selenopselaphus cyaneus, Fab., Gemm. & Har. Cat. p. 2168.

Selenopalpus chalybeus, White (♂), Voy. 'Erebus' & 'Terror,' Ins. 1846, p. 13. New Zealand.

Selenopalpus subviridis, White (♀), *loc. cit.*

The type of *S. cyaneus*, Fab., is a ♂ and is identical with *S. chalybeus*, White, the type of which is also in the British Museum. *S. subviridis*, White, is nothing but the ♀ of the same species. The locality given by Fabricius is evidently erroneous.

14. *Sessinia livida*.

Lagria livida, Fab. Syst. Ent. p. 124. Otahaiti.

The species is well known in collections, and is the type of Pascoe's genus *Sessinia*.

15. *Dohrnia tristis*.

Necydalis tristis, Fab. Mant. Ins. i. 1787, p. 170. In terra Diemenii.
Edemera tristis, Fab. Oliv. Ent. iii. 1795, no. 50, p. 12, pl. ii. fig. 13.
Dohrnia mirabilis, Newm. Zoologist, ix. 1851, App., p. 133.
Ithaca anthina, Olliff, Proc. Linn. Soc. N. S. Wales, (2) ii. 1887,
 p. 154.

Unfortunately all that remains of the type is the abdomen attached to the pin. The description, in conjunction with Olivier's figure, leaves no doubt that the insect was the ♀ of the species better known as *Dohrnia mirabilis*, Newm., and an examination of the abdomen makes this identity certain. Olliff evidently did not know Newman's insect, but his description is so full and detailed as to leave the synonymy beyond question.

Family Meloidæ.

16. *Epicauta dubia*.

Lytta dubia, Fab. Spec. Ins. i. 1781, p. 329. Sibiria.

17. *Epicauta marginata* (*cinerea*, Forst.).

Lytta marginata, Fab. Syst. Ent. 1775, p. 260. Hab. C. B. S.

Fabricius again gives a wrong locality, and does not cite the collection from which the type is taken. Olivier states (Ent. iii. p. 46. no. 16) that it is "du cabinet de M. Banks." The Banksian insect bears the label "Sp. Ins. no. 5," at which reference the species is synonymised with *Meloe cinereus*, Forst., a well-known N.-American species.

18. *Lytta nitidula*.

Lytta nitidula, Fab. Syst. Ent. 1775, App. p. 826. Anglia.

The locality is corrected in Ent. Syst. i. 2, p. 84, to Cap. Bon. Spei. The collection containing the type is not specified, but Olivier states that it is in the Banks Collection. The reference is incorrectly given in the Catalogues as p. 820.

19. *Euzonitis quadripunctata*.

Mylabris 4-punctata, Fab. Mant. i. 1787, p. 217. Russia.

The reference is incorrectly given in recent Catalogues as Syst. Eleuth. ii. 1801, p. 84.

20. *Zonitis angulata*.

Cantharis angulata, Fab. Mant. i. p. 168. Insula Amsterdam.

Zonitis angulifera, Blanch. Voy. Pôle Sud, Ins. iv. 1853, p. 191, pl. xii. figs. 17, 18.

The type agrees perfectly with specimens in the British Museum from Vavao and the Tonga Islands (*Z. angulifera*, Blanch.). Amsterdam Is. is in the southern Indian Ocean, so that the Fabrician locality again appears to be erroneous.

21. *Zonitis testacea*.

Mylabris testacea, Fab. Spec. Ins. i. 1781, p. 331. Sibiria.

Zonitis præusta, Fab. Ent. Syst. i. 2, 1792, p. 48. Italia.

Zonitis flava, Fab. Syst. Ent. 1775, p. 127. In Oriente.

Zonitis flava, Fab. Ent. Syst. i. 2, 1792, p. 49.

This species was three times described by Fabricius himself. The synonymy of the first two names given above was recognized by him, but *Z. flava*, described from the collection of Prof. Forskahl, was retained as a distinct species in his latest work (Syst. Eleuth. ii. 1801, p. 24).

The reference to *Z. flava* is given incorrectly in the Catalogues as Ent. Syst. ii. (*sic!*), 1792, p. 49, but the name really originates from 1775, and thus takes precedence as the specific name. This precedence is recognized by Reitter (Fauna Germ. iii. 1911, p. 397), but the name is not adopted by Borchmann in his recent Catalogue of this family (1917).

22. *Cissites testacea*.

Lymexylon testaceum, Fab. Spec. Ins. i. 1781, p. 256. Habitat —.

Horia testacea, Fab., Oliv. Ent. iii. 1795, no. 53 *bis*, pl. i. fig. 2 a (♀).

Horia cephalotes, Oliv. Ent. iii. 1795, no. 53 *bis*, pl. i. fig. 3 (♂).

This type has already been stated by Dr. C. J. Gahan (Ann. & Mag. Nat. Hist. (8) ii. 1908, p. 201) to be the ♀ of an African species probably identical with *Horia cephalotes*, Oliv., *H. senegalensis*, Cast., and *Cissites macrognatha*, Fairm. Indeed, it is doubtful whether any of the so-called species of *Cissites* described from Africa is more than a form, with greater or less development of the head, of the one species; this development varies greatly even in a series from the same locality. (N.B.—*C. nitida*, Gah., of Borchmann's Catalogue belongs not to *Cissites* but to *Horia*, as stated by its describer.)

When defining the genus *Horia* (Mant. i. 1787, p. 164), Fabricius had before him an insect from Tranquebar sent

him by Hübner (*vide* Naturforscher, xxiv. 1789, pp. 47-48). This he described as the ♂ of his earlier *L. testaceum* (1781), of whose country of origin he was ignorant, but as Dr. Gahan points out (*loc. cit.*) in this synonymy he was at fault. Dr. Gahan contends that the name *testacea*, Fab., for the type of *Horia* is invalid, but I think it may be fairly argued that the type of *Horia testacea* (1787) was the ♂ insect from Tranquebar, not the Banksian insect, and that, the types being distinct, the validity of the name is not affected by their supposed specific identity.

Olivier's figure of the ♀ of *Horia testacea*, Fab., in reality represents the ♀ of *Cissites testacea*, and is probably taken from the Banksian type. Singularly enough, he describes and figures next to it the ♂ of the same species as new (*H. cephalotes*).

The references to the literature of these two species, given by Borchmann in Junk's Coleopt. Catal. pars 69, 1917, are much confused; they should be distributed as follows:—

- Horia testacea*, Fab. Mant. Ins. i. 1787, p. 164; Ent. Syst. i. 2, 1792, p. 91; Syst. Eleuth. ii. 1801, p. 86.—Hübner, Naturforsch. xxiv. 1789, p. 47, t. 2. ff. 14-17.—Oliv. Ent. iii. 1795, no. 53 *bis*, p. 4, t. i. f. 2 *b*.—Guér. Icon. règne amin. Ins. 1829-44, t. 34. f. 10.—Sturm, Katal. 1826, p. 71, t. iii. f. 25.—Lap. Hist. Nat. Ins. ii. 1840, p. 280.—Gahan, Ann. & Mag. Nat. Hist. (8) ii. 1908, p. 203.—Wellm. Canad. Ent. xlii. 1910, p. 392. ? *sanguinolenta* *, Schröter, Abhandl. i. 1776, p. 364, t. 3, f. 6. Tranquebar.
- Cissites testacea*, Fab. Spec. Ins. i. 1781, p. 256.—Oliv. Ent. iii. 1795, no. 53 *bis*, t. i. f. 2 *a* (♀).—De Borre, C. Rend. Soc. Ent. Belge, 1883, pp. 136-138, fig. (♂).—Gahan, Ann. & Mag. Nat. Hist. (8) ii. 1908, p. 204. Africa.

Family Mordellidæ.

23. *Mordella octopunctata*.

M. 8.punctata, Fab. Syst. Ent. p. 263. In America septentrionali.

* *sanguinolenta*, Schröter, given by Borchmann as a synonym of *Cissites testacea*, has nothing to do with this species. The insect intended is evidently a species of *Horia*, said to originate from Surinam. Whatever be the species described, the name has no standing, as the author was merely comparing his insect with *Cantharis sanguinolenta*, Linn., and deliberately refrained from giving it a name (see Schröter, *loc. cit.* p. 323).

Family Rhipiphoridae.

24. *Macrosiagon sexmaculatum.*

Mordella sexmaculata, Fab. Syst. Ent. 1775, p. 263. America.

Rhipiphorus 6-maculatus, Fab. Ent. Syst. i. 2, 1792, p. 111.

At the second reference cited the type is stated to be in the Banks Collection, though no specimen now exists there. The species is described with no reference to any earlier work, but the description is almost word for word the same as that of *Mordella 6-maculata* (1775), where the type is stated to be in Dr. Hunter's Collection; this is now in the Glasgow University Museum.

The species has been placed by Horn and subsequent writers as a synonym of *Macrosiagon pectinatum*, Fab. (1775, *Mordella*), described immediately before it (Mus. Dom. Drury).

Family Tenebrionidae.

25. *Hoplocephala cornigera.*

Hispa cornigera, Fab. Spec. Ins. i. 1781, p. 82. Anglia.

This type was overlooked by me in my notes on the types of this family.

The locality given by Fabricius and copied by Olivier (Ent. iii. 1795, no. 55, p. 7) is erroneous, a mistake that caused Castelnau and Brullé to express doubt whether the species described by them under this name from Cuba (Ann. Sci. Nat. xxiii. p. 342) was identical with that of Olivier. They do not appear to have noted that the error arose with Fabricius himself.

The following species, placed originally by Fabricius in the Heteromerous genus *Cistela*, belong in reality to other families. Some of them were removed from *Cistela* by Fabricius himself in his later works, others have been recognised and correctly placed by later writers, but some I have not been able to trace in Gemminger and Harold's, or Junk's Catalogues:—

Family Dascillidae.

1. *Microcara livida.*

Cistela livida, Fab. Syst. Ent. 1775, p. 116. Tierra del Fuego.

Atopa livida, Fab. Syst. Eleuth. ii. 1801, p. 16.

Dascillus lividus, Fab., G. & H. Cat. p. 1615.

Dascillus lividus, Fab., Pic in Junk's Cat. pars 58, p. 13.

The species is omitted from Enderlein's list of the insects of Tierra del Fuego. A specimen obtained by Charles Darwin on the voyage of the 'Beagle' agrees well with the type, and as it is in much better preservation the following notes are made upon it :—

Similar to, but rather larger than, the European *M. testacea*, more ovate, more gradually narrowed in front and behind, the thorax being arcuately narrowed from base to apex. The third joint of the antennæ is about as long as the second and considerably more slender; the first joint testaceous, the rest fuscous with apex testaceous; underside fulvous, each abdominal segment except the last with a pair of round dark spots near the median line and a larger dark patch on each side towards the lateral margin. Length $6\frac{1}{2}$ mm.

Microcara fuegensis, Bourg., is evidently different, being smaller ($4\frac{1}{2}$ –5 mm.), glabrous, wanting the dark spots on the ventral segments, etc.

Family Silphidæ.

2. *Choleva angustata*.

Cistela angustata, Fab. Spec. Ins. i. 1781, p. 148. Anglia.

This appears to be the *C. sturmi*, Bris., of Continental entomologists.

Family Melyridæ.

3. *Hedybius aulicus*.

Cistela aulica, Fab. Spec. Ins. i. 1781, p. 148. Cap. bon. Spei.

4. *Hedybius hirtus*.

Cistela hirta, Fab. loc. cit. Cap. bon. Spei.

The types of both these species are ♀ and in poor preservation. I am not at present able to identify either of them with any of the described species of *Hedybius*, or to trace the names in modern Catalogues.

Family Galerucidæ.

5. *Apophyllia festiva*.

Cistela festiva, Fab. loc. cit. Cap. bon. Spei.

Apophyllia elegantula, Jac. Entom. xxiv. 1891, Suppl. p. 39.

6. *Megalognatha sexlineata*.

Cistela 6-lineata, Fab. *loc. cit.* Habitat —.
Cneorane sexlineata, Fab., Gemm. & Har. Cat.
Megalognatha bohemani, Baly.

7. *Diabrotica melanocephala*.

Cistela melanocephala, Fab. Syst. Ent. 1775, p. 118. Amer. Septentr.
Crioceris vittata, Fab. *op. cit.* p. 122. Carolina.
Diabrotica vittata, Fab., Gemm. & Har. Cat.

The identity of *Cistela melanocephala* with *Crioceris vittata* is admitted by Fabricius himself in his later works (Ent. Syst. i. 2, 1792, p. 12), and the name *Crioceris melanocephala* is employed for another species (*op. cit.* p. 3). The type of *C. vittata* is said to be in Mus. Dom. Monson.

XXII.—A Revision of the African Cichlid Fishes of the Genus
Tylochromis. By C. TATE REGAN, M.A., F.R.S.

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TYLOCHROMIS, Regan.

Supra, p. 84.

Body deep, compressed; scales cycloid or feebly denticulate; two lateral lines, upper ending below soft dorsal, lower extending far forward, ending behind in three branches on caudal fin. Mouth rather small, terminal, with the lower jaw not prominent; maxillary sheathed by the deep præorbital, slightly exposed distally; præmaxillary processes rather long, usually reaching frontals. Teeth in jaws small, conical, in two to five series, outer sometimes enlarged. Lower pharyngeals united by interlocking suture to form a triangular plate, with slender, pointed, uni- or bicuspid teeth at least near the posterior angles, and with enlarged, rounded, flat teeth in the middle at least posteriorly. Dorsal XIII–XVI 12–17; spines slender or moderate. Anal III 7–9; spines strong. Pectoral long, pointed. Caudal scaly, truncate or emarginate.

Occipital crest very strong, extending to anterior margin of frontals; parietal crests ending above middle of orbits near the orbital margin; postorbital part of skull short and deep, with lower edge of basioccipital very oblique; pharyngeal apophysis strong, formed by parasphenoid only, ending in a broadly ovate or subtriangular articular surface, narrowed

anteriorly. Vertebrae 29-32 (15-16 + 14-16); inferior apophyses of third united to form a strong median spine; præcaudals with parapophyses from the fourth; ribs, except the first, on parapophyses.

Tanganyika, Congo, and West African rivers from Gambia to Liberia.

Eight species.

In all the gill-rakers are short and broad, and there is a well-developed papillose pad on each side of the roof of the pharynx.

The species differ considerably in the pharyngeal dentition and in the size and form of the lower pharyngeal plate. *T. microdon* (fig. 1, A) and *T. mylodon* (fig. 1, B) are two extremes; in the former the lower pharyngeal is a comparatively small and weak plate (depth about $\frac{1}{2}$ maximum width), with numerous small slender bicuspid teeth and with a group of moderately enlarged, circular, blunt teeth occupying the middle and posterior third of the dentigerous area. In *T. mylodon* the lower pharyngeal is large and massive (depth about $\frac{1}{3}$ maximum width) and is nearly covered with very strong, circular, flat teeth, small bicuspid teeth appearing only near the posterior angles.

The species may be arranged according to the modifications of the pharyngeal dentition as follows:—

- | | |
|---|---|
| I. Enlarged rounded teeth of lower pharyngeal confined to posterior third of dentigerous part of plate | <i>microdon.</i> |
| II. Enlarged rounded teeth of lower pharyngeal confined to posterior half of dentigerous part of plate | <i>lateralis, jentinki.</i> |
| III. Enlarged rounded teeth of lower pharyngeal extending forward on anterior part of plate; small slender teeth at outer edges and near posterior angles . | <i>bangwelensis, intermedius,</i> |
| IV. Enlarged rounded teeth covering nearly the whole plate; small slender teeth only at posterior angles | <i>[labrodon, polylepis.</i>
<i>mylodon.</i> |

The enumeration of the number of scales in a longitudinal series and of gill-rakers on the lower part of the anterior arch will assist the identification of the species:—

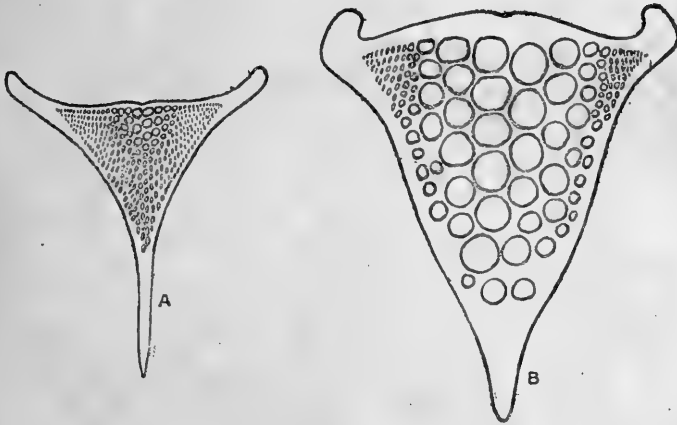
- | | |
|---|-------------------------|
| 33 to 35 scales; 15 or 16 gill-rakers | 1. <i>microdon.</i> |
| 32 to 35 scales; 17 or 18 gill-rakers | 2. <i>lateralis.</i> |
| 40 to 45 scales; 13 to 15 gill-rakers | 3. <i>jentinki.</i> |
| 37 or 38 scales; 14 or 15 gill-rakers | 4. <i>bangwelensis.</i> |
| 39 or 40 scales; 12 or 13 gill-rakers | 5. <i>intermedius.</i> |
| 33 or 34 scales; 18 or 19 gill-rakers | 6. <i>labrodon.</i> |
| 55 to 60 scales; 12 to 15 gill-rakers | 7. <i>polylepis.</i> |
| 40 or 41 scales; 17 or 18 gill-rakers | 8. <i>mylodon.</i> |

1. *Tylochromis microdon*, sp. n.

Pelmatochromis lateralis (part.), Bouleng. Cat. Afr. Fish. iii. p. 385 (1915).

Depth of body $2\frac{1}{5}$ to $2\frac{2}{5}$ in the length, length of head 3. Snout from a little longer than to nearly twice diameter of eye, which is $3\frac{1}{2}$ to nearly 5 in length of head, equal to or less than interorbital width or præorbital depth. Maxillary not extending to below eye; teeth small; 3 series of scales on cheek; 15 or 16 gill-rakers on lower part of anterior arch; lower pharyngeal teeth mostly slender, compressed, hooked; a triangular area on the posterior third of the plate with

Fig. 1.

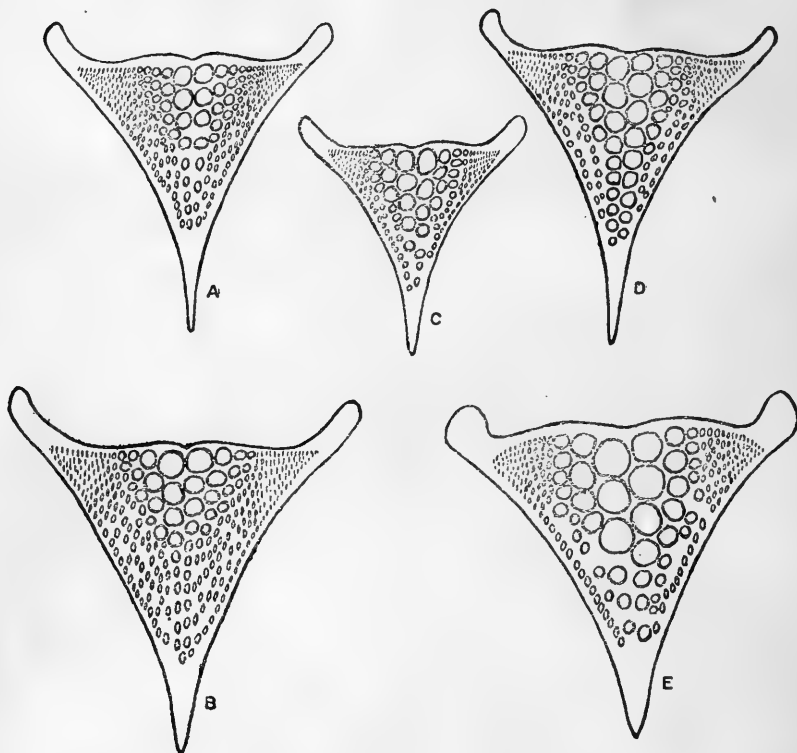


- A. Lower pharyngeal of *Tylochromis microdon* ($\times 2$) from a specimen 240 mm. long.
 B. Ditto of *Tylochromis mylodon* ($\times 2$) from a specimen 235 mm. long.

moderately enlarged, rounded, blunt teeth. Dorsal XIV–XVI 12–15; spines rapidly increasing to fifth or sixth, which is $\frac{2}{5}$ or a little more than $\frac{2}{5}$ length of head, thence decreasing or subequal. Anal III 7–8; third spine strong, about $\frac{1}{2}$ length of head. Pectoral longer than head and reaching anal in the young, but not in the adult. Caudal scaly, truncate or slightly emarginate. Caudal peduncle longer than deep. Scales 33 to 35 in a longitudinal series, 6 between origin of dorsal and lateral line, 22 to 26 in upper lateral line, 22 to 24 in lower, 2' between lateral lines.

Olive; scales with dark edges; dark longitudinal stripes between the series of scales; a dark bar above the operculum; sides of head with a dark network (adult); fins greyish; dorsal sometimes with pale and dark spots.

Fig. 2.



- A. Lower pharyngeal of *Tylochromis lateralis* ($\times 2$) from a specimen 220 mm. long.
 B. Ditto of *Tylochromis jentinki* ($\times 2$) from a specimen 270 mm. long.
 C. Ditto of *Tylochromis labrodon* ($\times 2$) from a specimen 140 mm. long.
 D. Ditto of *Tylochromis bangwelensis* ($\times 2$) from a specimen 240 mm. long.
 E. Ditto of *Tylochromis polylepis* ($\times 2$) from a specimen 220 mm. long.

Congo.

Four specimens, 155 to 260 mm. in total length, from Lakes Tumba and Leopold II.

2. *Tylochromis lateralis*.

Pelmatochromis lateralis, Bouleng. Proc. Zool. Soc. 1898, p. 148.

Pelmatochromis lepidurus, Pellegr. Bull. Mus. Paris, 1900, p. 275.

Pelmatochromis lateralis (part.), Bouleng. Cat. Afr. Fish. iii. p. 385, fig. 260 (1915).

Depth of body 2 to $2\frac{1}{2}$ in the length, length of head $2\frac{1}{2}$ to $3\frac{1}{4}$. Diameter of eye 3 to 4 in length of head; interorbital width $3\frac{1}{4}$ to $3\frac{3}{8}$. Teeth small; maxillary not extending to below eye; cheek with 3 or 4 series of scales; 17 or 18 gill-rakers on lower part of anterior arch. Lower pharyngeal with enlarged rounded teeth in a triangular area, the anterior angle of which is in the middle of the length of the denticerous part of the plate. Dorsal XIV–XV 12–15; last spine $\frac{1}{2}$ or a little less than $\frac{1}{2}$ length of head. Anal III 7–8; third spine from nearly $\frac{1}{2}$ to $\frac{2}{3}$ length of head. Pectoral longer than head, reaching origin of anal. Caudal slightly emarginate. Caudal peduncle about as long as deep. 32 to 35 scales in a longitudinal series, 5 or 6 between first dorsal spine and lateral line, 2 between lateral lines.

Olivaceous, with or without dark cross-bars; dorsal fin usually with series of dark spots.

Congo.

Six specimens, including the type of the species, 110–220 mm. in total length, from Monsembe, Bolobo, Dolo, and Stanley Falls.

3. *Tylochromis jentinki*.

Pelmatochromis jentinki (Steind., 1894), Bouleng. Cat. Afr. Fish. iii. p. 383, fig. 259 (1915).

Pharyngeal dentition as in *T. lateralis*, from which it is distinguished especially by the fewer gill-rakers (12–15), the smaller scales (40–45), and by having three series of scales instead of two between the upper lateral line and the anterior part of the lower. Dorsal XIII–XV 16–17. Anal III 8–9.

Total length 290 mm.

Gambia to Liberia.

4. *Tylochromis bangwelensis*, sp. n.

Pelmatochromis lateralis (part.), Bouleng. Cat. Afr. Fish. iii. p. 385 (1915).

Depth of body 2 to $2\frac{1}{3}$ in the length, length of head 3 to $3\frac{1}{4}$. Snout as long as postorbital part of head; diameter of eye 4 to $4\frac{1}{2}$ in length of head, less than præorbital depth; interorbital width 3 to $3\frac{1}{2}$ in length of head; maxillary not extending to below eye; outer teeth moderately strong; three series of scales on cheek; 14 or 15 gill-rakers on lower part

of anterior arch. Lower pharyngeal with slender hooked teeth only at the outer edges and near the posterior angles ; area of large rounded teeth extending forward on anterior half of plate. Dorsal XIV 14-15 ; spines increasing in length to last, which is $\frac{1}{2}$ or a little more or less than $\frac{1}{2}$ length of head. Anal III 7-8 ; third spine from less than $\frac{1}{2}$ to nearly $\frac{3}{4}$ length of head. Pectoral longer than head, extending to above anterior part or middle of anal. Caudal truncate or slightly emarginate. Caudal peduncle longer than deep. 37° or 38 scales in a longitudinal series, 6 or 7 from first dorsal spine to lateral line, 24 to 29 in lower, 2 between lateral lines.

Olivaceous ; often a dark spot on each scale ; sometimes six dark cross-bars ; vertical fins with or without dark spots.

Lake Bangwelu and Luapula River.

Five specimens, 170 to 240 mm. in total length.

5. *Tylochromis intermedius.*

Pelmatochromis intermedius, Bouleng. Cat. Afr. Fish. iv. p. 332, fig. 193 (1916).

Pharyngeal dentition nearly as in *T. bangwelensis*, from which it is distinguished by the fewer gill-rakers (12 or 13) and the more numerous scales (39-40). Dorsal XIV 15-17. Anal III 7-9.

Total length 110 mm.

Sierra Leone.

6. *Tylochromis labrodon*, sp. n.

Pelmatochromis lateralis (part.), Bouleng. Cat. Afr. Fish. iii. p. 385 (1915).

Depth of body $2\frac{1}{4}$ in the length, length of head $2\frac{4}{5}$ to 3. Snout as long as or a little longer than postorbital part of head ; diameter of eye 3 to $3\frac{3}{4}$ in length of head, greater (young) or less than preorbital depth ; interorbital width 3 to $3\frac{1}{2}$ in length of head ; maxillary not extending to below eye ; teeth small ; three series of scales on cheek ; 18 or 19 gill-rakers on lower part of anterior arch ; lower pharyngeal with slender teeth only at the outer edges and near the posterior angles ; area of large rounded teeth extending forward on anterior half of plate. Dorsal XV-XVI 13 ; spines subequal from sixth or increasing to last, which is $\frac{1}{2}$ or a little less than $\frac{1}{2}$ length of head. Anal III 7 ; third spine as long as last dorsal. Pectoral about as long as head, not or barely reaching origin of anal. Caudal slightly emarginate. Caudal peduncle not longer than deep. 33 or 34 scales in a longitudinal series, 6 or 7 from first dorsal spine to lateral line, 24 to 27 in upper lateral line, 26 to 28 in lower, 2 between lateral lines.

Olivaceous; dorsal with alternate series of pale and dark spots.

Upper Congo.

Three specimens, 110 to 225 mm. in total length, from New Antwerp and Stanley Pool.

7. *Tylochromis polylepsis*.

Pelmatochromis polylepsis (Bouleng., 1900), Bouleng. Cat. Afr. Fish. iii. p. 382, fig. 258 (1915).

Well distinguished from its congeners by its smaller scales (55–60). Pharyngeal dentition nearly as in *T. labrodon*, but teeth still larger.

Total length 300 mm.

Tanganyika.

8. *Tylochromis mylodon*, sp. n.

Pelmatochromis lateralis (part.), Bouleng. Cat. Afr. Fish. iii. p. 385 (1915).

□ Depth of body 2 to $2\frac{1}{2}$ in the length, length of head 3. Diameter of eye $3\frac{1}{4}$ to $4\frac{1}{4}$ in length of head, interorbital width $3\frac{1}{2}$ to $3\frac{3}{4}$. Teeth small; maxillary not extending to below eye; three series of scales on cheek; 17 or 18 gill-rakers on lower part of anterior arch; lower pharyngeal a very strong plate, almost covered with large, rounded, blunt teeth. Dorsal XIV 14; spines subequal from fifth or sixth; last $\frac{2}{5}$ or a little less than $\frac{2}{5}$ length of head. Anal III 7; third spine $\frac{1}{2}$ or a little less than $\frac{1}{2}$ length of head. Pectoral longer than head, reaching anal. Caudal peduncle longer than deep. 40 or 41 scales in a longitudinal series, 7 from first dorsal spine to lateral line, 27 to 29 in upper lateral line, 34 or 35 in lower, 2 between lateral lines.

Olivaceous, with six dark cross-bars; fins unspotted.

Lake Mweru.

Two specimens, 115 and 235 mm. in total length.

XXIII.—Notes on the Asilidæ: Sub-division Asilinæ.

By GERTRUDE RICARDO.

PROMACHUS, Loew.

Linn. Ent. iii. p. 390 (1848).

Trupanea, Macq. Dipt. Exot. i. (2) p. 207 (1838) [præocc. Schrank, Dipt. (1803)].

This large genus is very largely represented in the South African Region, and probably many more new species will

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be found. Eight new species are now described. The Oriental Region is also rich in specimens, five new species are now described and one from Australia wrongly placed by me under *P. interponens*, Wlk., in a former paper. Many of the specimens dealt with in this genus and in *Dysmachus* are in the Imperial Entomological Economic Collection.

Table for Species of Promachus from West Africa.

1. Abdomen with tuft-like hairs very apparent on basal segments. Legs usually blackish	2.
Abdomen with no such tufts. Legs reddish	4.
2. Hairs on the three first segments of abdomen yellow	<i>robertii</i> , Macq.
Hairs on the three first segments of abdomen white	3.
3. Moustache black and white or black and yellow. Femora chiefly black. Scutellum with black bristles	<i>fasciatus</i> , Fabr.
4. Genitalia of male with tuft of white hairs. Moustache yellow or white	5.
Genitalia of male with no such tuft. Moustache black and white	6.
5. Last segment of abdomen produced below slightly in male. Ovipositor with two acute points at apex. Scutellum with yellow hairs and bristles. Smaller species. Last segment of abdomen produced triangularly. Ovipositor with no spines. Scutellum with white hairs	<i>simpsoni</i> , sp. n.
6. Abdomen with short yellowish-white pubescence. Scutellum with yellow hairs and usually yellow bristles	<i>rufescens</i> , sp. n.
	<i>poetinus</i> , Wlk.

The following species described from this region of Africa, not included in the table, are: *P. trichozonus*, Loew, in the *P. fasciatus* group, with yellow pubescence on the forehead; *P. mediospinosus*, Speiser, in the same group with the whole underside of thorax and abdomen bright yellowish-red haired; *P. guineensis*, Wied., moustache snowy white, genitalia with tuft white hairs, scutellum with white hairs and bristles—a large species, measuring 26 mm.; ? *Asilus scutellatus*, Macq., and *Asilus albitarsatus*, Macq., both of which probably belong to the genus *Promachus*—the latter has the style of antennæ a little swollen at the end, and might therefore belong to the genus *Philomachus*, the former is described as having pale yellow legs and the posterior part of thorax and the scutellum testaceous red.

Promachus robertii, Macq.

Dipt. Exot. i. (2) p. 211 (1838); Loew, Dipt. Südafrik. i. p. 127 (1860).

The description of this species is very meagre, as follows:—

Black. Head white. Abdomen with the three anterior segments yellow-haired. Tibiæ externally chestnut. Wings reddish.

Length, ♀, 16 mm.

Thorax denuded, sides with ashy-grey tomentum. Coxæ, femora, and tibiæ with whitish hairs below. Wings with a grey streak in the first submarginal cell.

From Senegal.

Females from Sierra Leone (*W. G. Clements*), 93, 20; Freetown, 20. ix. 1899 (*E. E. Austen*); Kumasi, Ashanti; W. Africa, 23. v. 1907 (*Dr. W. M. Graham*), 19 8, 245; Ruwe, Lualaba R., Congo Free State (*Dr. Yale Massey*), 1906, 98; Unyoro, 3400 feet; Uganda, 11–15. xii. 1911; W. shores of Victoria Nyanza, Buddu, 3700 feet; Toro, Daro or Durro Forest, 4000–4500 feet (all *S. A. Neave*), 1912. 12. 3; and one female from Toro Forest, Uganda, 4. v. 1911 (*C. C. Gowdey*), 1914, 7, answer on the whole to this description, though they are larger, and the white hairs on legs are replaced by bright yellow hairs.

The following description is given for identification:—

A large robust species with practically black legs and bright yellow pubescence on abdomen and legs, belonging to the *P. fasciatus* group.

Length, ♀, 22–28 mm.

Female.—*Face* blackish covered with yellow tomentum. *Moustache* of yellow and black hairs. *Palpi* with yellow and black hairs. *Thorax* with black pubescence and bristles. *Scutellum* with yellow hairs and weak black bristles. *Abdomen* black, with bright yellow hairs on the first three segments and on the sides of the others; ovipositor very short; underside with bright yellow hairs. *Legs* black, the chestnut colour of tibiæ is hardly noticeable; coxæ and femora with long bright yellow hairs; tibiæ with shorter similar ones, and also with black hairs, the hind pairs with black hairs only; the middle femora are incrassate, armed with a bunch of numerous black bristles, the fore pair with only a few black hairs, the hind pair with short black bristles. *Wings* streaked with brown.

Promachus fasciatus, Fabr.

Syst. Ent. p. 793 [*Asilus*] (1775); see Kertész, Cat. for further references.

Promachus æqualis, Loew, Dipt. Südafrik. i. p. 127, pl. i. fig. 50 (1860).

Promachus floccosus, Kirby, Trans. Ent. Soc. Lond. p. 273 (1884); Hutton, Trans. New Zeal. Inst. xxxiii. p. 21, nota (1901); Ricardo, Ann. & Mag. Nat. Hist. (8) xi. p. 413 (1913).

Kirby's type, a male, is identical with this species, as pointed out by Hudson there was a mistake in the locality, there being no such place as Opabo, New Zealand, which is on the label—he believed it came from Opobo, W. Africa.

This well-known species is widely distributed, specimens in Brit. Mus. Coll. being from Sierra Leone, Senegal, Uganda Protectorate, Nyasaland, Natal, Ashanti, British E. Africa, and S. Africa.

In the I. E. E. Coll. are long series of specimens from Nyasaland.

All of these have the *moustache* varying from black and white to almost wholly yellow, but none entirely black.

A small male from Sierra Leone has the femora and tibiæ chiefly reddish yellow, also a large female from S.E. Katunga, but the femora are chiefly black.

Promachus simpsoni, sp. n.

Type (male) and type (female) from Yapi, Gold Coast, N. Territories, Nov. 1915 (*J. J. Simpson*), and a long series of males and females, all in I. E. E. Coll., males and females from N. Nigeria (*J. J. Simpson*), 1912, 460, in Brit. Mus. Coll.

A species nearly allied to *Promachus poëtinus*, Wlk., with redder legs, but at once distinguished in the male by the presence of a white tuft of hairs above the genitalia and the last segment of abdomen is somewhat produced below.

In the female the ovipositor is shorter and has two spines at its apex. The legs are almost entirely reddish, with a mere vestige of a black stripe on femora. *Moustache* and beard yellow.

Length, ♂ 19–23, ♀ 17–25 mm.

Male.—*Face* covered with whitish tomentum. *Moustache* composed of yellow hairs reaching the antennæ. Beard same colour. *Palpi* with yellow hairs. *Antennæ* blackish, the first two joints with yellow hairs and a few longer black ones. Forehead with black hairs. Hind head with yellow hairs extending round head and some short black bristles on each side of the occiput. *Thorax* brownish with yellowish tomentum and some long yellow hairs on its anterior border, pubescence of short black hairs; præsutural, supraalar, and postalar bristles all black usually and severally two in number, some yellow hairs on the posterior part among the dorsal black bristles. *Scutellum* with yellow hairs and

long strong yellow bristles forming a double row. *Abdomen* with the usual dark spots and yellow bristly hairs on the posterior borders of segments and on the first segment; hairs on the spots black, at sides yellow. *Genitalia* black, slender, club-shaped, the under lamellæ small but nearly half the length of the upper ones, the underside of the last segment produced somewhat and fringed with short black and yellow hairs. Pubescence on genitalia black, with a tuft of white hairs above. *Legs* xanthine-orange, with short white or yellow pubescence and black bristles; the black colour is confined almost wholly to the apices of femora and tibiæ, but the tarsi are wholly black, fore and middle coxæ each armed with one black bristle. *Wings* clear with reddish-yellow veins.

Female identical, but the pubescence on the black abdominal spots is yellow. *Ovipositor* about the length of the last segment.

Promachus rufescens, sp. n.

Type (male) from Sierra Leone, 58-166, and another male.

Type (female) from Moyamba, Sierra Leone, Feb. 26 (G. C. Dudgeon), 1906, 67.

This species might possibly be identical with *Asilus scutellatus*, Macq., described from Senegal. A small blackish species with reddish-yellow legs, reddish thorax, and scutellum covered with greyish-yellow tomentum. *Genitalia* with a very small tuft of white hairs.

Length, ♂ 15, ♀ 17 mm.

Male.—*Face* covered with glistening yellow tomentum. *Moustache* of scanty yellowish hairs. *Palpi* black with yellow bristles. Beard white. *Antennæ* black. Forehead with black hairs. Hind part of head with black bristles, some yellow ones intermixed. *Thorax* brownish with darker stripes; shoulders, sides, and posterior part of dorsum reddish, covered with yellowish tomentum; pubescence black, some yellow hairs at sides; bristles black. *Scutellum* reddish with yellowish tomentum, and covered with fairly numerous long whitish hairs, one or two black bristles present. *Abdomen* reddish, with whitish-yellow tomentum and the usual large black spot on each segment; pubescence black, whitish on the light parts; underside paler, with white hairs. *Legs* reddish yellow, the femora with a black stripe above and darker altogether; pubescence on legs white, thick; bristles black, with yellow ones intermixed on

the tibiæ, under side of femora, and on tarsi. *Genitalia* black, testaceous below; pubescence white, the last segment below produced to a large triangular piece wholly reddish with black hairs; the upper lamellæ long, club-shaped. *Wings* clear, with yellowish veins.

Female identical. *Ovipositor* long, composed of the last three segments, black.

Promachus poetinus, Wlk.

List Dipt. ii. p. 390 [*Asilus*] (1849); et vii., Suppl. 3, p. 597 [*Trupanea*] (1855); Loew, Dipt. Südafrik. i. p. 127 (1860).

Type (male) from Sierra Leone.

A female from Sierra Leone, presented by Rev. D. E. Morgan. A series of males and females from Bokani and from Boto, N. Nigeria (*J. J. Simpson*), 1912, 460, in Brit. Mus. Coll.

A series of males and females from Yapi, Gold Coast Territories, Nov. 1916 (*J. J. Simpson*). One female from Cotonon in Dahomey, 70 miles west of Lagos (*W. A. Lamborne*), 31. v. 1914.

A species very similar to *P. flavopilosus*, sp. n., from Uganda, but the pubescence on legs and abdomen is not so thick or so bright-coloured. *Scutellum* has sometimes black bristles besides the yellow hairs. *Moustache* whitish and black.

Length, ♂ 19-25, ♀ 23-25 mm.

Male.—*Face* with yellowish tomentum, the moustache composed of black bristles intermixed with fine white hairs, which are also present between the moustache and the base of the antennæ. *Palpi* with whitish-yellow hairs. *Antennæ* deep black, the first two joints with black hairs; the arista one and a half times as long as the third joint. Forehead with black bristly hairs. Hind part of head with white hairs, and four more short black bristles on each side. *Thorax* with white hairs anteriorly and on the breast-sides, elsewhere with black pubescence; præsutural bristles three, supra-alar three, one being a weak bristle, post-alar two, some of these bristles are often yellow. *Scutellum* with many yellow hairs, those on the outer border more bristly, in the type no black ones are present. *Abdomen* with short yellowish pubescence and rather longer hairs at sides; underside with soft yellowish hairs. *Genitalia* black, shining, long, and club-shaped; the under lamellæ also long, more than half as long as the upper ones, all with scanty yellow pubescence. *Legs* xanthine-orange, the fore and middle

femora with black stripes; the hind pair only black at their apices; fore tibiæ black below on the apical half and wholly at apex, the others black at apices, tarsi black; pubescence yellowish, short on femora, some long white hairs on the tibiæ, a fringe of yellow appressed hairs on the hind tibiæ, bristles chiefly black. *Wings* clear, with yellowish veins.

Female identical. *Moustache* more yellow than white with a few black bristles. *Scutellum* in some specimens with two or more black bristles. *Ovipositor* with the under lamellæ joined below to the upper triangular pair.

*Table of Promachus Species from South Africa,
including the Transvaal.*

1. Legs black, with white hairs. Scutellum with whitish hairs and bristles	<i>scalaris</i> , Loew.
Legs reddish; femora usually with a black stripe	2.
2. Antennæ wholly blackish	3.
Antennæ with the second joint yellow or red	4.
3. Legs with usually a short black stripe on under side of femora. Genitalia small. Moustache black in male, black and yellow in female	<i>amastrus</i> , Wlk.
Legs with the black stripe on upper side of femora. Genitalia large. Moustache yellow	<i>albicinctus</i> , Ricardo.
4. Small species. Legs reddish	<i>venerabilis</i> , Wlk.
Large species. Legs reddish. Femora with a black stripe below	<i>dorso</i> , Wlk.

Other species from this part of Africa are *P. fasciatus*, a widely distributed species, *P. caffer*, Macq., a variety presumably of the former, with yellow or white bristles on the legs and the moustache yellow, described from Kaffraria, and *P. vagator*, Wied., from S. Africa and Somaliland, with red-yellow tibiæ and long white hairs on the scutellum, said by Wiedemann to have the third joint thickened at the top, but Schiner declares it to be a true *Promachus* species.

Promachus scalaris, Loew.

Öfvers. Kongl. Vet.-Akad. Förhandl. xiv. 1857, p. 359 (1858); et Dipt. Südafrik. i. p. 130 (1860).

Males and females from Karonga, Brit. E. Africa, 7. vii. 1910 (*T. A. Neave*), in the Brit. Mus. Coll.

A male and female from junction Crocodile and Marico Rivers, Transvaal, in the Cape Museum Coll.

In spite of Loew's type being described as from Kaffraria,

these specimens appear to be identical with his species, answering in every detail to his description, with the exception of size, Loew giving the length as 20–20½ mm.—these measure from 24–25 mm.

It is a robust species distinguished by the wholly black legs with white pubescence and hairs and some white bristles. *Scutellum* with yellowish or whitish hairs and bristly hairs. *Palpi* white-haired. The *genitalia* at once distinguish the male, the upper forceps being large and curved to meet each other at their apices, leaving a space between, in which appears the middle organ, a slender piece with a large short spine near its base below; the forceps are bifid, the lower tooth being sharp and spine-like, the upper one large and obtuse.

Promachus amastrus, Wlk.

List Dipt. ii. p. 394 [*Asilus*] (1849); et vii., Suppl. 3, p. 599 [*Trupanea*] (1855).

Promachus scilurus, Wlk. List Dipt. ii. p. 395 [*Asilus*] (1849).

? *Promachus ædithus*, Wlk. List Dipt. ii. p. 429 [*Asilus*] (1849).

Promachus capreolus, Loew, Öfvers. Kongl. Vet.-Akad. Förhandl. xiv. 1857, p. 360 (1858); et Dipt. Südafrik. i. p. 333 (1860).

Promachus bicolor, Ricardo, Ann. & Mag. Nat. Hist. (7) vi. p. 173 (1900).

Promachus solus, Adams, Kansas Univ. Sci. Bull. iii. p. 153 (1905).

Types (male and male) from S. Africa (*Dr. Smith*).

Type (female) of *P. scilurus* from S. Africa.

Types (male and female) of *P. ædithus* from S. Africa (*Dr. Smith*).

Type (female) of *P. bicolor* from Pretoria.

Males and females from junction Blaaw Krantz and Tugela Rivers, Natal, Oct. 1896 (*G. A. K. Marshall*).

Two females in the Durban Coll. from Salisbury.

Males and females from Natal, Cape Colony, and Orange Free State in Cape Museum Coll.

The type of *P. scilurus* is in very bad condition, but appears identical with *P. amastrus*, as does *P. ædithus*, but owing to their condition it is impossible to be certain.

The specimen I named *P. bicolor* appears the same, evidently the wholly red legs with no black stripes being an exception to the general rule.

Adams's species, *P. solus*, described from one female, measures 15 mm., and appears from the description to be identical with Walker's type.

A species larger than *P. venerabilis*, Wlk., the second joint of antennæ is not yellow. *Genitalia* almost identical. Occiput with usually short yellow bristles, but sometimes

these are wholly or partly black. *Scutellum* with usually black bristles (some yellow ones are present in some specimens) and with white hairs. *Legs* reddish, usually with a short black stripe on under side of femora, apices of femora and tibiæ sometimes black; the tarsi appear darker, being dark at the joints. *Moustache* with yellow and black bristles. Length, ♂ 16-18, ♀ 18-23 mm.

Promachus albicinctus, Ricardo.

Ann. & Mag. Nat. Hist. (7) vi. p. 173 (1900).

Type (male) and type (female) from Pretoria (*W. L. Distant*).

Two females from Pretoria (*Distant*).

One male from Pretoria, 28. x. 1913 (*H. K. Munro*), 1904, 263.

One female from Transvaal, Sept., Nov. 1896 (*Young*), 97, 166.

Male and female from Zululand in Cape Museum Coll.

Distinguished from *P. venerabilis*, Wlk., by the black antennæ, from *P. amastrus*, Wlk., by the black stripe on the upper side of femora, it is very similar in general appearance to this last species.

Promachus fulvipes, Macq.

Dipt. Exot. i. (2) p. 209 [*Trupanea*] (1838); Loew, Dipt. Südafrik. p. 132 (1860).

Promachus venerabilis, Wlk. Trans. Ent. Soc. Lond. n. ser. iv. p. 129 [*Trupanea*] (1857).

From Loew's detailed description there is little doubt that Walker's species is the same as Macquart's species, which is recorded from South and E. Africa.

Walker's type, a male, came from Port Natal.

Males from Estcourt, Natal, Sept. and Oct. 1896 (*G. A. K. Marshall*), 1903, 17, and one female. A male from Piet Retief, Transvaal, 30. x. 1903 (*R. Crawshay*), 1903, 350. One male and one female from Estcourt. One female from Krantzkopf, Natal. One male from Mt. Fongosi, Zululand (*W. E. Jones*), in Cape Museum Coll.

A small neat species near *P. amastrus*, Wlk., but smaller; the black bristles on the *scutellum* are mixed with white hairs and have occasionally some white bristles. *Legs* more wholly reddish and tarsi reddish, the hairs on the *abdomen*, more especially in the male, are black, not white on the black part. The second joint of *antennæ* is yellowish.

Length 9-15 mm., 17 mm. is given by Loew.

The hairs below the antennæ are white, not black as Loew says, and the hairs on the abdomen are chiefly white, not black.

Promachus dorso, Wlk.

List Dipt. ii. p. 397 [*Asilus*] (1849); et vii., Suppl. 3, p. 599 [*Trupanea*] (1855).

? *Asilus rubripes*, Macq. Hist. Nat. Dipt. i. p. 310 (1834).

Type (female) from S. Africa (*Dr. Smith*), 44, 6.

Type (female) in very bad condition, appears to be a species not described by any other author except Macquart, who described *Asilus rubripes*, but states it has three submarginal cells, so that it is probably a *Promachus* species, and the description such as it is suits this Walker type, which is rather large, 25 mm., with almost wholly red legs; the femora alone have a dark stripe below, and short white pubescence on the legs. *Moustache* on the reddish face is composed of reddish bristles with some black ones intermixed. *Palpi* with reddish-yellow hairs and some black ones at the apex. *Antennæ* blackish, but the first two joints chiefly reddish with yellow hairs on underside and black ones on upper side. *Forehead* with yellow pubescence. Hind part of head with short stout reddish-yellow bristles. *Thorax* with black bristles and reddish-yellow hairs on posterior border. *Scutellum* with a double row of reddish bristles and some yellow hairs, also four or five black bristles. *Abdomen* with the usual spots and short yellow pubescence. Ovipositor short. *Wings* clear, with reddish-yellow veins.

Macquart gives the size of his species as 22 mm.

Table of Promachus Species from Central and East Africa.

1. Abdomen with tuft-like hairs, very apparent on the basal segments.....	2.
Abdomen with no such tufts	3.
2. Nearly allied to <i>P. fasciatus</i> , F. Bristles on scutellum chiefly yellow	<i>xanthotrichus</i> , Bezzi.
3. Legs blackish, only the tibiæ yellowish externally.....	4.
4. Pubescence on legs and the moustache yellow. Scutellum with black bristles and yellow hairs.....	<i>obscuripes</i> , sp. n.
5. Legs reddish or yellow; femora sometimes with a black stripe	6.
6. Antennæ usually partly red.....	7.
Antennæ wholly blackish.....	11.
7. Genitalia with tuft of white hairs. Last segment of abdomen produced below in the male	8.

- Genitalia with no such tuft 10.
8. Ovipositor of female long 9.
Ovipositor of female short 11.
9. Genitalia rather large; forceps club-shaped.
Ovipositor composed of the last three segments *flavibarbis*, Adams.
Genitalia slender; the forceps nearly bifid.
Ovipositor composed of the last two segments *ugandiensis*, sp. n.
10. Smaller than *P. negligens*, Adams. Genitalia longer *abdominalis*, sp. n.
11. Genitalia with a tuft of white hairs 12.
Genitalia with no such tuft 15.
12. Very large species. Moustache yellow and black. Scutellum with a double row of black bristles and with white hairs. Legs reddish *negligens*, Adams.
Genitalia of male long. Moustache yellow and black. Scutellum with black bristles and some white hairs. Legs blackish, only the tibiæ dull red *sokotræ*, Ricardo.
Genitalia of male short, with black tuft-hairs below. Moustache silky yellowish white. Scutellum with black and yellow bristles *breviventris*, sp. n.
Last segment of abdomen produced below. Moustache yellow and black. Scutellum with yellow bristles outside and black ones inside *binucleatus*, Bezzi.
Genitalia slender. Wings short. Moustache snowy white. Scutellum with yellow bristles *brevipennis*, sp. n.
13. Species with snowy-white moustache and white bristles at vertex. Scutellum with white and black bristles 14.
14. Femora reddish with a black stripe *rectangularis*, Loew.
Femora blackish *rueppellii*, Loew.
15. Bright yellow-haired species. Moustache yellowish. Scutellum yellow-haired. Legs bright reddish yellow, with black stripe on femora *flavopilosus*, sp. n.

The other described species from this region are *P. pontifex*, *P. rex*, *P. enucleatus*, Karsch, very large species with blackish legs, the tibiæ yellow-brown, also *P. bottegri*, ♂, Corti, with only the anterior tibiæ testaceous, *P. argyropus*, Bezzi, a black white-haired species with the first posterior cell closed and stalked, *P. chalcops*, Speiser, with brown-yellow legs which have thick yellow pubescence, *P. rapax*, Gerst., very insufficiently described; the femora and tibiæ blood-red, white-haired, all from E. Africa; also *P. gossypiatu*s, Speiser, in the *fasciatus* group near *P. xanthotrichus*, Bezzi, with black bristles on the scutellum and legs, moustache chlefly yellow; *P. apicalis*, Adams, from Rhodesia,

with black legs and a blackish abdomen, uniformly greyish-yellow pollinose.

Promachus xanthotrichus, Bezzi.

Ann. Soc. Ent. Belg. lii. p. 378 (1908).

This appears to be only a variety of *P. fasciatus*, Fabr., the only difference being that all the bristles on the *scutellum* are yellow, not black. There are series of specimens with this from Nyasaland in the I. E. E. Coll. and in the Brit. Mus. Coll., one female from Portuguese Congo, two females from Mashonaland, and one male from E. Ruwenzori, but in some specimens a few black bristles appear.

Bezzi described one male from the Falls of Semlia River, Ngami, Congo.

Promachus obscuripes, sp. n.

Type (male).

Type (female) *in coitu*, from Mt. Mlanje, Nyasaland, 27. xii. 1912 (*S. A. Neave*), I. E. E. Coll., and a series of males and females from the same locality.

A species recognized by its wholly black legs, with yellowish short pubescence, by the yellow moustache, and by the yellow hairs and black bristles on the scutellum.

Length, ♂ 16–19, ♀ 17–19 mm.

Male.—*Face* blackish with yellow-grey tomentum at sides. *Moustache* composed of long yellow bristly hairs. *Palpi* with yellow and black hairs. Beard yellowish. *Antennæ* blackish, the first two joints with yellow hairs. *Forehead* with black hairs. Hind part of head with yellow hairs and a few strong short black bristles on each side. *Thorax* with well-marked blackish stripes and greyish-yellow tomentum, the presutural bristles two in number, as are the supra-alar ones, but the post-alar are three in number, all black; dorsum with weak black hairs and a few pale yellow ones interspersed. *Scutellum* with long yellow hairs and black bristles on its posterior border and on dorsum. *Abdomen* with the usual large black spots bordered by greyish tomentum; weak yellow bristles are present on the sides of segments and yellow hairs; on dorsum the pubescence is short and yellow, longer on the first segment. *Genitalia* very large and stout; upper forceps swollen, club-shaped, the lower pair large, produced at the base, and ending in an obtuse point; the lower plates black, shining, all with black pubescence. *Legs* blackish, the tibiæ on their outer sides

pale yellowish; the femora and tibiæ with yellow pubescence, thickest and brightest in colour on the fore legs, lower side of tibiæ with black short hairs; middle and hind femora armed with black bristles, those on the tibiæ and tarsi strong and numerous. *Wings* clear, with grey streaks on apex on fore border.

Female identical. *Ovipositor* short.

Promachus adamsii, Ricardo.

Promachus flavibarbis, Adams, Kansas Univ. Sci. Bull. iii. p. 152 (1905), nomen bis lectum.

Females from Kabulumiro, Uganda, 1909 (*Col. Sir D. Bruce, A.M.S.*), 1909, 83; Bululu, Uganda, 6. i. 1911 (*C. C. Gowdey*), 1914, 7; Nyasaland, Nov. 1892 (*H. H. Johnston*), 94, 12; Uchweni Forest near Witu, British E. Africa, 25-27. ii. 1912 (*S. A. Neave*), 1912, 193; three females from Valley of Kafu River, Unyoro, 3400 feet, 23-28. xii. 1911 (*S. A. Neave*), 1912, 193, all in Brit. Mus. Coll.

Males and females *in coitu*, from Uchweni Forest near Witu, 25-27. xi. 1912 (*S. A. Neave*), in I. E. E. Coll.

These species answer in every particular to Adams's description. He described one female from near Fort Salisbury, Rhodesia, and gives the length as 27 mm.

The two black bristles on the *scutellum* are only present in one or two of the above specimens. *Ovipositor* of female long, composed of three segments. *Genitalia* of male black, shining, the forceps large, club-shaped, ending in broad flattened apices, with no projections or teeth; the lower lamellæ short and small, the border of the under part of last segment produced with yellow and black hairs; pubescence on genitalia black, with tufts of white hairs above.

Length, ♂ 21-23, ♀ 25-27 mm.

Promachus ugandiensis, sp. n.

Type (male) from Semliki Plains near south shore of Lake Albert, 2200 feet; Uganda (*S. A. Neave*), 1912, 193.

Type (female) from Kotakota, Nyasaland (*Dr. J. S. Old*), 1911, 221.

A male from 150-200 miles west of Kambove, 3500-4500 feet; Uganda (*S. A. Neave*), 1907, 230; a male from Blantyre, Nyasaland (*Dr. J. S. Old*), 1912, 401, and a female.

A species with a yellowish moustache and black bristles on the *scutellum*, the first two joints of the antennæ reddish.

Genitalia slender, reddish below. Ovipositor of female long.

Length, ♂ 21-22, ♀ 22-25 mm.

Male.—*Face* yellowish, covered with silvery-white tomentum. *Moustache* of yellow hairs, reaching the antennæ. *Palpi* with yellow hairs. *Antennæ* with a short third joint and long arista, the first two reddish joints with chiefly white hairs. *Forehead* with black hairs at sides and a very few yellow ones. Hind part of head with chiefly stout yellow bristles. *Thorax* brownish red, with grey tomentum and black pubescence and bristles, some white hairs at sides and posteriorly. *Scutellum* reddish, with grey tomentum, chiefly black bristles, and white hairs. *Abdomen* with short yellow pubescence, some black hairs intermixed on the black spots. *Genitalia* very similar to those of *P. brevipennis*, sp. n., but the under lamellæ are testaceous, short, and stout; the under side of the last segment is reddish and produced to a triangle and covered with short white hairs, the testaceous part with white hairs, the upper forceps with chiefly black hairs, the tuft of white hairs is represented by only a few white hairs, the upper forceps are almost bifid at apices; in one male the hairs on triangular produced segment are largely black. *Legs* reddish yellow, the femora with a black stripe; pubescence thick, white; bristles black. *Wings* clear, not very long.

Female identical. *Ovipositor* includes the seventh and eighth segments, and is about as long as the last two segments together.

Promachus abdominalis, sp. n.

Type (male) from Mt. Mlanje, Nyasaland, 7. xii. 1912, and other males (*S. A. Neave*).

Type (female) from Uchweni Forest, near Witu, 25-27. xi. 1912 (*S. A. Neave*), and males all in I. E. E. Coll.

One female from Chiromo, Nyasaland, Ruo River (*R. C. Wood*) (1916).

Three males and two females from 150-200 miles west of Kambove, 3500-4500 feet (*S. A. Neave*), 1907, 230.

A species nearly allied to *P. negligens*, Adams, but somewhat smaller, and the genitalia in male are quite different, being longer and more slender and with no white tuft above.

In the female the much longer ovipositor will distinguish it at once.

Length, ♂ 28, ♀ 24 mm.

Male.—*Face* honey-yellow with some grey tomentum.

Moustache of yellow stiff bristles, three black bristles near oral aperture. *Palpi* with black and yellow bristly hairs, often with only white or yellow hairs and no black ones at apex. *Antennæ* dull reddish, the first two joints with white pubescence, the third joint short, the arista more than double its length. *Forehead* with first yellow, then black hairs. Hind part of head with short stout black bristles intermixed with white hairs. *Thorax* reddish brown with grey tomentum and chiefly black pubescence; bristles posteriorly very stout, with long black hairs between. *Scutellum* covered with greyish-yellow tomentum and with stout black bristles on its posterior border, and others on dorsum, and with sparse short white pubescence. *Abdomen* with the usual black spots and grey bands, on which last are short white bristly hairs, and longer white bristles at sides; pubescence on the spots black and at sides. *Genitalia* blue-black, shining, the upper forceps long and stout, club-shaped, the lower lamellæ very short, in one specimen coloured red, with long black hairs below and chiefly yellowish ones above; the underside of the last segment not fringed with black hairs nor produced as in *P. negligens*. *Legs* dull red, but the femora blackish below and often partly so above, tarsi blackish; legs with short white pubescence, most noticeable on the tibiæ and tarsi. *Wings* large, clear, with reddish-yellow veins.

Female identical. *Ovipositor* long, composed of the sixth, seventh, and eighth segments.

Promachus negligens, Adams.

Kansas Univ. Sci. Bull. iii. p. 154 (1905).

The type was described as from near Fort Salisbury, Rhodesia.

Males and females from Mt. Mlanje, Nyasaland (*S. A. Neave*), in I. E. E. Coll.

Males and females from west of Kambove, 3500–4000 feet (*S. A. Neave*), 1907, 230; also from Kasama District, N.E. Rhodesia, Oct. 1904 (*R. L. Harger*), 1905, 79, in Brit. Mus. Coll.

A very large black species with grey bands on the abdomen. *Scutellum* with black bristles and white hairs. *Legs* dull red, apices of femora and tibiæ blackish. *Moustache* yellow, with some black bristles above.

Length given by Adams as 26–31 mm., but some of these measure as much as 35 mm.

In some specimens there are vestiges of a black stripe on the femora.

This species is distinguished from *P. flavibarbis*, now *P. adamsii*, by its larger size and entirely black *antennæ*, in the latter species the first two joints are reddish and the ovipositor of the female is longer, composed of the three last segments of abdomen.

Promachus sokotræ, Ricardo, in Forbes, The Nat. Hist. of Sokotra, p. 362, pl. xxii. figs. 7, 7a, 9, 9a (1903).

Types (male and female) and others from Adho, Diemellus, and Gochal Valley, Sokotra (*W. R. O.-Grant*).

Distinguished from *P. negligens* at once by the long *genitalia* in the males, the upper forceps long, cylindrical, bordered with black short hairs and at apex with long fringe-like black hairs, the white tuft above is very apparent. *Ovipositor* of female not very long, composed of the seventh and eighth segments of abdomen, which has the usual black spots and grey tomentose bands. *Scutellum* with many stout black bristles. *Moustache* with black and yellow bristles. *Legs* blackish, the tibiæ dull testaceous.

Length, ♂ 28, ♀ 33 mm.

Promachus breviventris, sp. n.

Type (male) and type (female) from the west slope of Kenya on Meru-Nyeri Road, 6000-8500 feet, Brit. E. Africa (*S. A. Neave*), 1911, 177; and other males and females from same locality.

A species allied to *Promachus binucleatus*, Bezzi, in the *genitalia* of male which have a very thick compact tuft of black hairs below; the *genitalia* are very short, with white hairs above. The ovipositor in female includes the seventh and eighth segments and is fairly long. *Legs* reddish with white pubescence and black stripes on the femora. *Moustache* white.

Length, ♂ 17-18, ♀ 20-22 mm.

Male.—*Face* chamois-colour with yellowish tomentum. *Moustache* composed of silky yellowish-white hairs, rather thick, and white shorter hairs are continued to the *antennæ*, which have the third joint wanting, the first two joints with some white hairs below and black hairs on upper and lower sides. *Palpi* with white hairs. *Forehead* with bristly white hairs, fairly numerous. Hind part of head with stout white bristles, becoming white hairs round the head. *Thorax*

chestnut-brown or blackish with the usual stripes and grey tomentum; pubescence black, rather thick, with a bunch of white hairs above the base of wings; bristles black. *Scutellum* with white hairs on its anterior border and black and yellow bristles beyond, the latter predominating—the black bristles always on dorsum, not on border. *Abdomen* with the usual black spots; pubescence chiefly yellow, some black on the posterior segments; underside with whitish hairs, the border of the last segment does not appear to be produced, but is bordered by the very thick coarse black hairs forming a thick tuft on each side, coalescing in the middle. *Genitalia* extremely short and small, black and shining, with black pubescence; the upper forceps stout, the white hairs above are thick and extend to the apices of forceps. *Legs* dull brick-red, the femora with black stripes above, the legs with thick white pubescence and many white bristles on the tibiae. *Wings* clear, with reddish-yellow veins.

Female identical. *Ovipositor* with some whitish pubescence, nearly as long as the last two segments together.

[To be continued.]

XXIV.—Some Notes on Babirussa.

By OLDFIELD THOMAS.

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THE British Museum owes to the generosity of Mr. Wilfred Frost a fine series of male skulls, eleven in number, of Babirussas collected by him in the island of Tali Aboe, in the Sula group, east of Celebes—a locality where they had been reported to exist, but from which, so far as I am aware, no specimens had been brought to any European Museum. In working these out and comparing them with the Babirussas of Buru and Celebes a certain number of interesting points have turned up, which may be worth publication.

Firstly, as regards the spelling of the names of the genus and type-species, these are quite correctly put by Lydekker* *Babirussa babyrussa*, none of the other variants of the two names being technically admissible. This being the case, it

* Cat. Ung. B. M. iv. p. 345 (1915).

is probably also more convenient to spell the vernacular name with a double s.

The typical species *Sus babyrussa*, Linn., was largely based on two figures of skulls, one by Grew and the other by Seba, so that the skulls depicted would have been co-types of the species. Of these two skulls, one—that figured by Seba—is still in existence (B.M. no. 67. 4. 12. 223), and may with propriety be formally selected as a lectotype. It was stated by Seba to have come from Buru, an assertion quite borne out by its characters.

The differences between the Buru and Celebes forms have been well pointed out by Deninger*, who shows how, by the more inward-pointing direction of the upper canines in the Babirusa of Celebes the nasals are pinched in mesially and other characteristics are produced by which that animal can generally be distinguished. The canines themselves are very much finer, and I may further note that well-marked basal pits appear always to be present in this species, while the bullæ in section are of the narrow-oval shape found in the Tali Aboe skulls.

Deninger named the Celebean form *celebensis*, although stating that the description by Lesson of *B. alfurus* applied to that animal, and not to the Buru one. With some hesitation I am prepared to accept his view that none the less *alfurus* should be considered a synonym of *babyrussa*, on the ground that Lesson was distinctly giving a new specific name—as was necessary under the code of that day—to *Sus babyrussa*, whose specific name he was using as a generic one. Lesson's book contained descriptions of all mammals known to him, and the accident that his description of some Babirusas seen in Java is thought by Deninger to apply best to *celebensis* does not, I think, alter the fact that Lesson was distinctly renaming Linné's *Sus babyrussa*, of which, therefore, *alfurus* would be a synonym.

Now, with regard to the Tali Aboe Babirusas, I find that, so far as the canines and nasals are concerned, they are emphatically of the Buru or *B. babyrussa* type, without any tendency towards the characteristics of the Celebes *B. celebensis*.

But there are certain differences which, being found in so fine a series as eleven Tali Aboe skulls, as compared with the actual type of *B. babyrussa*, appear to indicate that they should be subspecifically separated from the latter. I would suggest for the animal, in honour of the naturalist to whom we owe its discovery, the name of

* Ber. Nat. Ges. Freiburg, xviii. p. 1 (1911).

Babirusa babyrussa frosti, subsp. n.

Size slightly smaller than in *babyrussa*. Upper canines as in the latter, not bent in, crossing each other or compressing the nasals, as is the case in *B. celebensis*. But they are conspicuously smaller and shorter than in *babyrussa*, and do not rise nearly so high above the muzzle as in that animal. Basial pits almost always absent, only occurring (and these shallow) in two out of eleven skulls. Bullæ small, narrow, flattened from side to side, their breadth much less than their horizontal diameter, in marked contrast to the broad sub-triangular bullæ of typical *babyrussa*; the crest leading upwards from their outer corners behind the glenoid fossæ well developed, much higher than that on the outer side of the base of the paroccipital process, this proportion being reversed in *babyrussa*. Paroccipital process more slender.

Dimensions of the type-skull:—

Length, nasal tip to occiput, 274 mm.; condylo-basal length 268; zygomatic breadth 124; nasals, length 131, anterior breadth 22, mesial breadth 15, posterior breadth 31; occipital breadth 73; palatal length 178; bullæ, horizontal length 25, breadth 13.

Length of canine along front curve 141, greatest length above nasals 45; greatest basal diameter 13. Front of p^2 to back of m^3 68; m^3 , length 22, breadth 15. Length of lower canine 77. Length of lower tooth-row 74.

The older skulls may attain to 284 mm. in condylo-basal length.

Hab. Tali Aboe Island, east of Celebes.

Type. Adult (but not old) male skull. B.M. no. 19.11.23.1. Presented to the National Collection by Wilfred Frost, Esq. Eleven skulls examined.

In the above various points there is such a strong average difference between the Babirusa of Buru and the form found in Tali Aboe that I think the latter should certainly bear a varietal name, even though some of the points may prove to be rather "average" than absolute characteristics.

Six of the skulls (including the type) were obtained by Mr. Frost on the comparatively high middle third of Tali Aboe, while the other five came from the lowlands of the eastern third. The latter skulls—of which three at least are fully adult—are rather smaller than the former, but the difference does not amount to much, and is, perhaps, due to a shortage of the food available in competition with the native pigs of the lowlands.

Of the external characters of *B. b. frosti* I am able to say nothing.

It will thus be seen that the Museum is indebted to Mr. Frost for a donation of very great scientific value, as series of such skulls are very rarely obtained, and this one represents both a verification of the Tali Aboe locality and the discovery of a new subspecies.

With regard to references that have been made to "domesticated or semi-domesticated" Babirussas, Mr. Frost states that, at least in Buru and Tali Aboe, these animals are never domesticated, as they will not live in harmony with the native pigs, which are ubiquitous.

He also says that the reason it is so difficult to obtain females is that the boars put up such a plucky fight against the dogs used in hunting that it is impossible to get at the sows until such time as the male has been killed, thus enabling the females to get safely away. As a result, very few museums possess female specimens, and our own collection only contains one single immature skull of that sex.

XXV.—*A Further Collection of Mammals from Jujuy.*

By OLDFIELD THOMAS.

(Published by permission of the Trustees of the British Museum.)

DURING the winter of 1919—April to August—Sr. E. Budin made collections of mammals on the lower grounds of Jujuy, firstly in the near neighbourhood of the town of Jujuy, at an altitude of rather more than 1200 metres, and then on the still lower levels to the east, where the Rio Lavallen, lower down (northwards) called the Rio San Francisco, forms part of the upper waters of the Vermejo system. On this river the place where Sr. Budin collected was Villa Carolina, some 20 kilometres to the east of San Pedro de Jujuy, and therefore in the same faunal district as Manoel Elordi and Tartagal, where he had previously found such interesting things.

A few additional specimens were obtained at Yuto, about 70 km. north of Villa Carolina.

The present collection adds considerably to our knowledge of the Jujuy fauna, and contains examples of four new forms, of which the most noticeable is a *Marmosa* of a more northern type than any previously recorded from Argentina.

1. *Eptesicus hilairei*, Geoff.

♂. Yuto, Rio San Francisco (in spirit).
Forearm 44 mm.

2. *Myotis nigricans*, Wied.

♂. Yuto, Rio San Francisco (in spirit).
Forearm 33 mm.

3. *Molossops temminckii*, Burm.

♂. Yuto, Rio San Francisco (in spirit).
Forearm 30 mm.

This bat is the type of the genus *Molossops*, as selected and fixed by Miller*.

But it appears to me that the other species hitherto included in *Molossops* ought to be generically distinguished from it. For while in that genus, as represented by *temminckii*, there are only two lower incisors, m^3 is comparatively normal, of triangular shape, with a well-marked third commissure, and m_3 , in correlation, has a normal triangular posterior lobe, with two cusps, the other species all differ in these respects. I would therefore suggest they should be distinguished under the following name:—

CYNOMOPS, gen. nov.

Genotype, *C. cerastes* † [*Molossus cerastes*, Thos.].

General characters as in *Molossops*, with the following exceptions:—

Lower incisors 4. M^3 simplified ‡, with no third commissure, the tooth transversely oblong, scarcely broader externally than internally. M_3 equally simplified, the posterior lobe linear, with one cusp only.

Other species: *C. planirostris*, Pet., *brachymeles*, Pet., *mastivus*, Thos., and *paranus*, Thos. *Molossops milleri*, Osg., also presumably comes here, as it is compared with *planirostris*, but it is of about the size of *M. temminckii*, which is

* Fam. Gen. Bats, p. 247 (1907).

† I should naturally have selected *planirostris* as genotype, but specimens from so many localities (including Buenos Ayres) have been assigned to that species that there is always a little doubt about its exact identity. Moreover, the large *cerastes* contrasts better than *planirostris* with the little *temminckii* as a representative of the genus which contains all the large species of the group.

‡ Peters's beautiful plate of *planirostris* (Chiropt. Mus. Zool. Berl. pl. 18 B) shows the structure of the molars very well.

not mentioned, and the characters of the incisors and molars are not referred to.

4. *Felis yaguarondi*, Desm.

♀. 669. Villa Carolina. 500 m.

A fine fully adult female of the normal grey-brown colour. This is a valuable accession, as the Museum collection of these variable cats is very imperfect and much needs supplementing. I have long had an impression that the Jaguarondi and the Eyra may possibly represent but a single dimorphic species, as there seems little essential difference, other than colour, between the grey or brown "*F. yaguarondi*" and the bright reddish "*F. eyra*," and the two occur more or less throughout the same area. So far, however, every author has considered them distinct—as, indeed, they appear,—and without better material I do not like definitely to assert their identity.

5. *Mus musculus*, L.

♂. 547, 548, 556. Jujuy. 1258 m.

6. *Holochilus balnearum*, Thos.

♂. 615, 622, 623, 626, 627, 675, 687, 692, 695, 699 ;
♀. 610, 618, 621, 628, 629, 637, 638, 645, 561, 654, 655,
671, 674, 676, 677, 684. Villa Carolina. Alt. 500 m.

"Raton Nutria. Inhabits the banks of the river."—*E. B.*

I provisionally use for this "otter-rat" the name I gave in 1906 to one sent from Tucuman by Signor Dinelli. But in this genus the local differences are so slight and inconstant, and the ranges of these animals are probably, as in other river-animals, so great, that it is doubtful if even the few species that have been described are all valid.

7. *Hesperomys venustus*, Thos.

♂. 572, 582, 587, 597 ; ♀. 601. Jujuy. 1258 m.

♂. 619, 630, 634, 646, 647, 649, 653, 682, 686 ; ♀. 611,
633, 641, 642, 652, 656, 659, 678, 679, 688, 698, 707, 709,
711. Villa Carolina. 500 m.

8. *Hesperomys musculus cortensis*, subsp. n.

♂. 546, 564, 567, 577, 578, 598, 602 ; ♀. 553, 573, 579,
586, 599, 600, 604, 607. Jujuy. 1258 m.

"Caught in straw-yard."—*E. B.*

Size rather less than in true *musculus* of Maimara, feet and tail averaging shorter. Colour above slightly duller, browner, and less clear, and below, where the difference is more noticeable, the tone is a dull pale drabby, approaching (though much less than) that found in *Mus musculus*, while in true *musculus* the colour is a clear greyish white, with scarcely any suspicion of drabiness.

Dimensions of the type:—

Head and body 94 mm.; tail 83; hind foot 19; ear 15.

Skull: greatest length 24·5; condylo-incisive length 22·3; zygomatic breadth 13·4; nasals 9; interorbital breadth 3·8; palatilar length 10; palatal foramina 5·6; dental length 11; upper molar series 3·5.

Hab. as above.

Type. Adult male. B.M. no. 20. 1. 7. 46. Original number 577. Collected 29th April, 1919.

This *lauchia* is no doubt very closely allied to the true *musculus** of Maimara, with which it shares the number of fourteen mammæ; but on comparison of fifteen specimens with six of *musculus* it proves to have so uniformly drabbier an under surface, while both feet and tail average shorter, that I have thought it worthy of having a distinctive name.

A single old male skull—one of those overgrown examples which often render distinction by size so difficult—measures no less than 26 mm. in greatest length; but this is obviously abnormal, the type being of about the usual adult size.

9. *Oryzomys* sp., *flavescens* group.

♂. 613, 614, 655, 663, 680; ♀. 624, 636, 639, 640, 648. Villa Carolina. 500 m.

10. *Graomys lockwoodi*, Thos.

♂. 625, 631, 668, 681, 685, 694, 697; ♀. 616, 617, 644, 672, 673, 689. Villa Carolina. 500 m.

“Trapped among fallen trees.” “Lives in hollow tree-trunks.”—*E. B.*

These specimens again show that the presence or absence of slate-grey at the bases of the belly-hairs is in this group a character of no importance, all conditions occurring in the series.

None of these examples have feet quite as long as in the

* *Elignodontia laucha musculina*, Thos. Ann. & Mag. Nat. Hist. (8) xi. p. 138 (1913).

type, but that is a very old specimen. Their bullæ are all smaller than in the type of *G. cachinus*, and about the same as in *G. lockwoodi*.

11. *Akodon simulator*, Thos.

♂. 545, 550, 551, 555, 557, 560, 568, 570, 571, 574, 576, 593, 596, 603, 605, 608; ♀. 552, 558, 559, 569, 575, 581, 588, 590, 591, 594, 609. Jujuy. 1258 m.

♂. 620, 632, 650, 658, 660, 662; ♀. 612, 641. Villa Carolina. 500 m.

This fine series, of all ages, shows, firstly, that *A. simulator* is much more hypsodont than ordinary Akodons of the *arenicola* group, being, in fact, intermediate between the latter and the extremely hypsodont *Hypsimsys*. And the same is no doubt the case with the other large Akodons of the present group, most of which are known only by more insufficient material, often with greatly worn teeth. Degrees of hypsodontism are always very difficult to judge without specimens of many different ages; so that this series is of special value.

Secondly, I would note that *A. simulator* proves to be more variable in colour than usual, some specimens being, like the original set, grey anteriorly and buffy posteriorly, others with the buffy covering the whole body, and others, again, nearly uniformly brown. These differences are not local, and no corresponding differences can be found in the skulls.

12. *Akodon* sp. (near *A. dolores*).

(Villa Carolina.)

A skin (no. 656) from Villa Carolina, which appears to be quite indistinguishable from *Hesperomys venustus*, has assigned to it, but I feel sure wrongly, a skull showing a very close resemblance to that of the Cordova *Akodon dolores*, an animal with no external similarity to the *Hesperomys*, and belonging to yet another group of Akodon. No skin in the collection seems suitable for this skull, which must remain undetermined until further collections are made. *A. dolores* is not specially hypsodont, as are *A. simulator* and *cænosus*, nor are the incisors proodont, as is the case with *A. lactens* and *orbis*, from Leon, Jujuy, and Otro Cerro, Catamarca, respectively.

13. *Akodon cænosus*, Thos.

♂. 580, 585, 589, 592, 595, 606; ♀. 565, 566, 583. Jujuy. 1258 m.

This Akodon was originally described as a subspecies of *A. puer*, but is shown by better material to have a somewhat larger skull with more angular supraorbital edges, and to be distinctly more hypsodont than that animal—in fact, as much so as in the large *A. simulator*. I therefore recognize it as specifically distinct.

A complete male skull has a greatest length of 25.5 mm.; condylo-incisive length 23.2.

14. *Ctenomys sylvanus utibilis*, subsp. n.

♀. 713, 715. Yuto, Rio San Francisco. Alt. 500 m.

“Found among woods; sandy soil.”—*E. B.*

Size and general characters of true *sylvanus*, but lighter and with white patches on under surface.

Colour above near “snuff-brown,” but rather darker, the median dorsal line blackened in the paratype, but not so in the type. Under surface in general scarcely lighter, but in both specimens there are well-marked axillary white spots and conspicuous inguinal patches. Sides of muzzle scarcely blackened. Hands, feet, and tail more hairy than in *sylvanus*, less than in *budini*, the hands and feet white, the tail blackish for its proximal two-thirds, then white.

Skull about as in *sylvanus*, but in the available specimens the interparietals are larger, about equalling those of *budini*, and the palatal notch ends opposite the middle instead of the front edge of *m*².

Dimensions of the type:—

Head and body 190 mm.; tail 65; hind foot 34.5.

Skull: median length 45.7; condylo-incisive length 45; zygomatic breadth 23.7; nasals 16.2 × 7.8; interorbital breadth 10.2; breadth across brain-case 19.5; bimeatal breadth 28.5; palatilar length 20.3; dental length 26; upper tooth-series (crowns) 9.8.

Type. Adult, but not old, female. B.M. no. 20. 1. 7. 114. Original number 715. Collected 24th July, 1919.

This tuco-tuco would seem to be a less saturate form than true *sylvanus*, inhabiting more open woods, with the soil “arenoso” instead of “vegetal”—sand instead of humus. Its general tone is rather lighter, its muzzle is conspicuously so, while its prominent white axillary and inguinal patches afford the most obvious means of distinction, as there are none at all in *sylvanus*. Both forms are no doubt nearly allied to *budini*, but from that the distinction of *utibilis* in ground-colour, and especially in that of the lower surface, is markedly greater. Both *sylvanus* and *utibilis* occur at about 500 m., while *budini* comes from 2600 m.

15. *Ctenomys juris*, sp. n.

♂. 703, 706; ♀. 702, 704, 705. El Chaguaral, between San Pedro and Villa Carolina. Alt. 500 m.

"In stony ground in ravines running down to the river."
—*E. B.*

A small species like *C. fochi* externally, but with much smaller bullæ.

Size small, about as in *bergi*, *fochi*, and *dorsalis*. General colour usually quite uniform pale brown, nearest to "saya brown" along the back, paler on the sides. Under surface washed with pale buffy varying towards whitish; the best-marked specimens near "pinkish buff." Middle line of face normally little darker than back, but in two out of five specimens there is a marked darkening on the top of the muzzle, as in *fochi*. Size of neck with a buffy or whitish half-collar extending up to the ear. Inner side of forearm whitish, lighter than the belly; concolor with the belly in *fochi*. Hands and feet whitish. Tail dull buffy whitish, with a dark brown terminal crest.

Skull with broad nasals, little narrowed posteriorly. Zygomatic widely expanded, the anterior zygomatic breadth often greater than the posterior. Palatal notch to level of middle of m^2 . Bullæ small and narrow, but smoothly filled out, not compressed; markedly smaller than in *fochi*.

Incisors rather more proodont than usual, the index-angle about 108° , in the type of *bergi* 100° , in that of *fochi* 94° .

Dimensions of the type:—

Head and body 177 mm.; tail 72; hind foot 29.

Skull: median length 42; condylo-incisive length 42.3; zygomatic breadth (anterior) 27; nasals 13.2×7.5 ; inter-orbital breadth 10; breadth across brain-case 17; bimeatal breadth 27; palatilar length 19.7; dental length 25; upper tooth-series (crowns) 8.3.

Type. Adult male. B.M. no. 20. 1. 7. 116. Original number 706. Collected 3rd August, 1919.

The smaller bullæ and usually undarkened forehead will readily distinguish this tuco-tuco from its nearest ally *C. fochi* of Chumbicha, Catamarca.

Sr. Budin has taken great pains in getting tuco-tucos, making excursions in various directions to obtain them, and is now rewarded by the discovery of two further new forms. None appear to be found at Villa Carolina, or very close to the town of Jujuy.

16. *Dasyprocta variegata bolivivæ*, Thos.

Immature skull. ♂: Villa Carolina. 500 m.

17. *Galea comes*, Thos.

♂. 635, 666, 670, 691, 708; ♀. 643, 657, 661, 664, 696, 700, 701. Villa Carolina. 1258 m.

18. *Sylvilagus brasiliensis gibsoni*, Thos.

♂. 690. Villa Carolina. 500 m.

Not fully adult. Nape-patch less rufous than in type.

19. *Marmosa* * *budini*, sp. n.

♂. 714. Altura de Yuto, Rio San Francisco. Alt. 500 m.

"Caught in an upland wood."—E. B.

A medium-sized species, grey above and buffy yellowish below.

* I am quite unable to accept the nomenclatural results of Dr. Matschie's recent paper on the Didelphidæ (SB. Ges. Nat. Fr. Berl. 1916, p. 259), because, as in other cases, he bases his whole work on the obsolete and now generally discarded principle of elimination, instead of using modern methods for the identification and selection of genotypes. Some of his conclusions in the present case would be specially unacceptable to workers in general, such as his entire ignoring of my selection in 1888 of *brachyurus* as the type of *Peramys*, Less., and his long and complicated arguments that because the other species of the original *Peramys*—*brachyurus*, *tristriata*, and *pusilla*—fall into other genera, the fourth species mentioned—*crassicaudata*—must be taken as the genotype. Such a definite selection of the genotype of *Peramys* (*brachyura*) as that in the 'Catalogue of Marsupials' is in accordance with modern usage and cannot be ignored.

With regard, however, to *Monodelphis*, Burm., although Dr. Matschie's selection of its genotype is obtained, as I consider, in the wrong way, yet he has made a selection, and, in the absence of an earlier one, that would be valid, and I would therefore accept "*brachyura*" as its genotype. In consequence *Monodelphis* would antedate and supersede *Peramys* for the genus containing the common short-tailed opossum.

All Dr. Matschie's recent nomenclature work is similarly based on this unsound principle of elimination, so that his exceptional literary knowledge is rendered nugatory so far as the utilization of his results is concerned.

Incidentally I may note that the group called *Micoureus* by Matschie, who quotes its type as *D. laniger*, Desm., appears to need a new name, as *Micoureus*, Lesson, with type by subsequent selection *D. cinerea* (Thomas, 1888), properly goes to quite a different group. I would suggest the name *Mallodelphys* for the former, with *D. laniger* as its genotype. It should, I think, rank as a subgenus of the genus *Philander*, whose genotype, by tautonymy, is *Philander philander*, L.

Size about as in *M. murina*. Fur soft and fine, of medium length, hairs of back about 12 mm. long. General colour above rather browner than Ridgway's "light greyish olive"; sides lighter and more buffy; under surface rich buffy, the median area of throat and belly "light ochraceous buff," this colour also extending up, though less intense, on the outer sides of the hips. Top of muzzle dull buffy, cheeks rich buffy; black orbital rings well marked. Upper surface of hands and feet pale buffy; fifth hind digit about equal in length to the second; third longer and fourth longest. Tail with only about a centimetre at its base furry and coloured like the body; the rest naked, grey for its proximal half above and third below; the end white all round.

Skull of normal proportions; nasals expanded behind; supraorbital ledges well developed. Palatal imperfections of average extent.

Teeth rather large in proportion to the size of the skull. P^1 small, p^2 and p^3 much larger, subequal.

Dimensions of the type:—

Head and body 139 mm.; tail 186; hind foot 24.5; ear 22.4.

Skull: greatest length 38; condylo-basal length 37; zygomatic breadth 21.5; nasals, length 16.5, middle breadth 2.7, greatest breadth 5; breadth across postorbital processes 8.8; palatal length 21; length of maxillary tooth-row 15.7; first three molariform teeth 7.1.

Hab. as above. Yuto is about 70 kilometres north of Villa Carolina.

Type. Male, adult but not old. B.M. no. 20. 1. 7. 134. Original number 714. Collected 23rd July, 1919.

While of about the size of the members of the *Marmosa murina* group, and with similarly unfurred tail-base, this opossum has the greyish colour and yellowish belly of *M. cinerea* and its allies, and is thus readily distinguishable from any species as yet described. It is the first member of the group to be found in Argentine territory.

The species is named after Sr. Budin, in recognition of the keen and intelligent interest he takes in his collecting work.

20. *Marmosa elegans cinderella*, Thos.

♂. 554, 562, 563; ♀. 549, 561. Jujuy. 1258 m.
♂. 683, 693, 710. Villa Carolina. 500 m.

XXVI.—A new Species of *Mellivora* from Somaliland.

By R. C. WROUGHTON and Major R. E. CHEESMAN.

THE classification of specimens of *Mellivora* from S.W. Persia necessitated the survey of all material of this genus in the National Collection. It then became evident that certain specimens from Somaliland possessed characters differing from those of other African species of *Mellivora*, more especially from the two nearest named species, *Mellivora abyssinica*, Hollister, and *Mellivora sagulata*, Hollister.

Mellivora brockmani, sp. n.

A *Mellivora* having the grey of the mantle much lighter than that of *M. abyssinica*, with white marginal line of mantle 18 mm. broad and very distinct, and lacking the ochraceous colour of the mantle of *M. sagulata*. General colour black, with iron-grey mantle from between the eyes to half the length of the tail; mantle bordered with a clearly defined white marginal line.

The hairs of the mantle are entirely white and entirely black, mixed in a proportion to give a general colour of grey. Towards the margin the black hairs are absent, forming the white marginal line. Length of hairs about 26 mm. on the centre of the back.

Dimensions of the type:—Head and body 687 mm.; tail 220; hind foot 118; ear 35.

Skull: condylo-basal length 128; palatilar length (broken); interorbital width 34; length of carnassial 15.5; length of upper tooth-row behind canine 31.

Hab. N. Somaliland. Type from Upper Sheikh, Somaliland. Alt. 4300 ft.

Another specimen from Gorahai, Somaliland (*Capt. H. N. Dunn*).

Type. Adult male. B.M. no. 10. 10. 3. 10. Original number 268. Collected 11th January, 1910, by Dr. R. E. Drake-Brockman, and presented by him to the British Museum.

This species has been named in honour of Dr. R. E. Drake-Brockman.

XXVI. — *Notes on Myriapoda.* — XXI. *Colobognatha*, an Order of *Diplopoda* (*Millipedes*) new to Britain, represented by *Polyzonium germanicum* (Brandt). By the Rev. S. GRAHAM BRADE-BIRKS, M.Sc., Lecturer in Zoology and Geology, S.E. Agricultural College, Wye, Kent.

ON the occasion of a visit that the Lecturer in Agricultural Zoology here—Mr. C. A. W. Duffield—and the writer paid to the Juniper Wood, Wye, on the afternoon of the 24th of October, 1919, I took a millipede referable to the genus *Polyzonium*, Brandt, 1834. It appears that the order to which this genus belongs has been unrepresented hitherto in the faunal lists of the British Isles.

During November 1919 Mr. Duffield and I took a number of specimens of the same animal on subsequent visits to the wood, and one specimen was also taken there on the 13th of December.

Upon the dissection of some male specimens for the examination of secondary sexual characters of taxonomic importance and their comparison with those given by Latzel (1) in his figures of the species *P. germanicum* (Brandt, 1831), it was found that some points of agreement were very noticeable. At the same time I felt doubtful about the diagnosis, and thought it advisable to send a male specimen to Monsieur Henry W. Brölemann, the eminent French myriapodologist, who, with a courtesy now proverbial in his circle of English friends, made a careful examination of the animal and a sketch of the gonopods, together with a note on one of Verhoeff's papers (4). This assistance, submitted to me *in litt.*, makes my present task a light one, and I here express my best thanks to M. Brölemann for his valuable help.

M. Brölemann definitely referred the male I sent to him to the species *Polyzonium germanicum*, a member of the family *Polyzoniidæ*, Gervais, 1844, order *Colobognatha*, Brandt, 1834. Latzel (1) describes the *Colobognatha* an order differing from the *Chilognatha* in the structure of the mouth-parts, which are modified here to a greater or less extent with the suctorial function of the rostrum into which the circum-oral region is produced. Latzel adds an account of the family *Polyzoniidæ*, which he divides into two subfamilies—the *Platydesmia* and the *Dolistenia**,—the former including genera

* Latzel (*loc. cit.*) tells us that Brandt had previously subdivided the family into *Ommatophora* and *Typhlogena*, the former containing the genera with eyes, the latter including all without.

with less than seventy body-segments, the latter those with more than seventy. In the former subfamily he places *Polyzonium germanicum*, and gives a detailed description of the genus and species, devoting the whole of his plate xvi. (figs. 199–210) to the latter. Since Latzel's time further systematic work has been done in this group; some indication of its extent may be gathered from Verhoeff's work on German Diplopoda, (5) p. 23. The same author criticized Latzel on *Polyzonium* as early as 1898, and gave (4) an account of the species which the present note records, together with a figure of the gonopods (his plate vii. fig. 11). As M. Brölemann has pointed out to me *in litt.*, we find that in the anterior gonopod the coxal lobe (L in the figure cited), which in the animal itself is a definite structure quite easily seen, is not represented at all clearly in Verhoeff's figure. That this may be due more to incorrect reproduction than to the fault of the author is shown by Verhoeff's statement in the text (*loc. cit.*):—"Gegenüber den andern beiden Arten" [i. e., *P. bosniense*, Verhoeff, and *P. transsylvanicum*, Verhoeff] "ist *germanicum* ausgezeichnet durch (Abb. 11) das emporragende 3. Tarsalglied, dessen aufragende Spitze E, den Nebenlappen, dessen Rand in feine Spitzchen zerschlitzt ist (nicht 'gekerbt') das deutliche Femoralglied und den Höcker L des Endlappens der Hüften, welcher kaum vorragt und innen etwas eckig ist."

Verhoeff, in a later work (5) already quoted, gives an instructive account of the comparative anatomy of the group to which *Polyzonium* belongs. Sinclair (3) and Pocock (2) have both dealt briefly with the Colobognatha in English, and the former gives a useful figure of *Polyzonium germanicum* showing the general proportions of the whole animal.

Field Notes and other Observations.

Polyzonium can be distinguished readily in the field from all other British genera by its characteristic semicylindrical shape; whereas the dorsal surface of the animal is convex from side to side, the ventral surface is practically flat.

Latzel gives the dimensions of *P. germanicum* as 5–15 mm. long and 1.1–2 mm. wide.

The walking-legs perform their work with the same wave-like motion that is noticeable in so many other millipedes.

When disturbed the animal curls itself up like a clock-spring, and generally remains quite a long time in that position.

Since this species is widely distributed on the continent, it is interesting to take it first in Britain in that part of England

which is nearest to France. When the distribution of the Diplopoda of these islands is better known, we may find that such an occurrence has a special biological significance.

The wood where our specimens were captured is situated along the slopes and summit of the low chalk-hills which form part of the Wye Downs, running roughly north and south about a mile from Wye itself, and rising on the south from the Selbornian tract below, and on the west from the Chalk valley of the Great Stour, to a little over 500 feet above sea-level in some places. In the area of the wood where we took *P. germanicum*, some three-quarters of a mile E.N.E. from the town, the altitude is only some 400 feet, or 200 to 300 feet above Wye itself. In this portion of the wood hazel, beech, and coniferous trees are well represented, while the ground is often covered with grass and low-growing plants, among which there is a considerable quantity of fallen leaves and other plant débris in autumn. It is among the fallen leaves in this situation that we have taken *Polyzoniium*. As Mr. Duffield pointed out to me on one of our visits to this hunting-ground, there is quite a striking superficial resemblance between this new millipede with its yellow to brownish colouring and the fallen bud-cases of the beech to be found at Juniper Wood in the vegetable débris in which, as already stated, the animal itself occurs.

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- (5) ——. 'Die Diplopoden Deutschlands,' 1911-14.

Wye College, Kent,
19th December, 1919.

XXVIII.—*Note on the Freshwater Isopods known as Asellus aquaticus.* By CHAS. CHILTON, M.A., D.Sc., M.B., C.M., LL.D., C.M.Z.S., F.L.S., Professor of Biology, Canterbury College, New Zealand.

THE little freshwater Isopods which are common in many streams of different parts of Europe have hitherto always been known under the name of *Asellus aquaticus*, and,

although the animal has been fully described and figured by various authors, no one until recently appears to have suspected that the individuals belonged to more than one form or species. In a recent paper, however, Monsieur E. G. Racovitza* has pointed out that under the name *Asellus aquaticus* two quite distinct forms or series of forms have been confused, and that these differ distinctly from one another by several fairly well-marked characters. He adopts the name *Asellus aquaticus*, Linné, 1758, for one species which appears to be the commonest and the only one hitherto fully described and figured; for the other, which is therefore new, he suggests the name *Asellus meridianus*. For a full account of the differences between these two and for excellent figures showing them reference should be made to M. Racovitza's paper. It seems desirable, however, to call the attention of English naturalists to his results, and in doing so it will be sufficient to indicate briefly some of the more important differences. They are as follows:—

	<i>A. aquaticus.</i>	<i>A. meridianus.</i>
<i>Antenna</i> 2 ..	Male almost as long as body, female a little shorter.	Two-thirds length of body in both sexes.
<i>Maxilla</i> 1 ..	Four plumose setæ on distal margin of inner lobe.	Five plumose setæ on distal margin of inner lobe.
<i>Pereopod</i> 1 .	Adult male with large triangular projection on inferior margin of propod.	Inferior margin of propod almost straight, no projection.
<i>Pereopod</i> 4 .	Carpus with longitudinal row of 4-5 spines, discontinuous.	Carpus with row of 10-12 long spines, continuous.
<i>Pleopod</i> 1 of male.	Exterior margin of exopod emarginate.	Exterior margin of exopod straight.

Besides these there are other minor differences in the shape of the lateral margins of the pereop segments II. to V. and in the second pleopods of both male and female animals.

On receipt of M. Racovitza's paper I examined the specimens in my own collection, and find that both forms are represented—namely, *Asellus aquaticus*, numerous specimens collected in the Edinburgh-Glasgow Canal at Edinburgh about the year 1898, others in the River Neckar, Heidelberg, 22. iv. 1900; *Asellus meridianus*, several specimens from a small brook at Tunbridge Wells, England, forwarded to me by the Rev. T. R. R. Stebbing. I have dissected and examined a male and a female from each of these localities, as it is almost impossible to distinguish the two species by

* Archiv. Zool. Expér. et Gén. 1919, tome 58, Notes et Revue, pp. 31-43.

external characters unless one has fully adult and perfect males when they might be distinguished by the length of the second antennæ and by the shape of the lateral margins of segments 2 to 5 of the peræon. Many of my specimens are immature and in others the antennæ are broken off, and, though the Tunbridge Wells specimens showed the lateral margins of the peræon segments as described by Racovitza, the difference from the other specimens was hardly sufficient to be distinctive by itself.

The following are brief notes on the specimens I have examined. In the female from Edinburgh the inner lobe of the first maxilla showed the four setæ characteristic of *A. aquaticus* on the one side, while the appendage on the other side had only three* ; the second pleopod is circular in outline ; the male examined from Edinburgh is evidently not fully mature, for the first thoracic leg has the propod only slightly triangular, though it is certainly approaching towards the outline represented in Racovitza's figure ; in the fourth leg the row of spinules on the carpus is distinctly discontinuous and contains only a few spines ; the first and second pleopods show the characters described by Racovitza, the exterior margin of the exopod of pleopod 1 being distinctly emarginate.

In a male specimen of *Asellus aquaticus*, Linné, from the River Neckar the first and fourth pairs of legs correspond, on the whole, well with Racovitza's figures and descriptions, though the first one is not fully developed, and consequently the propod not so distinctly triangular ; the first and second pleopods are in close agreement with Racovitza's description, the emargination on the external border of the exopod being quite distinct.

Racovitza has examined and identified specimens of *Asellus aquaticus*, Linné, from "Askam bog (Yorkshire), Birmingham," from various localities in France, and from Carniola (Adelsberg), while on the testimony of other authors he records it from Norway, Poland, Livonia, Russia, Germany, Switzerland, and Greenland. The species is therefore very widely distributed. It is this species that has been so well described and figured by Sars †.

* Probably further examination would show that the oral appendages in *Asellus* are liable to a considerable amount of variation, as has been shown by Dr. Collinge to exist in the Oniscoidea or Terrestrial Isopoda (Journ. Linn. Soc., Zool. vol. xxxii. (1914) pp. 287-293, pls. xx., xxi.).

† 1867, 'Hist. nat. des Crustacés d'eau douce de Norvège,' p. 93, pls. viii., ix., & x.; and 1897, 'Crustacea of Norway,' vol. ii. p. 97, pl. xxxix.

In the male of *A. meridianus*, Racovitza, from Tunbridge Wells, both first maxillæ have five setæ on the apex of the inner lobe, the first thoracic leg has the propod distinctly oval, with the inferior margin straight and without any sign of a triangular projection to meet the end of the tip of the finger; the fourth thoracic leg has on the carpus a distinct row of about ten long spinules; the first and second pleopods are in close agreement with the characters assigned to this species, the outer margin of the exopod of pleopod 1 being without any trace of an emargination. In the female from Tunbridge Wells the inner lobe of maxilla 1 bears the five plumose setæ both on the right and on the left sides; the exopod of pleopod 2 is trapezoidal in shape as described by Racovitza.

Racovitza has examined specimens of *A. meridianus* from Dulwich and from Slapton Lea (Devonshire), and from numerous localities in France. He finds it very constant in its characters; it is, he says, not the only one of the series, other allied forms being found in the Mediterranean basin both in surface-streams and in underground waters. Of the underground forms, two—*A. cavaticus*, Schiodte, and *A. foreli*, Bl.—have already been described, and other forms will be described by M. Racovitza in a forthcoming memoir.

XXIX.—On a new *Tentaculate Cestode*.

By FRANK E. BEDDARD, D.Sc., M.A., F.R.S., F.Z.S.

THE occurrence of tentacles (I do not include the "proboscides" of the Tetrarhyncha) is so rare among Cestodes that a new example of this occurrence, characterising perhaps a new species or genus, is worth bringing to the notice of zoologists. So far we are only acquainted with one strictly comparable instance, shown in the genus *Schistometra*, of which I shall have something to say later. The only remaining tentaculate worms of this group are the little-known *Paratania* and *Polypocephalus*, which are regarded by Braun* as possibly identical, but of whose systematic position the ascertained facts of structure do not permit us to form a definite opinion; nor does the recent redescription of *Paratania* by Southwell† definitely settle the matter.

* In Bronn's 'Klassen und Ordnungen des Thierreichs,' Bd. vi.

† 'Ceylon Marine Biological Reports,' pt. vi., Jan. 1912, No. 22.

In any case the tentacles of this worm are numerous and form a circle towards the apex of the scolex above the four suckers.

In the worm which I here describe the tentacles are closely associated with the suckers and appear to protrude from them, one from each. As a matter of fact, I only saw in the living worm two tentacles, each belonging to a separate sucker; it is thus only an inference that each sucker has its tentacle, as is the case with *Schistometra togata*, though here there are two to each sucker. The tentacles are very mobile and at times totally disappear with lightning rapidity. The worm itself was obtained from the Guinea-fowl, *Numida mitrata*, and I found only one example in company with some smaller worms apparently belonging to the genus *Davainea*.

It is a small and slender worm of rather more than an inch in length and 1 mm. in breadth at the widest point, which is near the posterior end of the body. I could see no traces of hooks nor a rostellum. During life the suckers were much extended and mobile, as was also that part of the scolex in which they are implanted. After preservation the scolex was of the same diameter as the ensuing strobila. The scolex was rather injured by the pressure of the cover-glass in examination of the living worm. But I recognised at the anterior end a single large sucker-like ring, which seems to me to be not one of the four usual suckers—for there was no trace of the others,—but the mouth of an involution containing the anterior end of the worm, suckers and all. That there is nothing impossible in this view is obvious from the state of affairs in many larval Cestodes, as well as from the partial power of retracting the scolex in some adult forms. But the material in my hands does not allow of a positive statement. The slide remains for the examination of others. It would appear that the character of the tentacles and their position in relation to the suckers in this new form are quite like those exhibited by a worm recently described by Fuhrmann* as *Chapmania tapica* (= *Idiogenes tapica* of Clere)†. That worm, however, possesses a rostellum with hooks, and has internal characters which forbid its identification with that described here. Moreover, Skriabin‡ has lately asserted that the scolex (and

* Swedish Zool. Exp. Egypt, pt. iii. 1909, Cestodes, p. 19.

† Centralbl. f. Bakt. u. Paras. xlii. p. 722.

‡ *Ibid.* lxxiii. 1914, p. 399.

the scolex only) of Fuhrmann's example of *Chapmania tapica* is that of another genus altogether, viz., *Schistometra togata* of Cholodkovsky*.

There is also no doubt that the tentaculate Cestode described here has nothing to do with *Schistometra togata*, nor with my own † *Otiditænia eupodotidis*, which Skriabin regards as not only congeneric, but as being of specific identity, with *Schistometra togata* ‡.

For in *Schistometra*, according to Skriabin (Cholodkovsky examined examples without a scolex), the rostellum is armed and each sucker has two tentacles arising side by side from the upper end. There is also no doubt that the tentaculate worm found by myself in *Numida mitrata* has no relation to *Schistometra* in its general anatomy. This is entirely upon the plan of that of *Rhabdometra*, and I have compared the worm detail for detail with my preparations of *Rhabdometra cylindrica* §. It is to be noted, however, that the example of the tentaculate Cestode which I have in my possession is not perfectly mature, in that it is not in the process of shedding proglottids. It possesses the terminal segment, longer and more oval in form than those which precede it, as is usual among those Tapeworms in which the terminal proglottid has been observed. At the very extremity of this

* In a Russian work, being a Catalogue of Cestodes in the Cabinet of the Imperial Military-Medical Academy of Petrograd, 1912, p. 46.

† Proc. Zool. Soc. 1912, p. 194, and *ib.* 1914, p. 879.

‡ As to this identification I make the following observations:—I believe that Dr. Skriabin is quite right in identifying the genera *Schistometra* and *Otiditænia*. As he uses Cholodkovsky's name instead of mine, I presume that that name has the priority of date of publication, though both descriptions appeared in 1912—mine in March of that year; the month of issue is not given in my copy (due to the author's kindness) of Cholodkovsky's catalogue. I am not, however, convinced that the species are identical. It is to be noted that Cholodkovsky (Annuaire Mus. Zool. Ac. Sci. St. Petersburg, xx. 1915, p. 164) convinced Skriabin that the species described by the latter in his paper referred to here was not identical with *Schistometra togata*, but identical with a species described in MS. by Doppelmayr as *S. embiensis*. It does not remain clear as to which of these two the scolex alleged to be of *Chapmania tapica* really belongs. But, apart from the possible lack of knowledge of the scolex of *S. togata*, the arrangement of the testes of the latter in many rows does not agree with my observations upon those of "*Otiditænia eupodotidis*." As to *S. embiensis* it seems to me to differ from my species by the much more slender scolex, that of my species being more massive. But the testes agree as being in one row. The brick-red colour of the posterior segments of my worm as well as its different host are minor points of difference from the two species of *Schistometra* described by the three Russian authors.

§ P. Z. S. 1914, p. 859.

opens the water vascular system by a pore. I mention this for the reason that the characteristics about to be referred to may not be those of the fully mature species. The cortex and muscular system are so like those of *Rhabdometra cylindrica* that no description is necessary; and this applies to the water vascular system. On the other hand, I have detected certain minutiae in which the generative system differs, and I give the facts for what they may be worth as marks of differentiation. The testes are posterior in position and are developed dorsally, laterally, and ventrally, as in *Rh. cylindrica*. The cirrus-sac seems to be rather longer than in the last-named species; it extends well over the ventral vessel of the water vascular system—in *Rh. cylindrica* the cirrus-sac only reaches as far as, or just over, the same water vessel. The receptaculum seminis of the new species is more elongated in form than is that organ in *R. cylindrica*.

Both the uterus and the paruterine organ of my new tentaculate species correspond very closely in relative size and shape to the same organs in the less fully mature proglottids of *Rh. cylindrica**. This is also the case with the terminal segment of the worm. I find, however, that the end of the paruterine organ in the new species, where it comes into contact with the uterus, has no heap of calcareous bodies such as are present in the species with which I am comparing it; this seems to be a real difference, though the heaps of calcareous bodies are at least not always present in the younger paruterine bodies of *Rh. cylindrica*†.

It seems therefore to be clear, that the Cestode which forms the subject of these remarks would be undoubtedly referred to the genus *Rhabdometra*, were there no knowledge

* See text-fig. 5, p. 868, of my memoir just cited.

† I take this opportunity of adding a new fact of some little interest to what is known of the anatomy of *Rhabdometra cylindrica*. I found in the case of one proglottid only, out of a number which I examined, a duct leading from the anterior region of the uterus, which was followed to its opening on the ventral surface of the segment by an involution of the subcuticular layer as near as possible in the middle of the ventral surface. It will be observed that the occasional existence in the present species of a separate uterine pore is more striking as a retention of an archaic state of affairs than in *Dasyurotenia*, where (see Beddard, P. Z. S. 1915, p. 190, text-fig. 8) the occasional uterine pore is lateral and involves the lateral water vascular tube. It is clear that in the genus *Rhabdometra* a comparison is undoubtedly to be made with the Pseudophyllidea and the Ichthyotæniids, and not with the dorsal and ventral pores, connected though they are with the egg-holding system, of *Amabilia* and (P) *Schistotenia*.

of its peculiar tentacles. It is, of course, quite possible that such have been overlooked, especially in view of the fact that so few of the Cestodes known to science have been examined in a living condition. Their extreme retractility, amounting almost to disappearance, would render it most easy to miss them in sections through the scolex. I have myself been unable to discover them in sections of *Rhabdometra cylindrica*. If this lack of tentacles is only apparent and due to the difficulty of seeing them, it may be that this worm is identical with *Rhabdometra numida*, a species described by Fuhrmann from the Guinea-fowl *N. ptilorhyncha**. While therefore I believe myself to be correct in describing the worm as a "new tentaculate Cestode," it may not be a new Cestode. But further investigation is required before it can be asserted that the existence of retractile tentacles is characteristic of the genus *Rhabdometra*, and, for the matter of that, of other genera.

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GEOLOGICAL SOCIETY.

November 19th, 1919.—Mr. G. W. Lamplugh, F.R.S.,
President, in the Chair.

The following communication was read:—

'The Pleistocene Deposits around Cambridge.' By Prof. John Edward Marr, Sc.D., F.R.S., V.P.G.S.

This paper deals with the deposits in the immediate vicinity of Cambridge, and contains new records of sections, fossils, and implements. It is pointed out that, owing to alternating periods of erosion and aggradation, relative height above sea-level is not a trustworthy index of antiquity, and modifications of the classification proposed by W. Penning and A. J. Jukes-Browne are indicated.

The Author suggests the following chronological sequence, in descending order:—

	<i>Feet.</i>
(1) Barnwell Station Beds.....	20
(2) Newer Downing Site Beds.....	35
(3) Newer Barnwell Village Beds.....	45
(4) Huntingdon Road Clays.....	70
(5) Observatory Beds.....	85
(6) <i>Corbicula</i> Gravels (Barnwell village, etc.) ...	30

* Swedish Zool. Exp. Egypt, pt. iii. 1909, p. 36.

The figures on the left give the approximate height above sea-level.

It is believed that Nos. 6 and 5 were formed during a period of aggradation, and 4-1 during one of subsequent erosion with minor aggradation; but it cannot be conclusively proved that 6 and 3 are of different ages, although the deposition of the beds 6 below those of series 3, where they occur together, and the occurrence of *Hippopotamus* and *Belgrandia marginata* with *Corbicula* suggest an early date for these *Corbicula*-bearing beds.

Taking the beds in the order of reputed age, the following observations are noted:—

Chellean implements have been found at low levels at Barnwell and Chesterton, and may belong to the beds 1. The Observatory Beds have yielded abundant implements of Chellean, Acheulean, and early Mousterian types, the last-named apparently in deposits later than those containing the two first-named. Unfortunately mollusca and mammalia are very rare in these beds. The Huntingdon Road Clays require much further work, as only poor exposures have hitherto been found, and it is not clear that they are newer than the Observatory Beds.

The beds referred to the Newer Barnwell Village Series contain abundant remains of the mammoth, woolly rhinoceros, and fairly numerous horse-bones. Implements associated with them suggest an Upper Palæolithic age.

The Newer Downing Site Beds have yielded a cold molluscan fauna. They are probably somewhat earlier than the Barnwell Station Series, which has furnished a similar molluscan fauna, and also an Arctic flora, the plants of which were identified by the late Mr. Clement Reid. Reindeer occurs in these beds.

The paper is chiefly a record of facts, but it is intended to be preliminary to a detailed survey of the Pleistocene deposits of the Great Ouse Basin, which are so important as throwing light upon the relationship of the Palæolithic beds to the glacial accumulations, and also to the marine beds of March and the Nar Valley.

Appendix I, on the Non-Marine Mollusca, is supplied by Alfred Santer Kennard, F.G.S. and Bernard Barham Woodward, F.L.S., F.G.S.

Lists are given of the non-marine mollusca from the various sections, with their degrees of frequency. These lists are based on examination of old collections and on a large amount of new material. Notes are appended on some of the species, and conclusions as to the ages of the Cambridge gravels are given, based on the molluscan evidence.

Appendix II, on the Implements, is supplied by Miles C. Burkitt, M.A.

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THE ANNALS

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MAGAZINE OF NATURAL HISTORY.

[NINTH SERIES.]

No. 27. MARCH 1920.

XXX.—*Notes on the Asilidæ: Sub-division Asilinae.*
By GERTRUDE RICARDO.

[Continued from p. 185.]

Promachus binucleatus, Bezzi.

Ann. Soc. Ent. Belg. lii. p. 878 (1908); id. Ann. Mus. Zool. Univers. Napoli, iv. p. 14 (1914); Speiser, Schwed. Zool. Exped. p. 99 (1910).

A series of males and females from Narok, Masai Reserve (*Capt. A. C. Luckman*), a male from S.W. of Mt. Kenya near Nyeri, Brit. E. Africa, 22. ii. 1911, preying on a butterfly; all in I. E. E. Coll.

A male and female from Semliki Plains near south shore of Lake Albert, 2200 feet (*S. A. Neave*), 1912, 193.

A male from Kafu River near Hoima, Kumpala Road, 3500 feet, 29–31. xii. 1911 (*S. A. Neave*), 1912, 193; and a female from south of Lake George, Uganda, 3200–3400 feet, 17–18. x. 1911 (*S. A. Neave*), 1912, 123.

Males and females from west shores of Victoria Nyanza, Budda, Uganda, 3700 feet (*S. A. Neave*); others from Nairobi; south of Lake George; Banks of Victoria Nile near Maisindi Port; north of Lake Isolt, 3700 feet; S.E. Ankole; Unyoro; and Valley of Kafu River.

The female was described by Bezzi from Van Abala, Galla-land, and the male later by Speiser from near Kilimandjaro.

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15

The male is at once distinguished by the triangular enlargement of the last segment of the *abdomen* below, fringed by a tuft of black hairs; *genitalia* reddish. The female *ovipositor* proper is short, only the length of the preceding segment, but the last two segments (or at least the last one) are usually compressed.

It is a species with reddish *legs*, the femora with a black stripe; pubescence on legs short and white, bristles usually black. *Moustache* yellowish with a few black hairs above. *Scutellum* with yellow hairs, occasionally a black bristle or two appear.

Length, ♂ 18-20, ♀ 20-25 mm.

Promachus brevipennis, sp. n.

Type (male) and two other males from Valley of Kafu River, Unyoro, 3400 feet, 23-28. xii. 1911 (S. A. Neave), 1912, 193.

A species distinguished by the short wings and by the snowy-white moustache. Legs nearly wholly reddish. *Genitalia* slender, with a white tuft of hairs.

Length 23 mm.

Face blackish with grey tomentum. *Moustache* of rather silky-white hairs continued to base of antennæ, thick. *Palpi* with long white hairs. *Antennæ* with the third joint uniting, the first two joints slender, with chiefly white hairs. *Forehead* with black hairs, and a few white ones on its posterior border. Hind part of head with stout black bristles, continued round head, and then with white hairs. *Thorax* blackish, with grey tomentum and black pubescence, and long black bristles in centre beginning before the mid-line of dorsum, weak long white hairs are present on posterior part and at sides. *Scutellum* with a double row of stout yellow bristles and long white hairs. *Abdomen* long and slender, the pubescence chiefly yellow, but some black hairs on the spots and whitish bristles on the sides; underside with yellow pubescence, the last segment with white hairs. *Genitalia* composed of simple club-shaped forceps, the under lamellæ about half their length, all black, shining, with black hairs, the tuft of white hairs above thick and reaching beyond the middle of the forceps. *Legs* with the apices of femora and tibiæ and all the tarsi black; pubescence white, thick on the tarsi. *Wings* reaching about as far as the fifth segment of abdomen.

Promachus rectangularis, Loew.

Neue Beitr. ii. p. 5 [1854]; et Zeitschr. f. d. ges. Naturwiss. N. F. viii. (xlii.) p. 108 (1873); v. d. Wulp, Trans. Ent. Soc. Lond. 1899, p. 92, pl. iii. fig. 4 (1899).

Promachus cinicolor, Walker, 'The Entomologist,' v. p. 258 (*Eraz*) (1871).

Loew in Zeit. Ges. Naturwiss. suggests that Walker's *P. cinctipes* is the same as this—the type being lost, this question must remain in abeyance, but *P. cinicolor*, Wlk., is the same as the above species and *not* identical with Loew's *P. rueppellii*.

Loew's species, *P. rectangularis*, came from Massowah, Red Sea, and from Aden.

Walker's type, *P. cinicolor*, ♀, came from Harkeko, Dahleck Island, Red Sea.

Two females from Muscat, Arabia (*Lt.-Col. Jayskar*).

Three males from S. Othman, Arabia (*Nurse*), 25. iii. 95 and 3. iv. 95.

One male from Shendi, 1901, 190 and 187.

These all answer to Loew's description, with the exception of black bristles on the *scutellum* being present five or more in number as an inner row bordered on the outside by white bristles. Loew speaks of white bristles with occasionally a few black ones intermixed.

Walker's type has only white bristles.

Length about 20 mm., as Loew states.

A species distinguished by a thick white *moustache* and white hairs on head. *Scutellum* with long white hairs besides the bristles. *Legs* yellowish red with a black stripe on the femora, not always present, and apices of tibiæ and tarsi black. *Genitalia* with a thick tuft of white hairs. *Ovipositor* short.

P. rueppellii is very similar, but has the femora black, brown below at apex.

Promachus flavopilosus, sp. n.

Type (male) from Mlanje, Nyasaland, 17. xi. 1914 (*S. A. Neave*).

Type (female) from same locality, 14. xi. 1913, and a long series of males and females taken with various beetles, bees, and other diptera as their prey; all in the I. E. E. Coll.

A male from Uganda, 1910 (*Capt. A. D. Fraser, R. A. M. C.*), 1911, 193. Males from the Mbali-Kumi Road, 3700 feet,

south of Lake Salisbury; from between the south-east shore of Lake Kioga and Kakindu, 3500 feet; in the Valley of Kufu River, Unyoro, 3400 feet (*S. A. Neave*).

A bright yellow-haired species with yellow or white moustache, chestnut-coloured legs, and yellow-haired scutellum. Abdomen with large black spots and greyish-yellow tomentum and bright yellow hairs at sides.

Length, ♂ 17-20, ♀ 21-25 mm.

Many of these specimens have only yellow hairs and all bristles on the thorax yellow.

Male.—*Face* covered with bright yellow tomentum, the *moustache* thick, white, with two or more black hairs. *Palpi* with black and whitish hairs. Beard white. *Antennæ* blackish, with grey tomentum, the first two joints with black hairs, the third greyish at base. *Forehead* with black bristly hairs. Hind part of head with black hairs at vertex, then yellowish, becoming white near the beard. *Thorax* with well-marked dark stripes and yellowish-grey tomentum and short scattered black pubescence; of the præsutural bristles two are black, the third yellow, the two supra-alar are yellow, the two postalar are yellow, all with less long yellow hairs between them, the dorso-central bristles are chiefly black and more fine long hairs than bristles, one or two yellow bristles are on the posterior edge. *Scutellum* clothed with only long fine yellow hairs, rarely becoming bristles. *Abdomen* with yellow hairs on the dorsum of the first two segments and then with bushy yellow hairs on the sides and beneath; dorsum in centre almost bare, a little short yellow pubescence visible. *Genitalia* black and shining, with short yellow hairs on the upper and lower sides of forceps, which are long and club-shaped, the under lamellæ short and slender. *Legs* xanthine-orange, the fore and middle femora with black stripes above, the hind pair only black at apex; tibiæ black at apices; tarsi all black; femora and tibiæ with fairly long whitish or yellowish hairs, thick on the tibiæ and continued as shorter white pubescence on dorsum of tarsi, the hind pair with this only at sides, bristles black, only the femora are armed with bristles. *Wings* clear, with yellowish veins.

Female identical. *Ovipositor* black, shining, about the length of the last two segments.

A female from Uganda, between Kumi and N.E. shore, Lake Kioga, 3600 feet (*S. A. Neave*), has the tarsi almost devoid of the white pubescence and more black hairs in the moustache, otherwise identical with type.

Table for Species from India, Burmah, and Cochin China.

1. Legs black	2.
Legs bright yellow or reddish, sometimes partly black	6.
Legs blackish with reddish tibiæ	8.
2. Abdomen with yellow or reddish-yellow tufts of hairs on the first segments	3.
Abdomen with no such tufts of hairs	5.
3. Pubescence on abdomen bright reddish yellow. Genitalia club-shaped. Ovipositor short ..	<i>duvaucelii</i> , Macq.
Pubescence on abdomen yellowish	4.
4. Genitalia large, upper forceps truncate, notched. Legs with black and white bristles	<i>marcii</i> , Macq.
Genitalia small. Ovipositor long. Legs with long yellow pubescence	<i>binghamensis</i> , sp. n.
5. First posterior cell closed	<i>heteropterus</i> , Macq.
First posterior not closed	6.
6. Abdomen black with white hairs, extraordinarily short	<i>calanus</i> , Wlk.
7. Abdomen black with whitish-yellowish or greyish bands	8.
8. Small species. Legs wholly reddish yellow. Wings pale	<i>contractus</i> , Wlk.
Abdomen conical, stout, with whitish bands, Femora black at the apices, tarsi black	<i>apivorus</i> , Wlk.
Abdomen long with greyish yellow-haired bands. Legs entirely red	<i>maculatus</i> , Fabr.
Femora with a black stripe, tarsi black	<i>pseudomaculatus</i> ,
9. Abdomen with long bright orange-red pubescence	[sp. n.]
Abdomen with greyish bands. Tibiæ reddish yellow, ovipositor long	<i>leoninus</i> , Schiner.
	<i>yerburiensis</i> , sp. n.

The following species have also been described from this region:—

Promachus nicobarensis, Schiner, a species with a yellow-haired abdomen and a white tuft on the genitalia.

Promachus westermanni, Macq., the abdomen black with whitish segmentations. Legs black.

Promachus varipes, Macq., also supposed to be found in Manila, with a short yellow-haired abdomen. Femora above and the tibiæ red. Genitalia with a tuft of white hairs.

Promachus apicalis, Macq., with a black grey-banded abdomen, the anterior and immediate femora and tibiæ testaceous on the outside.

Promachus rufipes, Macq., with a black abdomen, red segmentations, and yellow-haired thorax with red pubescence.

Promachus ceylonicus, Macq., is probably an *Alcemus* or

Philodicus species, as the ovipositor is described as having a circle of spines. Legs testaceous.

Promachus duvaucelii, Macq.

Dipt. Exot. i. (2) p. 213 (1838) [*Trupanea*].

A pair from Dehra Dun, U.P., India, Nov. 1907 (*Lt.-Col. F. W. Thompson*), I. M. S., 1908-21.

One male (*Dr. Smith*), 68, 4, and one female with no locality stated.

Macquart's very insufficient description is as follows:—

Black. Palpi red-haired. Thorax with red tomentum and black bands. Abdomen with the three first segments red-haired. Legs black. Wings yellow.

Length, ♂ ♀, 12-16 mm.

Face, moustache, and beard yellow. An obscure streak in the marginal and first submarginal cells.

From Bengal.

A species varying in size, the females larger than the males. Distinguished by the bright reddish-yellow pubescence disposed as tufts on the first three segments of *abdomen* and as ordinary pubescence on the remaining segments, thickest here in the female. *Moustache* and beard, hairs on posterior part of thorax and on the *scutellum* the same bright colour, and the thorax coloured the same between the black stripes. *Moustache* has some black hairs on its upper part in the male only. *Legs* black with chiefly black pubescence, some white is present especially in the female. *Genitalia* of male black, shining, with black hairs, the upper forceps large club-shaped, the lower pair small, the underside of the last segment produced and bordered with short black hairs. *Ovipositor* short and small.

Length, ♂ 15, ♀ 18 mm.

Since this paper was sent to press, Mr. J. E. Macpherson, Officer in Charge, Forest Zoologist's Office, Dehra Dun, India, has sent me some Asilidæ for identification, the greater number being a long series of males and females of this species; the males have no black hairs in the moustache. All were captured at Dehra Dun.

Promachus marcii, Macq.

Dipt. Exot. i. (2) p. 213 (1838) [*Trupanea*].

A male from Gundumri, Bhandani, l. xii. 1912 (*A. D. Imms*), in jungle.

A species nearly allied to *Promachus duvaucelii*, Macq., who describes it thus:—

"Black. Head yellow. Thorax yellow-haired, with three stripes. Abdomen with the three first segments yellow-haired, all segments with a large black spot. Legs black. Wings yellow. (Pl. ix. fig. 2.)

"Length, ♂, 16 mm.

"Face, moustache, beard, and hairs of palpi yellow; some black bristles on the border of the epistome. Genitalia rather stout. Legs with black and whitish bristles; pulvilli yellowish white.

"From East India."

The chief difference seems to be the colouring of the pubescence, which is yellowish, not reddish, and is not so thick.

Genitalia are larger, the upper forceps at their ends inflated and truncate, rather notched, the underside of the last segment is produced to a rather greater length. *Abdomen* with black pubescence on sides and below.

This male measures 20 mm.

The figure by Macquart of the anus does not appear to be correct.

Promachus binghamensis, sp. n.

Type (male) from Sikkim, 1903 (*F. A. Müller*), presented by Lt.-Col. Bingham.

Type (female) from Sikkim, Darjeeling, 4. 01, Bingham Coll., and a male from the same locality.

A slender black species, with long yellow pubescence on the legs and on the abdomen, more or less disposed as tufts on the latter. Ovipositor long. Genitalia of male small.

Length, ♂ 24-27, ♀ 24 mm.

Male.—*Face* with yellowish tomentum. *Moustache* composed of fine yellow hairs and three or four black ones above. *Palpi* yellow-haired. *Antennæ* with black and yellow hairs on the first two joints. Forehead with long black hairs. *Thorax* blackish with yellow tomentum as narrow lines, outlining the stripes; pubescence black. *Scutellum* with black fine bristles and fine yellow hairs intermixed. *Abdomen* with the usual black spots and grey bands, the latter with yellow hairs, which are thickest at the sides, disposed somewhat tuft-like; the yellow pubescence is present on the black spots. *Genitalia* black with black hairs, the upper forceps small, club-shaped, the lower pair short but stout, the last segment not produced but with a tuft of black hairs; a similar tuft is present on the lower pair of forceps and black pubescence on the upper pair; underside of abdomen with long yellow hairs. *Legs* entirely black with long yellow hairs on the underside of the femora and tibiæ and

shorter ones elsewhere. *Wings* large, clear, the upper fork of the third vein with an unusually slight angle inwards.

Female identical. *Legs* with not quite so many long yellow hairs. *Palpi* black-haired. *Ovipositor* composed of the last three segments of abdomen.

Promachus heteropterus, Macq.

Dipt. Exot. i. (2) p. 212 (1838) [*Trupanea*].

Two females from Bellary District, Beeravalli, and Hada-galli, S. India, in I. E. E. Coll.

These females answer to Macquart's description, which is as follows:—

"Ashy grey. Abdomen with a large black spot on each segment. *Legs* black. *Wings* yellow, the first posterior cell closed. (Pl. ix. fig. 3.)

"Length, ♂, 18 mm.

"Face, moutache, and beard white. *Palpi* with white hairs. Forehead and hind part of head with yellow hairs. *Antennæ* with the third joint somewhat elongated. *Eyes* violet.

"From the coast of Malabar."

A black species with narrow pale segmentations on the white-haired abdomen. *Scutellum* with white hairs. *Ovipositor* short. These specimens measure 19 mm.

A female from Berhampur, India, allied to this species has a long *ovipositor*, reddish-yellow tibiæ, and the first posterior cell is only narrowed at the end, where it reaches the border—this latter point agrees with the description of *Promachus rufoungulatus*, Macq., but the author makes no mention of the pale-coloured tibiæ.

Promachus calanus, Walker.

Dipt. Saund. i. p. 122 [*Trupanea*] (1851); et List Dipt. Brit. Mus. vii., Suppl. 3, p. 607 [*Trupanea*] (1855).

Type (female) from East India, 68. 4 (Walker Coll.).

A species with an extraordinarily short abdomen, the type is in bad condition, but the abdomen is perfect. *Wings* very large. *Legs* stout, red, with fringes of black hairs. *Moustache* yellow with a few black bristles below the pubescence on forehead white. *Antennæ* wanting. *Scutellum* reddish with white hairs. *Abdomen* with telescopic segments appears brownish black with white hairs on basal segments. *Ovipositor* hardly discernible.

Length 12, wing-length 18 mm.

A female from Pundaluoya, Ceylon, is very much like it in

general appearance and shape, with the short *abdomen* and long wings, but having very pale yellow tibiæ it must be a different species.

Promachus contractus, Walker.

Ins. Saund. Dipt. i. p. 120 [*Trupanea*]; et List Dipt. Brit. Mus. vii., Suppl. 3, p. 606 (1855) [*Trupanea*].

Type (male) from India.

Type (female), India, 68. 4 (Walker Coll.).

A small species with pale-coloured legs and wings with pale yellow veins. Moustache yellow. Scutellum with pale hairs.

Length, ♂ 15½, ♀ 16 mm.

Male.—*Face* covered with glistening pale yellow tomentum. *Moustache* composed of yellow very strong bristles, with white hairs above to base of antennæ. *Palpi* with pale hairs. Beard white. Forehead with pale hairs, and bristles at back of head are white. *Antennæ* reddish. *Thorax* with two well-marked median dark stripes. *Abdomen* with the usual dark spots and grey segmentations, but the whole dorsum is thickly covered with white pubescence; underside wholly pale covered with short yellow hairs. *Genitalia* black, the upper forceps long club-shaped, the lower ones short, the last segment of abdomen on underside somewhat raised, hardly produced, the white tuft of hair above very distinct; hairs on forceps white and black. *Legs* pale yellow, the upper sides of femora and extreme apices of tibiæ darker, tarsi reddish yellow, bristles chiefly yellow; pubescence on legs white. *Wings* clear.

Female identical. *Ovipositor* long, composed of the last three segments.

Promachus apivorus, Walker.

Trans. Ent. Soc. London, (2) v. p. 282 [*Trupanea*] (1860).

Type (♀) from Burmah, 68. 4., with note, "This fly devours the large black bees"; in very bad preservation. Other females from Patani Cape, Siam, 21. vi. 1901 (*H. C. Robinson and N. Annandale*), 1916, 22; from Jambu, Siam, same collectors, from Hainan Island and from Chantabun, S. Siam (*Mouhot*).

A black species with grey segmentation on the abdomen. Moustache yellowish. Scutellum with black bristles and some yellow hairs. Ovipositor short.

Length 24–25 mm.

Face covered with pale yellow tomentum. *Moustachè*

reaches antennæ. *Palpi* with pale hairs. *Antennæ* black. Forehead with yellow hairs anteriorly and black hairs posteriorly. Bristles on occiput all yellow. *Thorax* covered with brownish-yellow tomentum, stripes not very distinct, posterior part of dorsum with black bristles and some whitish hairs. *Abdomen* conical, stout; pubescence white on the segmentations, black on the spots, white at the sides and below. Ovipositor black, shining, very short. *Legs* bright reddish; the coxæ, apices of femora, and tibiæ and tarsi deep black; pubescence chiefly white, bristles black. *Wings* large, clear; veins yellow.

Promachus maculatus, Fabr.

Syst. Ent. 794, 17 [*Asilus*] (1775), etc., see Kertész Cat.

Promachus flavibarbis, Macq. Dipt. Exot. i. (2) p. 212 (1838) [*Trupanea*].

Promachus copillus, Walker, List Dipt. ii. p. 389 (1849) [*Asilus*]; et vii., Suppl. 3, p. 607 [*Trupanea*] (1855).

Type of *P. copillus* (male and female), from India.

Males from Trincomalee, Hot Wells, Ceylon (*Yerbury*).

Males and females from Bangalore (*Capt. E. Y. Watson*).

A female from Colombo (*G. Meade Waldo*).

Macquart's species is evidently identical with this widely distributed species, he describes the hind tarsi as black. V. d. Wulp says they are darker. In the above specimens the tarsi appear usually dark reddish with black apices or nearly wholly black.

A large species distinguished by the yellow bands on the abdomen, surrounding the usual black spots. *Moustache* yellow. *Palpi* yellow-haired. *Scutellum* with black bristles and yellow hairs. *Genitalia* with a tuft of white hairs, the upper forceps large and forked, the inner part short, the outer piece long, the lower forceps small, the last segment is slightly produced on the underside. *Ovipositor* short. *Legs* reddish.

Wiedemann gives the length as 24–28 mm. He remarks it is not found in Italy as alleged, but he has examples from the Caucasus.

Promachus pseudomaculatus, sp. n.

Type (male) from Nilaveli, Ceylon, 19. vii. 91 (*Lt.-Col. Yerbury*).

Cotypes (two females) from same locality and Kuchavelli, Ceylon.

A large species very nearly allied to *Promachus maculatus*, F., but the femora have a black stripe above and the tibiæ at apices and all tarsi are black.

Length, ♂ 35, ♀ 32-33 mm.

Male.—*Face* covered with glistening yellow tomentum. *Moustache* composed of many large yellow bristles, and shorter yellower hairs are continued to the antennæ. *Palpi* with yellow hairs and black hairs and bristles at the apices. *Antennæ* blackish, the first two joints with black and yellow hairs. Forehead with black bristly hairs and some yellow hairs. Hind part of head with yellow bristles in the centre and below stout black bristles. *Thorax* brownish with brown-yellow tomentum and darker stripes; pubescence black, with black bristles posteriorly and some yellow hairs. *Scutellum* with a double row of black bristles and yellow hairs inside. *Abdomen* black with broad grey tomentose bands, the black being represented by the usual large spots; pubescence on the bands yellow, on the spots black. *Genitalia* with a small tuft of white hairs, the upper forceps more slender than those of *P. fasciatus*, ending in a point, the under pair very small; the underside of the last segment produced as a black almost square piece, very distinct, as long as the under forceps and together with the rest of genitalia covered with black pubescence. *Legs* reddish yellow with black bristles and chiefly short yellow pubescence. *Wings* large, clear; veins reddish yellow.

Females identical. *Ovipositor* composed of the last segment, very short; black, shining, with black hairs and a few lighter ones at apex.

Promachus leoninus, Loew.

Linn. Ent. iii. p. 404 (1848); Wlk. List Dipt. Brit. Mus. vii., Suppl. 3, p. 592 [*Trupanea*] (1855); Loew, Berlin. ent. Zeit. xii. p. 372 (1868); v. d. Wulp, Tijd. v. Ent. xli. p. 131, pl. iv. figs. 6-8 (1898); et xlii. p. 45 (1899).

One male from S. Shan States, Upper Burmah, 4000 ft., Nov. 1899 (*Lt.-Col. Bingham*), 1902, 31.

One male and one female from Sikkim, 1903 (*F. A. Müller*). Presented by *Lt.-Col. Bingham*.

A species originally described by Loew from the Greek Islands and Asia Minor, and recorded by him later from Mersina in Asia Minor. V. d. Wulp recorded it from India.

A species at once distinguished by the bright orange-red pubescence on *abdomen*, and the same-coloured hairs on *scutellum* and posterior part of *thorax*. *Moustache* and pubescence of forehead, beard, and hairs on *palpi* all bright yellow. *Legs* black, the tibiæ reddish yellow. *Genitalia* of male short, stout, covered with a thick tuft of white hairs.

Female with an extremely short *ovipositor*.

Length, ♂ 22, ♀ 18 mm.

Promachus yerburiensis, sp. n.

Type (male), type (female) *in coitu*, Trincomalee, Ceylon, 18. viii. 91 (*Lt.-Col. Yerbury*), and a series of males and females from Ceylon.

A male and other specimens from Guindy, Madras (Cragg Coll.). Female and other specimens from Coimbatore, S. India, I. E. E. Coll.

A fair-sized species. *Abdomen* with black spots and broad greyish bands. *Moustache* whitish, black below. *Legs* blackish, the tibiæ reddish yellow. *Scutellum* with yellow and black bristles. *Genitalia* of male simple. *Ovipositor* long.

Length, ♂ 25, ♀ 28–29 mm.

Male.—*Face* covered with pale yellowish tomentum. *Moustache* composed of whitish-yellow bristles with two or three black bristles interspersed and a row fringing the oral aperture, whitish-yellow shorter bristly hairs are continued to the base of the antennæ. *Palpi* with black hairs and some yellow hairs at the base. Beard white. *Antennæ* black with white hairs on the first two joints. Pubescence on forehead black with some white hairs. Bristles on occiput black. *Thorax* black covered with greyish tomentum, the stripes distinct, pubescence of short black hairs, some longer white ones with strong black bristles on the posterior half. *Scutellum* with black and yellow bristles and long white hairs. *Abdomen* with rather dense short pubescence, black on the spots, yellowish grey on the pale parts and on the first segment and partially on the second segment; hairs at sides and on the underside chiefly yellowish. *Genitalia* not large, the upper pair of forceps black, shining, club-shaped, the under pair short, stout, both with black hairs, the preceding segment black, shining. *Legs* blackish, tibiæ black at apices, all bristles black; pubescence black, white and long on the underside of femora, on the hind pair interspersed with black hairs, tibiæ with chiefly short yellow pubescence, but short black hairs are also present. *Wings* shorter than the body.

Female identical. *Ovipositor* long, composed of the last three segments.

Table for Species east of Cochin China and Burmah.

1. Abdomen with bands or tufts of lighter-coloured hairs at base	2.
Abdomen with no such bands or tufts .	5.
2. Legs wholly black	<i>bifasciatus</i> , F.
Legs partly reddish, femora black above.	3.

3. Thorax with some lighter tomentum.
All the tibiæ reddish *melampygius*, v. d. Wulp.
Thorax velvety black. Only the anterior
and middle tibiæ reddish
4. Tibiæ reddish 4.
Tibiæ paler in colour *manillensis*, Macq.
noscibilis, Austen.
5. Very large black species with black legs
and yellow-orange hairs at apex of
abdomen *plutonicus*, Wlk.
6. Legs usually reddish or yellowish, some
of the tibiæ at least paler in colour.
Ovipositor short 7.
Ovipositor long. Abdomen usually with
pale bands 9.
7. Large species. Abdomen yellow-haired.
Legs reddish yellow *chinensis*, sp. n.
Smaller species. Legs partly reddish .. 8.
8. Abdomen with black spots and yellowish
segmentations and sides. Genitalia
with white hairs. Legs reddish yellow.
Abdomen entirely black. Genitalia with
very few white hairs. Legs dark red
with black hairs *calorificus*, Wlk.
Deep black species. Only the fore and
middle tibiæ dull yellow. Genitalia
with white hairs *amorges*, Wlk.
philipinus, sp. n.
fusiformis, Wlk.
9. Legs reddish. Abdomen deep black .. 10.
Legs blackish, tibiæ usually reddish or
yellow 11.
10. Femora entirely black 12.
11. Large species. Bands on abdomen nar-
row. Scutellum with black bristles
and white hairs. Ovipositor composed
of the last four abdominal segments.
Moustache chiefly black *contradicens*, Wlk.
Large species. Bands of abdomen broad.
Scutellum with black bristles. Ovi-
positor of the last three segments
only. Moustache yellowish *lineosus*, Wlk.
Smaller, very pubescent species. Bands
of abdomen narrow. Scutellum with
black bristles and yellow hairs. Ovi-
positor of the last three abdominal
segments only.
Moustache blackish *transactus*, Wlk.
Slender black species. Scutellum with
a double row of black bristles. Ovi-
positor of the last four segments.
Moustache black *addens*, Wlk.
12. Femora black above, red below.
Genitalia very stout. Abdomen and
ovipositor as in *P. contradicens*.
Moustache black *complens*, Wlk.
Only the middle femora partly red.
Abdomen deep black with thick yellow-
haired segmentations and yellow hairs
on scutellum *raptor*, Austen.

The following have been described, not included in the tables:—*P. xanthostoma*, v. d. Wulp, from New Guinea, evidently only a subform of *P. bifasciatus*, having two dark streaks on the wing. *P. desmopygus*, de Meijere, Tijds. Ent. lvi., Suppl. p. 59 (1914), from Java, the abdomen having brown-yellow hairs on the first three segments in the male, and the female with the whole abdomen covered with them. *P. albopilosus*, Rondani, from Borneo, with the abdomen shining black and white-haired, the legs also white-haired. *P. felinus*, v. d. Wulp, from Borneo, with only the anterior tibiæ red, the wings pale brown. *P. leucopareus*, v. d. Wulp, from Java, the abdomen with yellow-ochre hairs and yellow tibiæ. *P. rufibarbis*, Macq., from Java, has a dark spot on the wing and long yellow hairs below the femora. *P. externetestaceus*, Macq., has the tibiæ externally testaceous, and some white bristles on the posterior legs. *P. rufomystaceus*, Macq., has a red moustache. Abdomen black with white segmentation. Wings yellow.

The other species described from the Philippines are *P. forcipatus*, Schiner, a species with red-yellow bands on the abdomen and the genitalia with a white tuft; *P. maculosa* and *varipes*, Macq., the former described as having two black spots on each segment of abdomen, and the legs with some white bristles; the latter also said to be found in India measuring 16 mm. Moustache and palpi yellow-haired. Genitalia of male from Manila with a white tuft of hairs. Abdomen with short yellow hairs and segmentations.

Promachus bifasciatus, Macq.

Dipt. Exot. i. (2) p. 215 [*Trupanea*] (1838), etc.

Ricardo, Ann. & Mag. Nat. Hist. (8) xi. p. 417 (1913).

Promachus strenuus, Walker, Proc. Linn. Soc. London, iv. p. 106 [*Trupanea*] (1860); et v. p. 264 [*Trupanea*] (1861).

Type of Walker's species (female) from Makassar, Celebes (Saunders Coll.).

Type (male) from Menado.

Male from Tond (Saunders Coll.). This specimen was compared by me with Macquart's type in the Paris Museum.

Male from Celebes.

V. d. Wulp records species from Gorontalo in Celebes, and gives a good description, suggesting Walker's species is identical, in which he is correct.

The species is curiously like the African species *P. fasciatus*, F., but the genitalia are different.

A black species distinguished by the wholly black legs and by the black abdomen with bushy white hairs on the first two segments of abdomen. *Moustache* yellow below, black above. *Thorax* black with no signs of stripes. *Scutellum* with black bristles and hairs. *Genitalia* of male large, the upper forceps with a blunt tooth near the base, then becoming concave on their inner edge, and ending in a blunt point, under pair short small, all hairs are black and numerous. *Legs* with chiefly black pubescence, some yellowish pubescence on the femora.

Length, ♂ 25-26, ♀ 23 mm.

V. d. Wulp gives the length as 19-22 mm.

Promachus melampygius, ♀, v. d. Wulp.

Tijd. v. Ent. ser. 2, vii. (xv.) p. 223 (1872).

A male from Sarawak, Borneo, another from Mt. Dulit, Philippines (*Everett Coll.*), 1901, 247.

A female from Pasir Ganting, West Coast, Sumatra, lat. 2° S., June 1914.

A female from Irisan, Benquet Province, Luzon.

V. d. Wulp described a female from Java, de Meijere a male and female from Padang, W. of Sumatra. Wulp describes the hairs on abdomen as ochre-yellow. De Meijere states they are so in the female, but in his male nearly white; he also gives the colour of the legs in both sexes as largely reddish, not pitchy brown as v. d. Wulp says, the femora being reddish below.

These specimens in the Brit. Mus. Coll. answer very fairly to the description, with the additional remarks by de Meijere, so that it seems safe to conclude it is rather a variable species with a wide distribution.

The hairs on abdomen in both sexes are whitish, tinged yellow in the female. *Legs* dull reddish, femora darker above, tarsi all black, and apices of tibiæ the same. *Palpi* in male with chiefly black hairs, in female some yellow hairs are intermixed. *Moustache* in male black and yellow, in female black sometimes with a few yellow bristles, in male the yellow bristles or hairs are a little more numerous.

A black species distinguished by the white hairs on the first three segments of the abdomen, by the partly reddish

legs, and by the white tuft of hairs on *genitalia*, which are short and small.

Length, ♂ 22-23, ♀ 22 mm.

V. d. Wulp gives it as 19½ mm.

Promachus manilliensis, Macq.

Dipt. Exot. i. (2) p. 310 [*Trupanea*] (1838); et Suppl. i. p. 207 [*Trupanea*] (1884); Ost.-Sack. Berlin. ent. Zeit. xxvi. p. 111 (1882).

A female from Cape Engano, North Luzon, Philippines (*J. Whitehead*), 98, 207.

This specimen answers fairly to the meagre description given by Macquart.

He first described the male as 24 mm. long with two white-haired bands on abdomen, and legs externally red. Palpi with white hairs, moustache white. Later he added the description of a female from the same place, Manila. Palpi with black hairs.

Length 20 mm.

Face covered with yellow glistening tomentum. Hind part of head with black bristles. *Thorax* velvety black with yellowish-brown tomentum at sides. *Scutellum* the same with black bristles. *Abdomen* the same, with black pubescence on all the segments except the first two. *Ovipositor* short, shining. *Legs* reddish with black stripes on femora, the hind pair more largely black; *tibiæ* black at apices; *tarsi* black; pubescence chiefly black, some yellowish hairs on hind femora. *Wings* clear, veins yellow.

Length 25 mm.

Promachus noscibilis, ♂, Austen.

Trans. Zool. Soc. London, xx. pt. 13, June 1905, p. 403.

One male, the type, from Wataikwa River, Dutch New Guinea.

The author states this is a species allied to *P. bifasciatus*, F., but distinguished by the lighter-coloured fore and middle *tibiæ* and the smaller *genitalia*.

P. manilliensis, Macq., must be nearly allied to this species; the *genitalia* will probably be found to be different when more specimens of each sex in the two species are to hand. The legs in Macquart's species are dull reddish, the femora are black above, the hind pair very largely black, as are also the hind *tibiæ*.

In the New Guinea species the legs are entirely black, with the exception of the fore and middle *tibiæ*, which are yellowish.

Promachus plutonicus, Walker.

Proc. Linn. Soc. London, v. p. 265 [*Trupanæa*] (1861).

Type (female) from Tond, Celebes, and another female from Menado, Celebes.

Three males from Cape Engano, North Luzon, Philippines, (*J. Whitehead*), 98, 207.

A very large, stout, black species; legs entirely black. Abdomen black-haired at apex in both sexes with fulvous pubescence. Wings brown.

Length, ♂ 25–30, ♀ 32–35 mm.

The males from the Philippines are, on the whole, so similar to the females that they no doubt are one species, but they differ slightly, as will be noted below.

Female.—*Face* with glistening yellow tomentum. *Moustache* composed of not very numerous long yellow bristles, numerous at the oral opening, fewer above, a few weak yellowish hairs below the antennæ, round the oral opening are strong black bristles. *Palpi* with black hairs. *Antennæ* blackish with some brown tomentum, the first joints with black hairs. Hind part of head with a few black bristles at each side of occiput, otherwise with yellow hairs. *Thorax* and *scutellum* velvety black with black pubescence and black bristles. *Abdomen* black; the first two segments with black hairs, dispersed almost as in tufts, shorter on the next three, which in the second female have some short fulvous pubescence; the last three segments with golden-yellow hairs, beginning on the posterior border only of the sixth segment; the *ovipositor* composed of the last segment is shining black, underside and sides with long black hairs. *Legs* stout, black; the fore coxæ with long golden-yellow hairs; pubescence on legs chiefly black, some very short fulvous pubescence on the femora and tibiæ. *Wings* longer than body, very large, tinged a deep brown with the usual grey streak.

Males.—*Face* greenish black with some grey tomentum. *Palpi* with black hairs. *Moustache* almost entirely black, and the hairs below antennæ black. Hind part of head with black hairs. *Abdomen* with distinct tufts of black hairs on the first three segments, but at the sides only. *Genitalia* short, the upper forceps small, pointed, covered with the golden-yellow hairs.

Promachus chinensis, ♂ ♀, sp. n.

Type (male), type (female), and another male from Tinghae, China (South), June 1899 (*P. de la Garde*), 1906, 89.

A robust reddish-yellow species; the legs reddish. Abdomen blackish, with yellow-haired broad bands. Moustache and hairs of palpi yellow.

Length, ♂ 25-30, ♀ 32 mm.

Male.—*Face* covered with yellow tomentum, the yellow hairs reach the antennæ, which are blackish, with yellow and some black hairs on the first two joints. Forehead with yellow hairs and some black bristles. *Thorax* brownish with a broad median black stripe, with a yellow tomentose border and with yellow tomentum at sides and on posterior part; pubescence of short black hairs, many rather like bristles, and the hairs are longer posteriorly. *Scutellum* with fine yellow bristles, one or two black bristles are present. *Abdomen* blackish, but all the segments, except the first three at their bases, are covered with dense yellow pubescence and yellow hairs, which last are thickest on the second segment and are present on sides of abdomen. *Genitalia* black, large, the upper forceps very stout, the lower pair very short, both covered with bright yellow hairs and some black hairs at base of upper forceps. *Legs* reddish yellow, the knees black, the uppersides of femora with a short black stripe; pubescence of legs yellow. *Wings* large, with yellowish veins.

Female identical. The yellow pubescence on abdomen not quite so thick. *Ovipositor* short, composed of the last segment.

Promachus calorificus, Wlk.

Proc. Linn. Soc. London, iv. p. 107 [*Trupanea*] (1860).

Promachus concolor, Wlk. l. c. v. p. 259 [*Trupanea*] (1861).

Promachus albicauda, v. d. Wulp, Tijd. v. Ent. (2) vii. (xv.) p. 228, pl. xi. figs. 12-14 (1872); id. xli. p. 133 (1898).

Type (male and female) from Makassar, Celebes.

Type (male) from Celebes (*concolor*).

V. d. Wulp described his species also from Celebes.

A stout blackish species with reddish legs. *Genitalia* with snowy-white large tuft of hairs above. *Wings* with a broad dark streak in submarginal cell. *Moustache* yellow, with some black bristles above. *Palpi* in male with black hairs; v. d. Wulp says in the female they are black and yellow.

Antennæ with the third joint as long as first one. *Thorax* covered with ash-grey and brown tomentum, stripes not visible. *Abdomen* with the black spots and narrow yellowish-haired segmentations, pubescence elsewhere chiefly black. *Genitalia* with very long upper forceps joining at end, under pair as long, curved up to them, the last segment of abdomen below somewhat produced. V. d. Wulp says the ovipositor is short, and gives the length as 16-18½ mm. This male measures about 15½ mm.

In the types of *P. calorificus* the hairs of palpi are black and yellow. *Ovipositor* of female short, black.

The male of *P. calorificus* is smaller than that of *P. concolor*, but the genitalia in both are identical.

In v. d. Wulp's figure the lower forceps are not so long, and do not reach up to the upper pair as they do in both these males. In spite of this, I believe they are the same species.

Legs reddish, the fore and middle femora with a short black streak above, the hind pair wholly reddish; tarsi black.

Promachus amorges, Wlk.

List Dipt. Brit. Mus. ii. p. 391 (1849) [*Asilus*]; et vii., Suppl. 3, p. 599 (1855) [*Trupanea*]; et Proc. Linn. Soc. London, i. p. 116 (1856) [*Trupanea*].

The type, a male, was described from Borneo.

A male from Pasir Ganting, W. Coast, lat. 2° S., Sumatra.

A blackish short-bodied species, with genitalia and ovipositor both very short and small. Legs chiefly dusky red. Moustache black and yellow.

Length, ♂ 8½-11, ♀ 12 mm.

Male.—*Face* covered with yellowish tomentum. *Moustache* rather thick, composed of yellow bristly hairs with black ones above and interspersed, some shorter black hairs are continued to base of antennæ. *Palpi* with black hairs. *Antennæ* black. Forehead with black hairs. Bristles on occiput black, with white hairs below.

Thorax brownish black, with very little appearance of stripes, tomentum dull brownish yellow. *Scutellum* the same, with fine black bristles. Pubescence on thorax black, longer behind. *Abdomen* brownish black or almost black, with black pubescence, long and thick on the first three segments, and on the other short but fairly thick; under-side with longer black hairs. *Genitalia* short, black; a few

white hairs represent the usual white tuft; the upper forceps black, club-shaped, ending in a point, the lower pair shorter, small, all with black pubescence; the under-side of the last segment of abdomen with a fringe of long black hairs. *Legs* dull reddish; the femora usually blackish on the upper sides and at apices; the hind tibiæ and all tarsi black; bristles all black and pubescence entirely black. *Wings* large, the small transverse vein below the middle of the discal cell.

Promachus philipinus, ♂ ♀, sp. n.

Co-types, two males from Cape Engano, North Luzon, Philippines (*J. Whitehead*), 98, 207, and type (female) from same locality.

A deep black-coloured species with the anterior and middle tibiæ pale yellow. *Genitalia* of male with a white tuft of hairs. *Moustache* in male yellow with a few black bristles above, in the female these last seem to predominate. Palpi with black hairs.

Length, ♂ ♀, 23 mm.

Male.—*Face* covered with yellow tomentum. Beard thick, yellow. *Antennæ* with black hairs on the first two joints. Hind part of head with black hairs. *Thorax*, *scutellum*, and *abdomen* deep black with black pubescence and black bristles. *Genitalia* black, stout, with black hairs, and with two long string-like appendages proceeding from below. *Legs* with black pubescence, the fore and middle coxæ with tufts of yellow hairs, the yellowish tarsi with some yellow hairs, the yellow colour is only present on the upper sides of the tibiæ. *Wings* clear, tinged brown, veins reddish yellow.

Female identical. *Abdomen* with black pubescence only, one of the males has some scattered fulvous pubescence on the apical half of abdomen. *Ovipositor* blue-black, shining, composed of the last segment, but the two preceding segments are also largely blue-black, shining.

Promachus fusiformis, Wlk.

Proc. Linn. Soc. London, i. 13, p. 39 (1856).

Type (female) from Malacca.

A female from Busen, Borneo (*purchased E. Heyne*), 97, 82.

A large black species with a spindle-shaped abdomen, the ovipositor long. Legs reddish. Moustache yellowish.

Length 31–32 mm.

Female.—Face covered with yellow tomentum. *Moustache* of yellow bristles, a few weak black ones present, the hairs continued to base of antennæ are yellow. *Palpi* with yellow hairs at base and black ones at apex. *Antennæ* imperfect, the first two joints black with black hairs. *Thorax* is apparently covered with bright yellow tomentum and the stripes are black, this is so in the fresh female; in the type the thorax appears greyish with no stripes. *Scutellum* in type blackish with grey tomentum; in the fresh female covered with bright yellow tomentum; both females with the scutellum covered with black bristles and hairs. *Abdomen* dull black with black pubescence, a few yellowish hairs are visible; ovipositor composed of the last four segments. *Legs* red, the knees and the last four tarsi black; pubescence chiefly yellow, black on fore femora; all bristles black. *Wings* large, clear, veins yellowish, the small transverse vein below the middle of the discal cell.

Promachus contradicens, Wlk.

Proc. Linn. Soc. London, iii. p. 87 [*Trupanea*] (1859); v. d. Wulp, Tijd. v. Entom. xli. p. 133 (1898).

Promachus interponens, Walker, l. c. v. p. 280 [*Trupanea*] (1861); Ricardo, Ann. & Mag. Nat. Hist. (8) vi. p. 414 (1913).

Types. Three co-types all from Aru Islands. Type of *T. interponens*, only one female from Batjan Island.

A species distinguished from *Promachus complens* by the wholly black femora and by the smaller genitalia of male.

Length, ♂ 27, ♀ 26–33 mm.

The type *P. interponens* appears identical with these.

Genitalia of male are black, shining, the upper forceps more slender than those of *P. complens*, and with their apical upper edges rather concave, forming a rudiment of a tooth, beyond the club-shaped forceps appear three cylindrical reddish-yellow bodies; on the underside the black projection is less triangular, almost square, and elevated somewhat; pubescence on genitalia black. *Scutellum* with black bristles and white hairs.

Promachus lineosus, Wlk.

Proc. Linn. Soc. London, i. p. 13 (1856) [*Asilus*].

Promachus vittula, v. d. Wulp, Tijd. v. Ent. xxiii. p. 167 (1880); id. Sumatra Exped., Dipt. p. 23 (1881).

Type (female) from Singapore, and another mutilated specimen.

One female from Singapore (*H. & N. Ridley*), 1904, 214.

One female from Sandaran Agong, Korinchi Lake, Sumatra, 2450 feet, May and June (1914).

V. d. Wulp described his species from one female caught in Borneo. His detailed description makes it certain that Walker's species is identical. V. d. Wulp's female measured 30 mm., these 26-28 mm. He also recorded a female from Datar, Sumatra.

A fine species with a long black *ovipositor* composed of the last three segments of *abdomen*, which is blackish with broad bright orange-haired segmentations, pubescence on the dark part chiefly of short yellow hairs. *Moustache* composed of strong yellow bristles with a few black ones among them. *Palpi* with black hairs. *Antennæ* black, the third joint shorter than the first one, but with a long arista. *Thorax* blackish with yellow tomentum, a median divided stripe and side ones very distinct. *Scutellum* with a double row of black bristles. *Legs* black; *tibiæ* reddish yellow, only dark at their apices. *Wings* yellowish, large, with a very small narrow dark streak in submarginal cell.

Promachus transactus, Wlk.

Proc. Linn. Soc. London, vii. p. 207 [*Trupanea*] (1864).

Promachus inornatus, v. d. Wulp, Tijds. v. Ent. (2) vii. (xv.) p. 230 (1872).

Type (female) from Mysol, Celebes.

The species is evidently the same as the one described by v. d. Wulp from Borneo and Halmaheira. He distinguishes it from his species *Promachus albicauda* (identical with *P. calorifica*, Walker), to which it is nearly allied by the difference in the *genitalia* and by the *moustache* being more largely black with a few white hairs below, the *thorax* has distinct stripes, the pubescence on thorax is longer and thicker, the femora are entirely black, and the *tibiæ* red-yellow with black apices, the hind *tibiæ* often much darker.

Length $18\frac{1}{2}$ -19 mm.

The Walker type is in bad condition, and measures about 15 mm. *Legs* as described above. *Abdomen* appears to have black spots with grey segmentations. *Ovipositor* long, composed of the last three segments of abdomen. *Scutellum* with not very stout black and yellow bristles.

Promachus addens, Wlk.

Proc. Linn. Soc. London, v. 280 (1861) [*Trupanea*].

Promachus gilolonus, Walker, l. c. vi. p. 7 (1862) [*Trupanea*].

Type (*addens*), a female from Batchian.

Type (*gilolonus*), a female from Gilolo, and a male with the name of *macera* from the Eastern Archipelago.

Both Walker's species appear to be identical, they are distinguished from v. d. Wulp's *P. felinus* by all the tibiæ being reddish; in his species only the anterior pair are thus coloured. A small slender blackish species with a black *moustache*. *Abdomen* with grey segmentations. *Wings* with dark brown veins.

Length, ♂ ♀, 10 mm.

Females with glistening yellow tomentum. *Moustache* of long stout black bristles, a very few white fine hairs are visible below. *Palpi* with black hairs. *Antennæ* blackish, the first two joints with black hairs, third joint as long as the first joint; the arista long. Forehead with black hairs. *Thorax* with distinct double median and side stripes. *Scutellum* with double row black bristles and a few short white hairs. Pubescence on abdomen black, white on segmentations and at sides. *Ovipositor* long, composed of the last four segments. *Legs* black, tibiæ dull red with black apices, pubescence of legs chiefly white. *Wings* clear, with one dark streak.

Male is identical. *Genitalia* small, but upper forceps stout, club-shaped, lower ones very small, both with black hairs.

Promachus complens, Wlk.

Proc. Linn. Soc. London, v. p. 236 [*Trupanea*] (1861); Ost.-Sack.

Ann. Mus. Civ. Genova, xvi. p. 424 (1882); de Meijere, Tijds. v.

Eat. lviii. p. 113 (1915); id. Nova Guinea, ix. p. 335 (1913).

Types (male and female) from Dorey, New Guinea (A. R. Wallace).

This species, *Promachus contradicens* (including *P. interponens*, from Australia), *Promachus noninterponens*, Ricardo, and *Promachus raptor*, Austen, form a group of nearly allied species, only distinguished by the colouring of the femora and by slight differences in the genitalia. They are large species, the females with broad bodies and very long ovipositors, both sexes with blackish abdomens and narrow yellow or golden-yellow segmentations.

This species measures, ♂ 16, ♀ 21 mm.

Moustache in the male black and yellow, in the female entirely black.

Male.—*Abdomen* with yellow-haired segmentations and black spots, pubescence yellow. *Genitalia* with very large stout upper forceps, armed at apices with black hairs; lower forceps not distinct, a wrinkled black triangular piece proceeds from the underside of the last segment. *Legs* reddish yellow; the femora black on their upper sides, the hind pair chiefly black. *Tibiæ* the same colour, only the hind pair black at apices; all tarsi black, the pubescence on legs is chiefly yellow and short, longer on the underside of tibiæ, with long black hairs on the underside of femora; some short black pubescence is intermixed with the yellow pubescence. *Wings* with the small transverse vein below the middle of the discal cell.

Osten-Sacken records a female from Momi, New Guinea.

De Meijere records the species from Zoutbron and Hollandia, near Humboldt Bay in North New Guinea, and from Etna Bay, Dutch New Guinea (*South*).

He describes these last specimens as measuring 23 mm., and speaks of the fore femora only as being red at the apex below.

Promachus raptor, Austen.

Trans. Zool. Soc. London, xx. pt. 13, p. 492 (1915).

A species nearly allied to *Promachus complens*, Walker, but distinguished from it by the colouring of the femora, which are chiefly black, only the middle pair partly reddish, and by the almost bushy yellow hairs on the abdomen and scutellum, which last character serves to distinguish it from the other allied species.

From Dutch New Guinea.

Promachus noninterponens, Ricardo.

Promachus interponens, Walker, see Ricardo, Ann. & Mag. Nat. Hist. (8) xi. p. 414 (1913), in parte.

Type (male) and type (female) from N.E. Queensland (*C. M. Kelsall*) (1910).

In the above publication on the Asilidæ of Australia, I placed this pair under *Promachus interponens*, Wlk., now the same as *P. complens*, Wlk., but find this was an error and that they are a distinct species, the colouring of the femora being black above, but red below, and the *genitalia*

of the male are different; the tooth of upper forceps is more distinct, the under forceps are longer, reaching more than half the length of the upper pair, the triangular projection on the underside of the last segment is much elevated and covered with black hairs, the pubescence on genitalia black, but at apices chiefly yellow. *Scutellum* with a few black bristles and with many long yellow hairs. *Ovipositor* of female includes the last four segments of abdomen. *Moustache* of stout black bristles with a few long white hairs intermixed in the female, in the male the yellow hairs are much more numerous and deeper in colour.

The following species from China are included, though they more properly belong to the Palæarctic Region, as most of them apparently come from North China:—

Promachus testaceipes, *albopilosus*, *viridiventris*, and *pallipennis*, Macq. Of these the first has legs red, the second species has the legs black, but the tibiæ testaceous, and is white-haired, the third has a shining green abdomen, and the fourth has black legs with red tibiæ, and might possibly be identical with *Promachus anicius*, Wlk. Macquart described the type a male, but makes no mention of the tuft of white hairs on genitalia.

Promachus maculipes, Wlk., from Hongkong, should be deleted from the list, as the type is apparently lost.

Two new species of *Promachus* have been described from Formosa by Matshumura, in 'Thousand Insects of Japan,' *Additamenta*, ii. pp. 326–328, date not stated:—

Promachus horishanus, measuring 24 mm.—Abdomen of female resembling those of *P. complens* group, the last five segments of abdomen said to be narrow, shining, forming the ovipositor presumably, the anterior segments with long reddish-brown hairs. *Scutellum* with fulvous and black bristles. Legs fuscous with yellow and black hairs.

Promachus formosanus, measuring 21 mm.—Male with a white tuft to genitalia. Abdomen brown, according to figure of male with lighter bands. Legs black, tibiæ pale fulvous. *Scutellum* with long black bristles.

Promachus anicius, Wlk.

List Dipt. Brit. Mus. ii. p. 392 [*Asilus*] (1849); et vii., Suppl. 3, p. 604 [*Trupanea*] (1855).

Type (female) from China (*presented by G. Reeves, Esq.*);

a male present in the Brit. Mus. Coll. is mentioned in Suppl. vii. as from China (*presented by T. Lay, Esq.*), but no description of it is given; another male is from China (Walker Coll.), 92, 196, and females from N. China, 51, 14, and Foochow, China, 91, 100.

A species distinguished by yellow bands on the abdomen, by the red tibiæ, and by the white tuft of hairs on the genitalia. Moustache yellow. Palpi with yellow hairs.

Length, ♀ 22-24, ♂ 24-26.

Female.—*Face* covered with the soft yellow hairs of *moustache*. Beard yellow. *Antennæ* blackish. *Thorax* blackish with yellow tomentum as stripes and at the sides. *Scutellum* covered with yellow hairs and with one or two black bristles. *Abdomen* with a deep black spot on each segment, bordered with a grey tomentum, band extending to the sides, both covered with short yellow hairs, the pubescence on the black spots chiefly short, yellow. *Ovipositor* composed of the last segment blue-black, shining. *Legs* black, tibiæ red. *Wings* clear, veins yellow.

Male identical. *Scutellum* with many more black bristles. *Genitalia* with a tuft of white hairs, the upper forceps short, club-shaped, the lower pair short, the under pair produced, all with long black pubescence.

Promachus leucopygus, Wlk.

Trans. Ent. Soc. Lond. n. ser. iv. p. 129 [*Trupanea*] (1857).

Type (male) from China (Saunders Coll.), 68, 4.

A species nearly allied to *Promachus anicius*, Wlk., but distinguished by the hind tibiæ only being yellowish.

Length 10 mm.

The yellow hairs on the *scutellum* are very bushy, and are also very thick on the hind part of the thorax. *Abdomen* with the first three segments bordered with numerous yellow hairs, the remaining segments with black hairs. *Genitalia* with a thick white tuft of hairs nearly concealing them; they are small and short. Tibiæ (hind pair) are said by Walker to be testaceous with black apices, the rest of the legs presumably black. In this type the fore pair are black, the middle pair are wanting.

Promachus yesonicus, Bigot.

Ann. Soc. Ent. France, (6) vii., Bull. 79, 3 (1887).

Promachus ater, Coquillet, Proc. U.S. Nat. Mus. xxi. p. 37 (1898):

A male from Japan (*G. Lewis*), 1910, 320; another from

Hisjoe, Japan; another from hills near Kobe, Japan (*Hon. E. Scarlett*), 1900, 189; another from Japan, 61, 128. A female from Yokohama District (*H. Prior*), 1901, 13; another from Japan (Pascoe Coll.), 93, 60.

Coquillet records 4 males, 4 females, from Japan. His species is the same as this.

A species closely allied to *Promachus anicius*, Wlk., but the *scutellum* has no black bristles and is covered by dense yellow hairs; the *ovipositor* is composed of the last two segments of abdomen and is blue-black, shining. The *genitalia* has a much thicker tuft of white hairs extending over the sides and nearly covering the upper forceps. The hairs on the abdomen appear to be more numerous, especially on the underside, and are all yellow.

Length, ♂ 12-16, ♀ 28 mm.

PHILOMACHUS, Karsch.

Berl. ent. Zeit. xxxi. p. 375 (1887) [præocc. Gray, Aves, 1851].

A genus established for one species, distinguished by the third joint of antennæ ending in a flat knob, from E. Africa.

Philomachus rhopalocerus, Karsch.

Berl. ent. Zeit. xxxi. p. 375 (1887).

Philomachus hypoleucochætus, Bezzi, Ann. Soc. Ent. Belg. lii. p. 379 (1908).

A male from Mt. Fongosi, Zululand (*W. E. Jones*), and males and females from Kimberley, Nov. 1913, in the Cape Museum Coll.

A medium-sized species with an almost wholly white or yellowish *moustache*. *Scutellum* with black bristles and white hairs. *Genitalia* with a tuft of white hairs above, below with a large black shining point produced from the underside of the last segment of abdomen, exactly similar to those of species of the genus *Machimus*. *Legs* reddish with darker femora, which have long white pubescence on both sides; *tibiæ* have long fine blackish hairs below.

Length 15-20 mm.

Bezzi's species from Banana and Mayumbe, Congo, is evidently the same; he describes the *moustache* as white mixed with a few black bristles.

DYSMACHUS, Loew.

Dipt. Südafrik. i. p. 143 (1860).

Lophonotus, Macq. Dipt. Exot. i. (2) p. 241 (1838) [præocc. Stephen, Lepid., 1829].

This genus is very strongly represented in the South

African region, and, judging from the many new species met with in the collections I have had access to, there must be a large number of species still to be described. The only other Region with species of this genus is the Palæarctic. I have not been very successful in identifying Loew's species, but little of the material is from the Cape, whence most of his species came—they are inserted in the table after the descriptions, which may afford some help in their identification in the future.

The Walker types belonging to this genus are the following:—

D. abuntius, *D. aphellas*, *D. amazenes*, *D. isse*, *D. nous*, and *D. mivatus* (which latter is placed wrongly in *Apoclea* in Kertész's Cat.), *D. phæax*, and *D. ladon*.

D. phæax is the only one I have been able to identify—it appears to be the same as *Dysmachus auribarbis*, Macq.

All the others are in such a dirty and imperfect condition it is impossible to identify them in any way—it would be advisable to delete them from the list of specimens in this genus.

D. ladon, type, appears to be lost, it is not in the Brit. Mus. Coll.

The species in the following table marked with a * are all known to me and represented in the Brit. Mus. Coll.

Table of *Dysmachus* Species.

Loew's Division I.

No bristles before the segments of abdomen.

I^a.

Mane extending the whole length of the thorax.

- | | | |
|---|----|------------------------------------|
| 1. Scutellum with tufts of snow-white hairs . | 2. | |
| Scutellum with no such tufts | 3. | |
| 2. Tibiæ reddish at base. Genitalia large with white and black pubescence | | * <i>suillus</i> , ♂ ♀, Fabr. |
| Genitalia reddish with white pubescence, an East African species | | <i>nanus</i> , ♂, Bezzi. |
| 3. Large species. Moustache mostly yellow. Smaller species. Moustache black and yellow or white | 4. | |
| 4. Tibiæ reddish at base, scutellum with yellow hairs and black bristles | 5. | |
| Tibiæ honey-yellow or yellow, scutellum with hairs and bristles yellow or fox-red | 6. | |
| 5. Moustache wholly yellow. Genitalia long and slender | | * <i>auribarbis</i> , ♂ ♀, Macq. |
| Moustache partly black. Genitalia club-shaped | | * <i>chalcogaster</i> , ♂ ♀, Wied. |

6. Genitalia with arms of upper forceps widely separated, bifid **tibialis*, ♂ ♀, Macq.
Pubescence of scutellum and abdomen fox-red.
Tibiæ bright yellowish red. Moustache reddish yellow and black **leoninus*, ♀, Schiner.
Near *leoninus*. Thorax with paler pubescence. Moustache black. Scutellum with black hairs *ursinus*, Schiner.
7. Curved bristles on head yellow. Genitalia very short and stout **porcellus*, Speiser.
8. Tibiæ reddish yellow or yellow 9.
Tibiæ red at the base only 10.
9. Tarsi black. Scutellum with white hairs *orientalis*, ♂, sp. n.
Tarsi yellowish. Tibiæ with a black stripe. Scutellum with yellow hairs *tarsalis*, ♂, sp. n.
10. Scutellum with yellow hairs and black bristles *rhodesii*, ♂ ♀, sp. n.
Scutellum with yellow hairs only *hirtipes*, ♂ ♀, sp. n.

To this division *Dymachus pellitus*, Wied., probably belongs, described as having fox-red pubescence on the abdomen and on scutellum, and with the same-coloured mane.

I^b.

Mane extending from the middle only.

11. Blackish with white pubescence. Mane white. Moustache white, long. Legs black, tibiæ brown at base *albus*, ♂, Loew.

II.

Abdomen with bristles before the segments.

II'.

No bristles on the underside of abdomen.

12. Blackish. Moustache black with white hairs at sides. Legs black, tibiæ brown at base *melanopholus*, ♂, Loew.
13. Moustache black and yellow. Legs black. Scutellum with yellow hairs *congoiensis*, ♂ ♀, sp. n.
Moustache yellow in male, yellow and black in female. Tibiæ honey-yellow at base. Scutellum with yellow hairs *flavopilosus*, ♂ ♀, sp. n.

II^{2a}.

Bristles on underside of abdomen. Mane extending the whole length of thorax.

14. Small grey species. Abdomen covered with white pubescence. Legs black 15.
15. Mane very distinctly white posteriorly. Moustache snow-white. Bristles on legs white. Scutellum with black bristles *molitor*, Wied.
Mane as above. Moustache black and yellow. Scutellum with no black bristles *albovittatus*, Schiner.

- Mane not distinctly white posteriorly.
Moustache black and white. Bristles on legs black *parvus*, ♂ ♀, sp. n.
16. Mane very distinctly white posteriorly 17.
Mane not so, chiefly black 20.
17. Scutellum with white or yellow hairs and pale bristles. Small species 18.
Scutellum with white or yellow hairs and black bristles 19.
18. Legs blackish. Moustache white, large . . *spiniventris*, ♂, Loew.
Tibiæ and tarsi reddish. Moustache white. *transvalensis*, ♂, sp. n.
19. Tibiæ red at base. Legs with black bristles. **albofasciatus*, ♂ ♀,
Anterior and middle tibiæ red with a black [Ricardo].
stripe. Legs with white bristles **leucotenia*, ♂, Bezzi.
- Tibiæ and tarsi testaceous. Legs with black and white bristles *ustulatus*, ♀, Loew.
20. Thorax with light ochre-yellow pubescence. *pulcher*, ♂, Loew.
Thorax with no such pubescence 21.
21. Scutellum with white or yellow hairs and pale bristles 22.
Scutellum with white hairs and black bristles 23.
Scutellum with only black hairs and bristles. 24.
22. Small dark species. Tibiæ red at base. Mane black with white hairs at sides. Genitalia large *natalensis*, ♂ ♀, sp. n.
Legs wholly black. Mane scanty, black. Genitalia short and small *rapax*, ♂ ♀, sp. n.
Small grey species 23.
23. Scutellum with white tufts of hair and reddish-yellow hairs and a double row of black bristles. Genitalia long. Abdomen with a black central stripe. Tibiæ dull reddish brown *wroughtoni*, ♂ ♀, sp. n.
- Hairy black species. Scutellum with very long black bristles and a few white hairs in the middle. Genitalia long. Legs almost entirely black *hirsutus*, ♂, sp. n.
- Scutellum with a double row of black bristles and white tufts of hair. Mane black. Legs with white bristles, only knees and base of fore tibiæ testaceous . *montanus*, ♂ ♀, sp. n.
- Scutellum with many black bristles and tufts of white hairs. Mane black bordered with dull yellowish hairs. Legs with yellow and black bristles *similis*, ♂ ♀, sp. n.
24. Mane large, black with white hairs at sides. Genitalia short. Tibiæ red at base . . . *nigricans*, ♂ ♀, sp. n.

II 2^b.*Mane from the middle of thorax only.*

25. Mane black 26.
Mane black and white or yellow 27.
26. Dull ashy grey. Moustache white and black. Scutellum with white hairs and bristles. Ovipositor very short. Legs black, tibiæ pale brown outside *angustibarbis*, ♂ ♀, [Loew.]

27. Black-grey. Moustache yellow and black. Scutellum with white hairs and eight black bristles. Ovipositor very short. Legs black, tibiæ brown *setiventris*, ♀, Loew.
 Mane white posteriorly. Scutellum with white hairs and bristles. Genitalia and ovipositor short. Legs bronze-green *albopilosus*, ♂ ♀, sp. n.
 Mane yellow and black, very scanty. Scutellum with yellowish hairs and bristles. Genitalia large, and long. Legs wholly blackish *nigripes*, ♂ ♀, sp. n.

The following species are not included in the table owing to insufficient descriptions. I have not been able to identify any of Macquart's species except *Dysmachus tibialis*:—

Dysmachus comatus, Wied., *Dysmachus incisuralis*, *geniculatus*, *flavibarbis*, *forcipatus*, *albibarbis*, *rufus*, Macquart, all from the Cape of Good Hope.

Dysmachus dubius, Bezzi, from Somaliland, probably does not belong to this genus, as he himself doubts, remarking it has not the crested mane.

Loew's Division I.

No bristles before the segments of abdomen.

I^a.

Mane extending the whole length of the thorax.

Dysmachus suillus, Fabr.

Syst. Antl. p. 168, 19 [*Dasyogon*] (1805); see Kertész's Cat. for further references.

Specimens in the Brit. Mus. Coll. are:—

One male and female from the Cape, and a male and female from Cape Town; one female from S. Africa (*Dr. Smith*), 44, 6.

In the Cape Coll. are males and females from Kayena, Cape Colony, Oct. 1916 (*L. Peringuez*); from Cape Town (*L. Peringuez*); from Kraafontein, Cape Colony (*Lightfoot*); from Grahamstown, from Mussel Bay, and from Ookiep, Namaqualand.

A species easily distinguished by the two tufts of white hairs on the *scutellum*. The genitalia are figured by Macquart in Dipt. Exot. i. (2), p. 242, pl. x. fig. 7; v. d. Wulp in Tijds. v. Ent. xix. p. 173 (1876), describes them as

follows:—"Shining black with a close and very long, chiefly black pubescence, the upper lamellæ are rather short and stout, and have between them an erect slender organ, which is white-haired at the end; the under lamellæ are considerably longer and end in a pair of long and pointed curved spines."

Dysmachus auribarbis, Macq.

Dipt. Exot. i. (2), p. 242 (1838); Schiner, Verh. zool.-bot. Ges. Wien, xviii. p. 400, 102 [*Lophonotus*] (1867).

Dysmachus chalcogaster, Loew (nec Wied.), Dipt. Südafrik. i. p. 152 [*Lophonotus*] (1860).

? *Dysmachus phæax*, Walk. List Dipt. Brit. Mus. ii. p. 412 [*Lophonotus*] (1849).

In Brit. Mus. Coll. are male and female from Cape Colony, a female from Cape Town, 11. xi. 1914 (K. H. Barnard), 1914, 15; another from Simons Town (*P. de la Garde*), 96, 2, Oct. 1893. In Cape Coll. a male and female *in coitu* from Matroosberg, males from Cape Town (*Peringuez*), Simons Town (*P. de la Garde*), and females from Hex River and Stellenbosch. These specimens vary very much in size from 17–25 mm.

The *moustache* is black and white, and the *mane* black with many outstanding bristles, a few scattered white hairs are discernible posteriorly, but not forming a white stripe. *Scutellum* with black long bristles on posterior border. *Legs* bronze-coloured, with tibiæ largely reddish brown on upper sides and tarsi chiefly reddish. Specimens measure, ♂ 14–18, ♀ 15–16 mm.

This species, originally described by Macquart, has been further described by Schiner in 'Novara Reise,' Dipt. p. 186 [*Lophonotus*] (1868).

He distinguishes it from *D. chalcogaster*, Wied., by the wholly yellow *moustache*, by its darker colouring, and, above all, by its *genitalia*; the forceps are bifid as in *D. chalcogaster*, but the upper arm of fork is very slender and pointed, the under arm thicker and longer, ending in a curved point, with a row of short bristles below, reaching an obtuse tooth, the part from the base to the above-mentioned tooth is considerably longer than in the Wiedemann species.

He considers Loew erred in making it a synonym of *D. chalcogaster*, and suggests Loew's description of a specimen he calls *D. chalcogaster* applies to *D. auribarbis*, Macq.; he suggests Loew's *D. cupreus*, a ♂, is the same as *D. chalcogaster*.

From an examination of the few specimens in the collections I have had access to, Schiner's remarks appear correct, but the drawing of the genitalia of *D. cupreus* by Loew is probably not very correct—it does not represent the genitalia of *D. chalcogaster* accurately.

Walker's *D. phæax* appears to be identical with this species, but the type is in very bad condition, from S. Africa (*Dr. Smith*), 44, 6.

Dysmachus chalcogaster, Wied.

Zool. Mag. i. pp. 3, 35, 50 [*Asilus*] (1819); id. Dipt. Exot. p. 189, 13 [*Asilus*] (1821); id. Ausszweifel. Ins. i. p. 442, 26 [*Asilus*]; Schiner, Verh. zool.-bot. Ges. Wien, xvi. p. 684, 26 [*Lophonotus*]; id. xvii. p. 401, 101 [*Lophonotus*] (1867).

Dysmachus cupreus, Loew, Dipt. Südafrik. i. p. 154, 2, pl. ii. fig. 5 (1860).

There do not appear to be any specimens of this species in the Brit. Mus. Coll., but in the Cape Mus. Coll. are a male and two females from Cape Colony answering to the description as given by Wiedemann and Schiner. It has a golden-yellow moustache, with black bristles at the sides and above. Schiner gives the genitalia as long and club-shaped, the forceps bifid. The above specimens measure 23–27 mm.; Wiedemann gives 16 mm.

[To be continued.]

XXXI.—*On some Freshwater Fossils from Central South Africa.* By R. BULLEN NEWTON, F.G.S.

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[Plate VIII.]

INTRODUCTION.

THIS communication deals with an enquiry into the history of certain obscure freshwater fossils occurring in a highly siliceous rock from Africa, the important outcome of which is in respect of their geological age. In this connexion, therefore, I have had referred to me for determination three hand-specimens of a chalcedonized rock containing fossils, which have been discovered by Mr. A. J. C. Molyneux, F.G.S., in the Matabeleland region of Central South Africa.

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They were forwarded by Dr. G. Arnold, Curator of the Rhodesia Museum, with the following remarks from Mr. H. B. Maufe, B.A., F.G.S., Director of the Geological Survey of Rhodesia:—"The Chalcedony in which the Gastropods and Plant-remains discovered by Mr. A. J. C. Molyneux occur, is found at the base of the Kalahari Sand, which is widely spread in Northern Matabeleland. No other fossils are known from these beds. They lie on a peneplain eroded in Upper Karroo Beds and are older than the present river-system. The peneplain is younger than the Kimberlite pipes, supposed to be Upper Cretaceous, but any evidence of age from palæontological data would be most valuable." An examination of these rocks proved them to be completely silicified, having the appearance of a flint within and possessing a similar conchoidal fracture. Externally two of the specimens are of a rough sandstone character of reddish brown or straw-colour, due possibly to weathering by exposure, while the third example is of similar reddish colour but much smoother, having been probably subjected to some kind of erosion. From a study of the organisms, which comprise small Gastropods resembling *Viviparus* and *Paludestrina*, and plant-remains belonging to the genus *Chara*, there is no doubt as to the freshwater origin of this deposit and its representing a relic of an ancient fluvio-lacustrine bed or a former region of marsh-land. The more prominent fossils are restricted to the surface, although microscopical sections of the flinty matrix indicate their existence throughout the rock, but in a distinctly more comminuted state. It should be noted also that the *Chara* remains are quite abundant, whereas the shells are of rarer occurrence.

DESCRIPTION OF THE FOSSILS.

The rocks, which are numbered 1350, 1351, and 1352, may have their fossils thus briefly described:—

Rock no. 1350.—This contains several fruits of *Chara* of minute size bearing extremely fine spiral striations, which are arranged longitudinally in tufts of two or more at slightly distant intervals, being sometimes represented by cavities in which the fruits have disappeared, although leaving behind as mural impressions the familiar markings of their external conformation (Pl. VIII. fig. 6). The surface of this rock is rather eroded, being smoother than the others, which renders the stem-structures of the *Chara* too obscure for definition, although they appear to be wider than those associated with specimen no. 1352. There are scarcely any indications of Gastropod remains in this rock.

Locality. S. side of Shangani River flats on road to Lubu (Bubi District).

Rock no. 1351.—Near the margin of a central depression in this rock is a crowded group of minute *Chara*-stems of smaller diameter than those represented in no. 1352. In close proximity is a well-preserved oval fruit of medium size as well as fruit-cavities of minute size; obscure Gastropod remains are also present, but too indefinite for identification (Pl. VIII. fig. 2). Similar structures are also displayed in a microscopical section of this rock, especially a stem-section cut transversely, exhibiting about fourteen minute tubular apertures surrounding a moderately wide central canal (Pl. VIII. fig. 7).

Locality. N. flank of Kana Valley on road to Lubu (Sebungwe District).

Rock no. 1352.—On the surface of this rock are displayed some narrow, fragmentary, flattened stems of *Chara* (Pl. VIII. fig. 4), less than a millimetre in diameter, bearing the equidistant, longitudinal, rounded ridges and furrows characteristic of that genus; the stems also exhibit a system of branching with obscure thickenings at the joints, while at their exposed transverse ends are indications of the central tube and surrounding minor tubes or cells which are so typical of *Chara* morphology. No fruits are directly associated with the stems, although there is a large, rather coarse, and spirally ridged ovate body lodged in a small cavity quite close to some stem-fragments, which represents an *oogonium* or fruit (Pl. VIII. fig. 5). Besides the plant-remains are some minute Gastropods with faint longitudinal striations, too obscure for determination, although the larger form, measuring 3 mm. in height and diameter, with a wide base and short conical spire, belongs to *Viviparus* (Pl. VIII. fig. 1 a), while another with an elongate spire and a more or less cylindrical axis, measuring 2.5 mm. in height and less than 1 mm. in diameter, may be a *Paludestrina* (Pl. VIII. fig. 1 b). There is another and somewhat different Paludestriniform shell on the surface of this rock of rather similar dimensions, giving a fairly complete dorsal outline (Pl. VIII. fig. 3) with a lengthy spire. These specimens exhibit no internal characters of the aperture, being firmly embedded in the siliceous matrix and yielding only dorsal views.

Locality. Kana Umzola, N. flank of Kana Valley on road to Lubu (Sebungwe District).

My grateful thanks are due for the following additional and more technical notes on the Charophyte-remains contained in these rocks, which have been kindly drawn up by Mr. James Groves, F.L.S., one of our chief authorities on the morphology of recent Characeous Plants:—

Rock no. 1350.—This shows what is probably an oospore with a dark margin representing a section of the enclosing spiral cells which constitute the oogonium-sac. It is of small dimensions, being about $.45 \times .35$ mm. The spaces between the spiral lines are somewhat convex, although this may be due to being chalcedonized. The outline of the margin corresponds roughly with the impressions of associated oogonia measuring $.775 \times .525$ mm. There is another supposed oogonium or a larger oospore about two-fifths of which is exposed, having a definite surrounding margin of dark mineralized matter and showing a diameter of $.425$ mm. The crushed oogonium (or oospore) in close proximity has, apparently, a much tapered base (Pl. VIII. fig. 6).

Rock no. 1351.—Contains a large oogonium, which, on account of its size, would be a different species to that seen in no. 1350. It is probably $1 \times .6$ mm. The branchlets near by are about $.26$ – $.3$ mm. in diameter. A microscopical slide cut from this rock exhibits a good diagonal section of a branchlet (or small stem) with a diameter of about $.4$ mm. and possessing a probable diplostichous cortex, as it consists of about fourteen cells in section (Pl. VIII. fig. 7). Certain small cylinders, considered to be bract-cells, show a diameter of about $.2$ – $.3$ mm., but no branchlet-node was observed. Another stem or branchlet section gives a diameter of about $.6$ mm. A further microscopical slide shows a good transverse section of stem with a diameter (including cortex) of about $.45$ mm. The cortex is almost certainly diplostichous, cells fourteen and of nearly equal diameter ($.03$ mm.). The smaller ecorticate sections may be both branchlets and bract-cells, although, from their position, there is no indication of whorls.

Rock no. 1352.—The *Chara* remains on the surface of this specimen belonged probably to a medium-sized plant of about the stature of the living *Chara vulgaris*.

Stem moderately stout, about $.65$ – $.90$ mm. in diameter. Cortex triplostichous, rather irregular, primary series sometimes much the larger, but secondary cells of varying diameter. No cortex nodes determinable.

Whorls of about eight branchlets. Branchlets from about .25-.4 mm. in diameter, fully corticato-cortex diplostichous. Points of meeting of upward series well shown. No branchlet nodes apparent.

Stipulodes doubtful whether haplostephanous or diplostephanous, only one series seen, bistipulate. Two well-developed, cylindrical, acuminate stipulodes clearly shown, directed upwards, which are on the stem node.

Fruit about .75 mm. in length and about .45 mm. in diameter (Pl. VIII. fig. 5). Spiral cells showing about thirteen convolutions. Apparently a full-grown fruit, somewhat crushed in the upper part. A microscopical preparation of this rock exhibits a good median section of an oogonium with the oospore outlined therein. Dimensions of the oogonium about 1.125 mm. long and .7 mm. broad. Convolutions apparently from twelve to thirteen, but these can only be estimated, as the cells are obscure at both ends. Dimensions of oospore (probably shrunken) about .70 mm. long and .35 mm. broad. In size of oogonium and number of convolutions this corresponds approximately to *Chara hispida* among living species. There are several good transverse sections of stems about .4 mm. thick, the cortex evidently diplostichous, the number of cells being about fourteen, and the alternation of primary and secondary series being in some cases indicated by a considerable difference in the diameter (Pl. VIII. figs. 8, 9).

STRATIGRAPHY.

These obscure fossiliferous remains are of so restricted a character that they present little evidence as to their geological age. Although representing the first fossils from the Matabeleland deposit, as stated by Mr. Maufe, it is of interest to note that Dr. A. W. Rogers* has referred to a similar occurrence in the "Surface quartzites" of Cape Colony (near Komgha Village, N. of East London), which have yielded silicified seeds of *Chara* associated with silicified shells of *Limnæa*, and regarded as of Tertiary age. Again, minute *Chara* fruits occur in a hard cream-coloured limestone which Mr. Beadnell discovered some years since in the Northern Fayûm of Egypt, a small fragment of which is in the Geological Department of the British Museum. It was collected when Mr. Beadnell was on the staff of the Geological Survey of Egypt, being included in his manuscript list of fossils from

* 'An Introduction to the Geology of Cape Colony,' 1905, p. 360; and second edition, 1909, p. 381.

that region, but subsequently omitted its occurrence when writing his memoir on the geology of the Fayûm*. That rock contains no other fossils in association, although according to the MS. list the molluscan genera *Melania*, *Planorbis*, and *Unio* were found in the same series of beds which were horizoned as Lower Oligocene or Bartonian. The Egyptian fruits are rather rounder than those of the Central African rock, being probably more-closely related to those of the Oligocene deposits of Britain and Europe. A somewhat similar association of organisms occurs in the rocks of the Sichel Hills and Nagpur regions of Central India, which are recognized as of Uppermost Cretaceous age. Those deposits, often highly siliceous or chalcedonic, contain *Chara* (*C. malcolmsoni*) and freshwater mollusca, and were first noticed by Malcolmson †, his fossils being described by J. de C. Sowerby, while the material more particularly from the Nagpur country was later monographed by Hislop and Hunter ‡. The smaller Gastropods, referred to by these authors under the familiar name of *Paludina*, but belonging to the genera *Viviparus* and *Puludestrina*, may claim some resemblance to the present African specimens, especially to J. de C. Sowerby's *Viviparus* (*Paludina*) *deccanensis*, and the so-called *Melania hunteri* of Hislop which is here considered to belong to *Paludestrina* §. These Indian rocks, known as the Intertrappean beds of the Deccan Trap series, are likewise full of a large *Physa* (*P. prinsepii*), besides Unioniform and other shells, as well as numerous Ostracodiform Crustaceans, all of which are entirely absent in the new African material. Malcolmson and Sowerby referred such beds to the Tertiary period, while Hislop and Hunter recognized them as Lower Eocene. Neumayer|| subsequently studied the same Mollusca from the writings of the English authors, and pointed out their close relationship to forms characterizing the Laramie Beds of North America belonging to the topmost Cretaceous; hence to that age he ascribed this extensive formation of India, a result which has long been accepted by the Geolo-

* 'The Topography and Geology of the Fayûm Province of Egypt,' Survey Department, Cairo, 1905.

† Trans. Geol. Soc. London, 1840, ser. 2, vol. v. pls. xlv., xlvii. pp. 537-575.

‡ Quart. Journ. Geol. Soc. London, 1860, vol. xvi. pp. 166-176, pls. v.-vii.

§ Quite recently Col. H. H. Godwin-Austen, F.R.S., has urged the necessity of a generic revision of these Deccan Trap Mollusca: 'Records Indian Mus.' 1919 (October), vol. xvi. part vi.

|| 'Records Geol. Surv. India,' 1884, vol. xvii. pp. 87, 88 [=a translation from Neues Jahrb. 1884, vol. i. Briefl. Mitt. pp. 74-76].

gical Surveyors of that country. More recently Mr. E. W. Vredenburg* has added further confirmation of this late Cretaceous age for the Indian deposits by referring to the occurrence of *Physa prinsepii* in the Maestrichtian strata of Baluchistan associated with the Ammonite, *Sphenodiscus ubaghsi*, Grossouvre, accounting for the freshwater Gastropod as having been washed out of a neighbouring estuary during the deposition of the marine Ammonite-rocks. The probability of this correlation of the Indian beds with the Laramie group seems also to be demonstrated by the occurrence in both of Dinosaurian reptiles, for it is known that the Lameta deposits forming the lowest part of the Intertroppean series of India have yielded *Titanosaurus* † in supposed association with *Physa prinsepii*, as also, according to Hislop ‡, with *Viviparus deccanensis* and other shells common to those Indian rocks. It is of interest to note that *Titanosaurus* and further Dinosaurs have been also described from the Upper Cretaceous deposits of Madagascar (around Mevarana) by M. C. Depéret §, but with no record of their association with fluvio-lacustrine mollusca or plant-life. No *Chara* relics are known from the true Laramie group, although Mr. Knowlton || has described *C. stantoni* from the Bear River deposits of the United States which he regarded as of Laramie age, but which Mr. Stanton ¶ believes to be older, and of an age nearer the base of the Upper Cretaceous—probably between the Cenomanian and Turonian, as judged by the European standard of stratigraphy. G. R. Wieland** also supports an Upper Cretaceous age for the Bear River Beds, although recognizing them as older than the Laramie. Again, a faunistic resemblance has been pointed out among the fossils of the Belly River deposits of Canada and those of the opalized beds of New South Wales ††, both of which exhibit an estuarine facies, as they contain Plesiosaurian and Dinosaurian remains as well as freshwater and marine mollusca and other organisms, while such deposits are referred to the Uppermost Cretaceous. In estimating the importance of

* 'Records Geol. Surv. India,' 1907, vol. xxxv. pp. 114-118.

† Lydekker, 'Records Geol. Surv. India,' 1877, vol. x. p. 38; and R. D. Oldham's edition of Medlicott and Blanford's 'Manual of the Geology of India,' 1893, pp. 264, 265.

‡ Quart. Journ. Geol. Soc. 1864, vol. xx. pp. 280-282.

§ Bull. Soc. Géol. France, 1896, ser. 3, vol. xxiv. pl. vi. pp. 176-194.

|| 'Botanical Gazette' (Indiana), 1893, vol. xviii. p. 141.

¶ American Journ. Sci. 1892, ser. 3, vol. xliii. pp. 98-115.

** Mon. United States Geol. Surv. 1905, vol. xlviii. p. 208.

†† R. Bullen Newton, Proc. Mal. Soc. London, 1915, vol. xi. pl. vi. pp. 217-235.

these facts, it would seem possible that this African formation, with its freshwater assemblage of organisms, would appear to favour a correlation with the Intertrappean beds of India, and consequently would be Upper Cretaceous. Such a result is in support of the now generally received view of the existence of a land-connexion between India and Africa during the Cretaceous epoch. Moreover, palæontological researches support the theory of such a land-surface being continuous from Upper Palæozoic times, and so uniting Australia, India, Madagascar, Africa, and America—a stretch of territory known as Gondwana Land, which has yielded the celebrated *Glossopteris flora* *. At the close of the Cretaceous epoch this great land-area was broken up, and finally became submerged by the invasion of the Tertiary Sea †.

CONCLUSIONS.

This chalcedonized rock from Matabeleland is mentioned by Mr. Maufe as occurring in a peneplain of Upper Karroo Beds and at the base of Pleistocene deposits known as the Kalahari Sands, which in this region of Africa mostly cover the basalts and the other underlying formations. Dr. Passarge ‡ has described similar rocks to the south in the Kalahari country under the group-name of "Botletle Schichten," and later Mr. G. W. Lamplugh § recognized the same deposits in the Batoka Gorge of the Zambesi River, and termed them "Chalcedonic Quartzite." No definite geological age has been assigned to this formation, on account of the absence of palæontological evidence, although Dr. Passarge has attempted a divisional sequence of the beds as they occur in the Kalahari Desert, involving certain climatal conditions, the oldest of the beds being regarded as Eocene.

It is important also to again mention the presence of similar beds made known to us under the name of "Surface Quartzites" by Dr. A. W. Rogers, containing both *Chara* and *Limnæa*, occurring in the South-eastern area of Cape Colony, thus proving fairly conclusively a contemporaneity of deposition with the chalcedonic rocks of Matabeleland, the Zambesi territory, and Kalahari.

It is now suggested, from an examination of the obscure

* E. A. N. Arber, "On the Distribution of the *Glossopteris* Flora," Geol. Mag. 1902, pp. 346-349.

† See Mr. R. D. Oldham's remarks on this subject in his edition of Medlicott and Blanford's 'Manual of the Geology of India,' 1893, p. 211.

‡ 'Die Kalahari,' 1904 (Berlin), pp. 196, 285, 648.

§ Quart. Journ. Geol. Soc. 1907, vol. lxiii. p. 198.

fossils referred to in the paper, that this African formation, extending from the Zambesi country to Cape Colony, may be older than Eocene, and that its occurrence in a basaltic region comparable to that of the Deccan Trap country of Central India may point to a similar horizon for its deposition, viz., Upper Cretaceous. The assemblage of organisms found at present in the African rock is admittedly very small, but, so far as it goes, it seems to offer resemblances which would associate it in time with that characterizing the Intertrappean beds of India. It is to be hoped that additional specimens may be forthcoming which might help to confirm these stratigraphical suggestions, and so to strengthen the view that these chalcidized deposits may represent part of the land-platform which united Africa with India during Cretaceous times.

EXPLANATION OF PLATE VIII.

GASTROPODA.

- Fig. 1. (A) *Viviparus* and (B) *Paludestrina*?. Dorsal views of surface-specimens, $\times 8$. No. 1352. [Fig. 1 B has been intensified.]
 Fig. 2. *Viviparus*; microscopical transverse section from near the base of a specimen, $\times 7$. No. 1351.
 Fig. 3. *Paludestrina*?, dorsal view, $\times 8$. No. 1352. A surface-specimen embedded in rock. [Figure intensified.]

PLANTÆ.

- Fig. 4. *Chara* stems as seen on the rock-surface, exhibiting typical longitudinal flutings and obscure transverse jointings, $\times 7$. No. 1352.
 Fig. 5. A *Chara* fruit or oogonium of comparatively large size, exhibiting strong spiral ridges, embedded in a matrix cavity, $\times 7$. No. 1352.
 Fig. 6. A surface-series of *Chara* fruits and cavities of minute size in longitudinal arrangement, with microscopically fine spiral striations, $\times 5$. No. 1350.
 Fig. 7. A *Chara* stem cut transversely, as seen in a microscopical section of rock, showing the existence of about fourteen tubular apertures encircling the large central canal, $\times 8$. No. 1351. [Figure intensified.]
 Fig. 8. A group of transversely cut *Chara* stems, as seen in a microscopical section of rock exhibiting similar structures to the foregoing, $\times 10$. No. 1352.
 Fig. 9. *Chara* stems in transverse section, as seen in a microscopical preparation of rock showing an oval form with indications of the cortical cells, $\times 20$. No. 1352.

XXXII.—On the Geographical Distribution of the Genus *Anomis*, Hübner (*Lineopalpa auctorum*), a Noctuid of the Family *Gonopteridæ*. By Colonel C. SWINHOE, M.A., F.L.S., &c.

[Plates IX.—XII.]

THIS paper is in continuation of my paper on the geographical distribution of the subgenus *Cosmophila*, a section of the genus *Anomis*.

In 'Moths of India,' vol. ii. p. 409 (1894), Hampson puts *involuta*, Walker=*basalis*, Walker=*colligata*, Walker, all three from Ceylon, and *propinqua*, Butler, from Aden, as synonyms to *subulifera*, Guenée, from Abyssinia.

He puts *metaxantha*, Walker (type without locality), *combinans*, Walker=*guttanervis*, Walker, both types from Ceylon; *commoda*, Butler, from Japan, *privata*, Walker, from Shanghai, *revocans*, Walker, from Moreton Bay, Australia, *vulpina*, Butler, from Venna Levu, Figi Isl., *inducens*, Walker, from Java, *simulatrix*, Walker, from Sierra Leone, *albitibia*, Walker=*nigritarsis*, Walker, from Ceylon, all under *fulvida*, Guenée, locality erroneously stated to be N. America.

Seitz, in his 'Palearctic Noctuids,' 1914, pp. 359, 360, puts *fulvida* into the genus *Rusicada*, Walker, and puts under it *combinans*, *inducens*, *nigritarsis*, *revocans*; *privata*, and *commoda*, and describes two subspecies—*subfulvida* and *griseolineata*—from China and Japan, unknown to me.

Guenée's habitat for *fulvida* is N. America, but this is evidently an error; it is a common Eastern form; Walker's type of *metaxantha* has no locality—this is also a common Indian form.

Sir George Hampson has pointed out to me that Hübner's genus *Anomis*, type *exacta*, from America, is congeneric with Guenée's genus *Lineopalpa*; *Anomis* was erected in 1827 and Guenée's in 1852, therefore the former has precedence.

I am very much indebted to the Rev. C. R. N. Burrows, the well-known genitalia expert, for the great care and trouble he has taken in the dissection and examination of numerous examples of *Anomis* I have sent him from many localities, and the notes that follow are all entirely due to him.

The differences in the genitalia of some of the forms from widely separated localities is generally very great, but in some cases it is slight, as, for instance, between *sabulifera*

from Abyssinia, *involuta* from Ceylon, and *dona* from Roebourne, W. Australia; but there are distinct differences, and to my mind it is impossible to believe that localities that could not have had any connexion with each other for many hundreds of millions of years could possibly contain one and the same species of Noctuid, which is not migratory, and the larva and pupa of which could not have been carried by any commercial agency.

"The study of the genitalia of Lepidoptera is still in its infancy. It may well be that forms of construction overlap and resemble one another in species far apart in detail and far apart in origin. But this remains to be proved. When one bears in mind cases like those of the genus *Tephrosia* *biundularia* and *crepusculata*, in which the genitalia differ, as far as has been discovered, only in the forms of a few names, or in *Xylophasia*, where the three recognized species—*monoglypha*, *sublustris*, and *lithoxylea*,—in which the difference appears to lie in the number of certain hairs; or, again, when one remembers the number of spines which cannot be separated by the eye, but possess well-marked differences in the genitalia, such as the *nictitans* group of *Hydræcia*, and the *Acronicta*'s, *tridens* and *psi*, it may well be that further study is necessary to learn the exact bearing of the genitalia upon classification. Any way, it does not so far appear to have presented greater uncertainty than have other lines of examination." (*Burrows*.)

General Facies of Anomis and Cosmophila.

Valves delicate, sometimes weakly armed, margins generally ragged. Coremata on ninth abdominal segment attached dorsally to the tegumental ring, and also to the valves, extremely extensile and voluminous. Juxta* usually strongly developed. Scaphium generally present, tip minutely bifid, generally with tuft of long hairs ventral on eighth abdominal segment, connected with strongly developed segmental divisions. Anellus strongly armed with minute spines.

SECTION I.

Juxta absent. *Anellus* exposed.

Anomis exacta, Hübner. (Pl. IX. fig. 1.)

Valves narrow, angulated at mid-length, unarmed.

* *Juxta* (Pierce), a plate fused to the front of the anellus.

Coremata voluminous, double.
 Penis long, cornuti two, rounded, small.
 Saccus bulbed.
 Caraccas, Venezuela, Jamaica.

Anomis mesogona, Walker. (Pl. IX. fig. 2.)

Valves not angled, thickened basally, waved.
 Coremata double.
 Anellus spines very minute.
 Penis with single, broad, flat cornutus.
 Saccus bulbed.

Anomis sabulifera, Guenée. (Pl. IX. fig. 3.)

Valves narrow, angled mid-length, unarmed.
 Anellus spines small.
 Coremata voluminous, double.
 Penis long, thin, cornuti several, spines minute.
 Saccus pointed.
 Type, Abyssinia.
 Dar-es-Salam, E. Africa.

Anomis involuta, Walker. (Pl. IX. fig. 4.)

Same as in *sabulifera*, but saccus not pointed, anellus spines very large.
 Type, Ceylon.
 Simla and throughout India.

Anomis dona, Swinhoe. (Pl. X. fig. 5.)

Similar, but uniformly smaller; anellus spines smaller, saccus pointed.
 Type, Roebourne, W. Australia.

Anomis brima, nov. (Pl. X. fig. 6.)

Similar, a larger and very dark form.
 Anellus spines smaller than the above.
 Type, Queensland.

SECTION II.

Juxta Y-shaped.

Anomis fulvida, Guenée. (Pl. X. fig. 7.)

Juxta soft, obtuse, large.
 Valves short, narrow, truncate, unarmed.

Coremata small, single.

Saccus arcuate.

Penis narrow, cornuti several, fine.

Type, N. America (ex errore).

Assam, throughout India, Malayana, Moluccas. Examples from Assam, Borneo, and Java dissected; genitalia all similar.

Anomis busana, nov. (Pl. X. fig. 8.)

Juxta hard, arms widely separated, large.

Valves very large, rounded, ragged, unarmed.

Coremata large, single.

Penis very large, cornuti four, large, various.

Saccus arcuate.

Type, Busan, South-east Borneo.

Anomis revocans, Walker. (Pl. XI. fig. 9.)

Juxta soft, obtuse, small.

Valves narrow compared with length.

Coremata small, single.

Penis long, narrow, cornutus single, hooked.

Saccus arcuate.

Type, Moreton Bay.

Queensland, Brisbane, Victoria, Cape York.

Anomis scitipennis, Walker. (Pl. XI. fig. 10.)

Juxta soft, pointed.

Valves short, narrow, rounded, unarmed.

Coremata single.

Penis stout, short; cornutus single, hooked.

Saccus pointed.

Type, Sarawak, Borneo.

Sarawak.

SECTION III.

Juxta with separate arms.

Anomis amboinensis, nov. (Pl. XI. fig. 11.)

Juxta arms very long, much longer than genital cavity, rigid, blunt.

Valves large, pointed.

Coremata single, voluminous.

Penis very large, cornutus one, large.

Saccus arcuate.

Type, Amboina.

SECTION IV.

Juxta quadrate.

Anomis combinans, Walker. (Pl. XI. fig. 12.)

Juxta rigid, small.

Valves large, wide.

Harpe soft, spined.

Coremata voluminous.

Penis very large, cornuti several, large.

Saccus rounded.

Scaphium beaked.

Types, Ceylon.

Kandy, Kina Balu, N. Borneo, Engano Island.

Genitalia all similar, but the Bornean examples are much darker than those from Ceylon and the Engano form very dark.

Anomis albitibia, Walker. (Pl. XII. fig. 13.)

Juxta rigid, small.

Valves large, ovate.

Harpe soft, spined.

Coremata double, voluminous.

Penis very large, cornuti several, large.

Saccus rounded.

Scaphium linear.

Types, Ceylon.

Assam, S. India, Perak.

Anomis commoda, Butler. (Pl. XII. fig. 14.)

Juxta rigid, very large.

Valves large, rigid.

Coremata voluminous, double.

Penis very large, cornutus one, curved.

Saccus rounded.

Type, Japan.

Nikko, Yokohama.

Anomis metaxantha, Walker. (Pl. XII. fig. 15.)

Juxta rigid, smaller than genital cavity.

Valves very large, pointed.

Harpe hard, long.

Coremata voluminous, double.

Penis very large, cornutus one, large, hooked.

Saccus rounded.

Type-locality ignotus.

Assam, Sikkim, Nilgiris, India generally.

Anomis sumatrana, nov.

♀. Upperside: head, body, and fore wing uniform ochreous grey, transverse lines red-brown: fore wing with a short subbasal line from the costa, an antemedial slightly sinuous line from the hinder margin to the median vein; a medial perfectly straight line not quite reaching the costa, a straight line between this and the outer margin, running from the median vein to near the costa; costal line red-brown; cilia dark brown: hind wing suffused with brown. Underside uniformly pale ochreous grey; both wings crossed a little beyond the middle by a pale greyish line, outwardly curved on the fore wing below the costa and bent outwards at the middle on the hind wing.

Expanse of wings, ♀, $1\frac{6}{10}$ inch.

Padang, Sumatra; two examples.

Anomis involuta, Walker, xiii. p. 1003 (1857).

Siam, Yatung, Ceylon, Assam, Karachi, Simla, Bombay, Nilgheris.

Anomis dona, Swinhoe.

Uniformly smaller than the preceding, the underside without the pale blackish suffusion through the cell of the fore wing.

Roebourne; seven examples.

Anomis brima, nov.

Upperside: fore wing dark olive-brown, transverse markings blackish, the entire wing irrorated with black atoms; subbasal line indistinct, antemedial line outwardly oblique from the costa; a broad discal blackish band, its outer edge with several angles; a round paler space in the upper part of the band: hind wing uniformly dark blackish; cilia of both wings white. Underside with black suffusion on the entire surface of both wings except on the borders.

Expanse of wings, ♂ ♀, $1\frac{4}{10}$ inch.

Type, ♂, Queensland; type, ♀, Roebourne; three examples.

Anomis fulvida, Guenée.

Its square form of wings and the clear white spots forming the orbicular and reniform easily distinguish it. It is well figured in Hampson's 'Moths of India,' vol. ii. p. 409.

I have it from Assam, Kina Balu, Sarawak, Java, and Perak, many examples. I have had the genitalia of examples from several localities examined by Mr. Burrows; he says they are all identical.

Anomis busana, nov.

♂. Fore wing narrower than in *fulvida*; colour uniform bright ferruginous, the orbicular white but very small, the reniform obsolescent, represented by a pale, brownish, indistinct dot, with another below it, but well separated from it; the transverse lines darker red and highly sinuous, the sub-basal and antemedial lines outwardly oblique from the costa, the postmedial line erect but not reaching the costa, the sub-marginal line finishing some distance from the hinder angle; a line between the last two from the costa to the median vein; cilia brown, with white tips: hind wing slightly suffused with brown, paling towards the abdominal margin; cilia white, with grey spots.

Expansion of wings, ♂, $1\frac{7}{10}$ inch.

Type, Busan, S.E. Borneo; two examples.

Anomis revocans, Walker.

A large form, much larger than any of the Indian species. Fore wing dark ochreous brown-red as a rule, some specimens a little paler: hind wing suffused with black transverse lines much as in *busana*; orbicular and reniform small and pale black, in one example the reniform is large, deep black, with a curled black line connecting it with the black spot above it. In size, colour, and in the formation of the genitalia it is quite distinct.

I have it from Victoria, Brisbane, Queensland, and Cape York.

Anomis scitipennis, Walker, Journ. Linn. Soc., Zool. vii. p. 76. (1864).

Cosmophila ochreifusa, Swinhoe, Ann. & Mag. Nat. Hist. (8) xviii. p. 408 (1906).

A very distinct species.

Walker's type came from Borneo, mine from Sumatra. I

have only one example from Borneo, and have had its genitalia examined (Pl. XI. fig. 10). It very nearly resembles my type of *ochreifusa* in the Brit. Mus., and therefore I put it provisionally here until I can get a specimen for dissection.

Anomis amboinensis, nov.

♂. Fore wing narrow; head, body, and fore wing clear ochreous red-brown, very uniform in colour; the orbicular represented by a very minute white dot; the transverse lines hardly visible, the postmedial and two lines (all very sinuous and upright) somewhat close together before the outer margin, only faintly indicated: hind wings pale ochreous grey without markings; cilia of both wings white, with ochreous-red points. Underside: fore wing pale ochreous red, the hinder marginal space and the entire hind wing nearly white.

Expanse of wings, ♂, $1\frac{1}{10}$ inch.
Type, Amboina.

Anomis combinans, Walker, xiii. p. 1001 (1857).

Cosmophila guttanervis, Walker, xiii. p. 1003.

Smaller, paler, and brighter-coloured than *revocans*; wings similarly shaped.

Types, Ceylon; four examples.

Anomis inducens, Walker, xiii. p. 1004.

Paler than *combinans*; the hind wings very pale ochreous grey, in *combinans* they are suffused with blackish; the markings of the fore wing are very similar, but the subbasal line is more oblique and the reniform is always represented by a blackish spot.

Type, Java.

I have three Javan examples and two from St. Aignan Island, Tobriand group.

Anomis prima, nov.

A very dark form, larger than *combinans* or *inducens*; the hind wings are entirely dark blackish brown.

Expanse of wings, ♂, $1\frac{2}{10}$ –2 inches.

Type, Kina Balu, N. Borneo; five examples.

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Anomis albitibia, Walker, xiii. p. 1001.

Rusicada nigratarsis, Walker, xiii. p. 1006.

A small species, very dark, transverse lines quite different to all the others.

Types, Ceylon.

I have examples also from Assam, Ahmednagur, Rangoon, and Perak.

Anomis commoda, Butler, Ann. & Mag. Nat. Hist. (5) i. p. 203 (1878).

A large dark species, with fairly broad fore wings; hind wings dark blackish brown. Quite a good species.

Type, Japan.

I have seven examples from Yokohama and Nikko.

Anomis metaxantha, Walker, xiii. p. 1005.

Paler than *commoda*; fore wing similarly shaped; the genitalia shows that it is quite distinct from all the others.

Type-locality ignotus.

It is a common form in India. I have sixteen examples from Assam, Rangoon, and Bombay.

XXXIII.—*The Cirripede Subgenus Scillælepas; its Probable Occurrence in the Jurassic Rocks* (S. gaveyi, sp. n.). By THOMAS H. WITHERS, F.G.S.

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[Plate XIII.]

MORE than half a century ago the late Mr. G. E. Gavey collected from the Lias at Mickleton Tunnel, near Chipping Campden, Gloucestershire, remains of a Cirripede, which has up till now remained undescribed. Mr. Gavey, however, listed the specimens in 1853* as "*Pollicipes*; 2 new species," and the late Rev. P. B. Brodie (1857 †), in two short notes,

* G. E. Gavey, "On the Railway Cuttings at the Mickleton Tunnel, and at Aston Magna, Gloucestershire," Quart. Journ. Geol. Soc. London, 1853, vol. ix. p. 34.

† Brodie, Rev. P. B., "On a new Species of *Pollicipes* in the Inferior Oolite near Stroud, in Gloucestershire," Brit. Assoc. Rep. (1856) pt. ii. p. 64; 1857.

Brodie, Rev. P. B., "On the Occurrence of some new Species of *Pollicipes* in the Inferior Oolite and Lias of Gloucestershire," Ann. & Mag. Nat. Hist. ser. 2, vol. xix. 1857, p. 103.

drew attention to the fact that Mr. Gavey had found a new species of *Pollicipes* in the Lias, and this at that time was the earliest-known occurrence of the subclass Cirripedia.

The Cirripede valves from Mickleton Tunnel, now in the Gavey Collection in the Geological Department of the British Museum, number nine in all, and, although four kinds of valve are represented—namely, carina, subcarina, scutum, and tergum,—it would appear from their ornament that all belong to a single species. They are undoubtedly the valves of a pedunculate Cirripede belonging to the family Scalpellidæ, but the generic reference is not so certain. The species is provisionally referred to the subgenus *Scillælepas* of the genus *Calantica* for reasons given below (see p. 261 *et seq.*).

Calantica (Scillælepas) gaveyi, sp. n.

1857. *Pollicipes* sp., Brodie, P. B., Brit. Assoc. Rep. (1856) pt. ii. p. 64.

1857. *Pollicipes* sp., Brodie, P. B., Ann. & Mag. Nat. Hist. ser. 2, vol. xix. p. 103.

Diagnosis.—Capitular valves with regular, widely-spaced, raised ridges or zones of growth, between which are fine transverse and longitudinal lines, and, especially in the lower two-thirds of the valves, with irregular closely-set punctæ—a feature not noticed in any other fossil Cirripede. Carina tapering rapidly towards the apex. Scutum probably triangular, with almost straight widely-spaced ridges. Tergum comparatively long and narrow, with the angles of the zones of growth situated less than one-third the distance from the carinal margin.

Distribution.—Pliensbachian [presumably *davœi*-zone]: Mickleton Tunnel, near Chipping Campden, Gloucestershire.

Holotype.—The carina (In. 18981) figured on Pl. XIII. fig. 2.

Collection.—Collected by the late G. E. Gavey, C.E., F.G.S., and now in the Geological Department of the British Museum, registered In. 18980—In. 18988.

Material.—At least three individuals are represented by the material, which comprises two almost complete carinæ and a fragment of another, one subcarina, five incomplete terga (of which three are right valves and two are left valves), and an impression of part of a scutum. The valves are preserved as an intensely brittle jet-like substance.

Measurements.—Except for the valve considered to be a subcarina, all the valves are somewhat incomplete, and, in the circumstances, to give only their actual measurements

would convey a very inadequate idea as to their size; probable measurements are therefore given:—

		Actual, in mm.	Probable, in mm.
Carina (In. 18980)	Length	12·4	13·0
	Breadth	4·1 (at about 4 mm. from base).	5·0
Carina (In. 18981)	Length	12·3	14·2 (as shown by impression).
	Breadth	5·2	
Subcarina (In. 18983)	Length	3·3	
	Breadth	2·0	
Tergum (In. 18984)	Length	14·4	17·0
	Breadth (circa)	6·0	6·0

Description.—*Carina* semicylindrical, moderately bowed inwards, strongly convex transversely, imperceptibly keeled in its upper half, the valve tapering rapidly towards the apex, which is sharply pointed; basal margin moderately convex. Outer surface marked with regular, widely-spaced, prominent, raised ridges or zones of growth, which show, especially in one valve (In. 18981), a tendency to become broken up into bead-like prominences. Fine transverse and longitudinal lines are to be seen between the main ridges, but the longitudinal lines are not so well marked as in the terga. The valve is marked, especially in its lower part, with irregular, closely set, fine punctæ.

Scutum.—On the specimen In. 18986, lying near a right tergum, was a badly crushed and shapeless valve, evidently showing its inner surface. At its base could be discerned one or two rather long and straight furrows, and these suggested to me that the fossil represented another kind of valve. It was possible to clear away most of the minute fractured particles of shell, and there was then exposed some eight or nine prominent, straight, equidistant furrows. A plaster-cast taken from this impression shows that the furrows represent the widely-spaced ridges or zones of growth such as are seen on the carina and tergum above, except that they are straighter and longer, and there is no doubt that we have here an impression of the outer surface of a scutum of the type seen in the species known as *Pollicipes aalensis*, *Pollicipes ooliticus*, and *Archæolepas quenstedti*.

Tergum subtriangular, slightly convex transversely, comparatively long and narrow, with prominent, widely-spaced, transverse ridges, which form an acute angle of which the apex is situated about one-third the distance from the carinal margin; there is no definite apico-basal ridge or fold. Carinal

margin very slightly convex, almost straight, not divided into an upper and a lower portion; occludent margin gently convex, almost straight, and forming with the carinal margin an angle of about 35° ; scutal margin slightly convex, rather longer than the occludent margin, with which it makes a rounded angle. The valve is ornamented similarly to the carina, but the longitudinal lines are more apparent.

Subcarina more than half as wide as long, not nearly so strongly convex as the apical portion of either of the two carinæ; basal margin slightly convex. The inner surface of the valve slopes towards the outer surface and forms a sharp edge, so that there is no possibility of this valve being merely the broken off apical portion of a carina.

Systematic Position of Calantica (Scillælepas) gaveyi.

Darwin, in his Monograph (1851), referred the known Jurassic species (*Pollicipes concinnus*, Morris*, *P. ooliticus*, Buckman†, and *P. planulatus*, Morris‡) to the genus *Pollicipes*. Now the distinguishing characters of *Pollicipes*, which is essentially a recent genus, and evidently a polyphyletic one, is the downward growth of the valves, and their large number (from eighteen to over one hundred). Certainly the valves of the above three species have a downward growth, and since there is evidence in only one species—*P. concinnus*—that the valves numbered more than eighteen, Darwin must have relied on the downward growth of the valves, and almost as certainly on the distinctive characters of the detached valves as compared with those in the genus *Scalpellum*. *Scalpellum* has more modified valves, numbering from twelve to fifteen.

Two further genera have since been established which embrace Jurassic species—namely, *Archæolepas*, Zittel§ (1884), and *Pycnolepas*, Withers|| (1914), the former including the species *Pollicipes redtenbacheri*, Opperl, *Pollicipes royeri*, de Loriol, and *Pollicipes quenstedti*, von Ammon, and the latter including certain Cretaceous species, together with

* Morris, J., 1845, Ann. & Mag. Nat. Hist. ser. 1, vol. xv. p. 30, pl. vi. fig. 1; Darwin, C. R., 1851, Pal. Soc. Monogr. Lepadidæ, p. 50, pl. iii. fig. 1.

† Buckman, J., 1844, Geol. Cheltenham, p. 95, pl. iii. fig. 7; Darwin, C. R., 1851, Pal. Soc. Monogr. Lepadidæ, p. 50, pl. iii. fig. 2.

‡ Morris, J., 1845, *op. cit.* p. 31, pl. vi. fig. 2.

§ Zittel, K. A. von, 1884, Sitzungsber. k. b. Akad. Wiss. München, Bd. xiv. Heft iv. p. 581.

|| Withers, T. H., 1914, Ann. & Mag. Nat. Hist. ser. 8, vol. xiv. pp. 170, 200.

the Tithonian species *Brachylepas* (?) *fimbriatus* and *B.* (?) *tithonicus*. I have already shown* (1914) that the genus *Scillælepas* existed in the Upper Cretaceous (Upper Senonian and Danian), and it was then pointed out that, although there was no definite evidence, certain of the detached valves described as *Pollicipes* from the Jurassic rocks have much resemblance to the valves of *Scillælepas*.

In *Pollicipes*, *Archæolepas*, *Pycnolepas*, and *Scillælepas* all the valves have a downward growth, so that, in the absence of definite evidence as to their number and disposition, all that one has to go by in referring detached plates to either of those genera is their shape and structure. These are the only criteria we have in placing *S. gaveyi*.

Undoubted species of *Archæolepas* have the carina much reduced in size as compared with the remaining capitular valves; it is somewhat triangular in shape and slightly expanded at the basal angles. Neither the carina nor the terga in *S. gaveyi* are at all like the valves in *Archæolepas*, and the presence of a subcarina, which is absent in that genus, renders it unlikely that it is a species of *Archæolepas*.

There is a superficial similarity in the structure of the carina, principally in the prominent transverse growth-ridges, with that of *Pycnolepas*, but the rounded basal margin shows it to be of a different type of valve. The tergum and scutum are altogether different in structure, thus preventing the species being referred with any confidence to the genus *Pycnolepas*.

S. gaveyi might be referred to *Pollicipes*, for the carina appears to be of much the same shape as the recent species; but the absence of definite evidence as to the number of valves in *S. gaveyi*, the fact that the tergum differs markedly, and that the impression of the scutum shows that the valve was of the same type as in *P. ooliticus*, makes one hesitate to refer the species to *Pollicipes*, more especially so since it would seem that hardly any of the Jurassic or even Cretaceous species can be confidently referred to *Pollicipes*.

Now the terga of *S. gaveyi* are particularly elongate, as are also those of the genus *Scillælepas*. While there is nothing in favour of the reference to *Scillælepas* in the character of the carina, there is nothing opposed to it; but the most convincing of the valves is the scutum, of which, unfortunately, we have only the impression. This, however, shows it to be a valve resembling the scutum of *P. ooliticus* and *P. quenstedti*, and particularly like the scutum in both the recent and fossil species of the genus *Scillælepas*.

If the shape and structure of these detached valves be

* Withers, T. H., 1914, *op. cit.* p. 192.

trustworthy evidence, then the species, *P. ooliticus* and *P. aalensis**, *P. quenstedti*, and *P. (?) lotharingicus* †, Méchin, all of which have valves similar to *S. gaveyi*, are probably nearly related, and belong to *Scillælepas*.

Against this view is the fact that Darwin has described and figured in his Monograph (p. 52, pl. iii. fig. 2 *b*) a comparatively large rostrum of *P. ooliticus*, similar to but rather wider than the carina. I am not at all sure, however, that in this particular Darwin has allowed sufficiently for variation, and that the valve really is a rather wide carina; a view of the inner surface of the valve would have decided the matter.

Zittel has referred the species *P. quenstedti* to his genus *Archæolepas*, but the valves appear to differ in structure from the valves in *Archæolepas*, and this view is strengthened by the fact that there is among the valves of *P. quenstedti* figured by Max Schlosser (1881) ‡ a rostrum which agrees much more with the rostrum of *Scillælepas*, being decidedly different in shape from the rostrum in undoubted species of *Archæolepas*.

Altogether the evidence, while not conclusive, is in favour of referring *S. gaveyi* to *Scillælepas*, and it is clear that there is no indication of its affinity with *Pollicipes*. I am inclined to think that further material will show this species, together with *Pollicipes ooliticus*, *P. aalensis*, *P. quenstedti*, *P. (?) lotharingicus*, and probably one or two other Jurassic species, to belong to *Scillælepas*, or, at least, to a genus nearly related thereto.

Comparison with other Species.—*Pollicipes (?) lotharingicus*, Méchin, from the *spinatus*-zone of Agincourt (Meurthe-et-Moselle), France, is the only other species known from the Pliensbachian, although it occurs at a somewhat higher horizon than *S. gaveyi*. Only a single carina and tergum are known; the carina appears to be much more attenuated and tapering than *S. gaveyi*; the tergum differs in its proportions, having a shorter occludent margin, which makes a larger angle with the carinal margin, and the scutal margin is proportionally much longer, and the angles formed by the zones of growth appear to have their apices much nearer to the carinal margin. Moreover, the valves do not appear to be marked with longitudinal lines, since no mention is made of them in the description, and nothing is said of the fine

* Richardson, L., 1908, Geol. Mag. dec. v. vol. v. p. 352, text-fig.; Withers, T. H., 1911, Proc. Cotteswold Nat. F. C. vol. xvii. pt. ii. p. 275.

† Méchin, A., 1901, Bull. Soc. Sci. Nancy, ser. 3, vol. ii. fasc. i. p. 16, pl.

‡ Schlosser, Max, 1881, 'Palæontographica,' Bd. xxviii. p. 60, pl. viii. fig. 8.

punctæ, which form a marked feature in *S. gaveyi*. While it is apparent that *S. gaveyi* differs from *P. (?) lothuringicus*, the figures of the latter species are not good as regards detail, and some mistake appears to have been made in the printing, for the figures in the plate are upside down and the lettering gives the wrong names to the margins of the valves.

Another Liassic species—*Pollicipes rhomboidalis*, Moore*, —from the Hettangian (Sutton Stone), was said to be based on a scutum and carina, although the specimen figured appears to be a tergum and the description of the scutum applies to it. It is not at all like the tergum in *S. gaveyi*, for the valve is subrhomboidal, the carinal margin being divided into an upper and a lower portion. The carina is not described.

The remaining Liassic species is *Pollicipes liasinus*, Dunker†, which is founded on a valve supposed to be a tergum from the Lias of Halberstadt; but it is impossible to determine from the figure whether it is a Cirripede valve at all.

EXPLANATION OF PLATE XIII.

Stramentum pulchellum, G. B. Sowerby, Jun., sp.
Turonian: Black Head Bay, Co. Antrim, Ireland.

Fig. 1. Holotype of *Loricula macadami*, Wyville Thomson, now in the collection of the Public Art Gallery and Museum, Belfast.

Shell showing the left side uppermost; to the left-hand can be seen the left portion of the *carina*, with the opposing right portion (*c*) projecting from beneath it, the left portion of the *carina* being followed by the left *carinal latus* (*cl'*), left *tergum* (*t'*), left upper *latus* (*ul'*), and the left *scutum* (*s'*), the outer basal part of the right *scutum* (*s*) slightly projecting. Below the *carina* are six of the left *subcarinal* scales (*cs'*) of the peduncle, followed by incomplete rows of the *carino-lateral*, *upper lateral*, and *scutal* scales of the peduncle, the *subscutal* scales not being present. × 2 diam.

This is in further illustration of my paper on "The Cirripede Genus *Stramentum* (*Loricula*): its History and Structure," *Ann. & Mag. Nat. Hist.* ser. 9, vol. v. pp. 65-84, pls. iii. & iv.

Calantica (*Scillælepas*) *gaveyi*, sp. n. Pliensbachian [presumably *davæi*-zone]: Mickleton Tunnel, near Chipping Campden, Gloucestershire.

Figs. 2, 3. Carinal valves. × 3 diam. In. 18981, In. 18980.

Fig. 4. Subcarina. × 4.5 diam. In. 18983.

Fig. 5. Tergum (incomplete right valve). × 3 diam. In. 18985.

Figs. 6, 7. Terga (incomplete left valves). × 3 diam. In. 18987, In. 18988.

Fig. 8. Scutum (part of valve as seen in a plaster-cast taken from the natural mould after removal of the crushed shell-fragments). × 2 diam. In. 18986.

* Moore, C., 1867, *Quart. Journ. Geol. Soc. London*, vol. xxiii. p. 539, pl. xvi. fig. 31.

† Dunker, W., 1848, 'Palæontographica,' vol. i. p. 180, pl. xxv. fig. 14.

XXXIV.—*Notes on Fossorial Hymenoptera*.—XL. *On new Species in the British Museum*. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Superfamily **VESPOIDEA**.

Family **Scoliidæ**.

Subfamily *ELIDINÆ*.

Myzine albohirta, sp. n.

♂. Pallide flavus; fronte, mesonoto antice lateribusque, mesopleuris postice sternoque nigris; flagello, segmentis abdominalibus dimidio basali, aculeoque pallide rufo-testaceis; alis hyalinis, venis testaceis, stigmatibus flavo.

Long. 12 mm.

♂. Clypeus short and broad, three times as broad as its greatest length, broadly rounded apically. Antennæ short and stout, about equal in length to the thorax and median segment combined, of even thickness throughout; supra-antennal tubercles large and flattened. The whole insect clothed with white hairs, which are longest on the pleuræ. Head broad and transverse; eyes converging towards the clypeus, their inner margin only slightly sinuate. Pronotum twice as broad as long, the anterior margin straight, the hind margin only feebly arcuate. The black portion of the mesonotum closely punctured, the yellow median portion much more sparsely and indistinctly punctured. Scutellum large, more than half as long as the mesonotum, broadly subtruncate at the apex, moderately convex; median segment short. First tergite short, obliquely sloped anteriorly to the very short petiole. Abdomen elongate, only slightly narrowed at the extremities, the segments not constricted, each segment pale testaceous red on the basal half. Seventh tergite deeply triangularly incised at the apex, rather broadly rounded and blunt at the apex on each side of the incision. Sternites 3-7 with a raised transverse space at the base, which is bounded apically by a curved carina, which is produced into a point near the middle of each sternite, the basal portion of the raised space is coarsely longitudinally striated; seventh sternite produced and rounded at the apex. Seventh tergite longitudinally striated at the extreme base. Radial cell short and broad, first abscissa of the radius equal to the second, third about as long as the first and second combined, fourth almost equal to the third; cubital and discoidal nervures extending

to the margin of the wing; second recurrent nervure received close to the middle of the third cubital cell.

Hab. Saqâra, western desert, 10 miles south of Cairo; July 30, 1915 (Egyptian Department of Agriculture).

Very distinct owing to the very short stout antennæ and the sculpture of the sternites.

Family Psammocharidæ.

Deuteragenia kandiensis, sp. n.

♀. Nigra; femoribus anticis, tibiis anticis, scapoque apice subtus ferrugineis; mandibulis dimidio apicali brunneis; alis hyalinis, venis fuscis, macula parva fusca circa nervulum, maculaque magna cellulam radialem, apice excepto, cellulas cubitales secundum tertiumque, cellulæque discoidalis secundi majorem partem occupante fusca.

Long. 11 mm.

♀. Mandibles tridentate at the apex, the outer tooth the longest; clypeus convex, broadly truncate at the apex, finely and closely punctured; antennæ inserted a little above the base of the clypeus. Front and vertex finely and very closely punctured; posterior ocelli as far from each other as from the eyes. Antennæ a little shorter than the head, thorax, and median segment combined; second joint of the flagellum half as long again as the third. Maxillæ at the base furnished with a brush of very long hairs. Thorax and median segment finely and closely punctured; pronotum very widely arched posteriorly; scutellum convex, much broader than long; median segment rounded, with a shallow longitudinal groove from the base which is not continued on the apical slope, the segment very sparsely clothed with long whitish hairs. Abdomen shining, sparsely and minutely punctured; the transverse groove on the second sternite well developed; hind tibiæ without spines. Second abscissa of the radius nearly twice as long as the third; the second cubital cell on the cubitus scarcely longer than the third; cubitus extending to the margin of the wing. Nervulus distinctly postfureal; cubitus of the hind wing originating beyond the transverse median nervure.

Hab. Kandy, Ceylon, September 1918 (*O. S. Wickwar*);

3 ♀ ♀.

Allied to *D. marpesia*, Bingham, from the Malay Peninsula, but in that species the coxæ, trochanters, and femora of the intermediate and hind legs are red; the median segment granulate, without a groove from the base and less strongly

rounded; and the basal fuscous fascia of the fore wing is continued along the basal nervure to the costa. The median segment in *marpesia* is without long hairs.

Superfamily **SPHECOIDEA**.

Subfamily *PEMPHREDONINÆ*.

Psenulus nigrolineatus, Cam.

Mellinus nigrolineatus, Cam. Journ. Str. Br. Roy. Asiat. Soc. xviii. p. 22 (1907).

Mellinus nigromaculatus, Cam. l. c. p. 23.

These seem to me to be merely slight colour-varieties of the same species. A variety in which the yellow markings on the mesonotum are narrower than in the typical form occurs in Ceylon.

Hab. Borneo, Kuching (typical); Ceylon, Kandy (*O. S. Wickwar*).

Allied to *P. pulcherrimus*, Bingh., but is a larger and more robust species, and has the basal area of the median segment much more strongly striated.

Subfamily *SPHECINÆ*.

Sceliphron (Chalybion) sommereni, sp. n.

♀. Viridi-cyanea; mandibulis basi, scapo, flagello articulis 5 basilibus, tegulis, pedibusque, coxis exceptis, rufo-ferrugineis; alis hyalinis, apice late infumatis, venis ferrugineis; capite thoraceque albo-pilosis.

Long. 17-20 mm.

♀. Clypeus with a row of five small teeth on the apical margin, slightly convex; second and third joints of the flagellum subequal. Mesonotum rather closely punctured, more closely than in *chalybeum*, Sm., and less deeply grooved in the middle than in that species. Otherwise similar to *chalybeum*, Sm.

Hab. Kabete, near Nairobi, E. Africa (*Dr. van Sommeren*); 3 ♀ ♀.

Possibly an extreme local variety of *S. chalybeum*, but the very great colour-differences, especially of the legs and wings, and the distinctly closer puncturation of the mesonotum, seem sufficient to merit specific rank. The colour of the basal antennal joints in *chalybeum* appears to be subject to considerable variation.

Subfamily *PHILANTHINÆ*.*Cerceris expulsa*, sp. n.

♀. Nigra; abdomine rufo-ferrugineo; mandibulis basi, carina interantennali, macula parva utrinque pone oculos, tegulis macula parva, postscutello linea transversa utrinque, tergito primo fascia apicali, tibiisque extus flavis; alis fuscis; flagello brunneo-ferrugineo; clypeo apice bidentato; segmento mediano area basali basi oblique, apice transverse, striata; sternito secundo area basali elevata nulla; area pygidiali nigra, elongata, apice angustissime rotundata.

♂. Feminae similis; clypeo fascia longitudinali flava; tegulis immaculatis; postscutello omnino nigro; clypeo apice leviter emarginato; segmento mediano area basali oblique striata; sternito sexto angulis apicalibus spina longa armato; area pygidiali apice truncata.

Long., ♀ 13, ♂ 11-13 mm.

♀. Clypeus broad, rather sparsely punctured, produced just before the apex into two small tuberculate teeth, the space below the teeth forming a small deflexed triangle; a deep fovea at the inner angle of the lateral lobes of the clypeus. Face broad, the eyes strongly divergent towards the clypeus; antennæ inserted more than half as far again from the anterior ocellus as from the base of the clypeus. Head broader than the thorax, closely but not very deeply punctured; posterior ocelli much further from the eyes than from each other. Head, thorax, and median segment clothed with silver pubescence, which is most noticeable on the clypeus, face, and pleuræ; the thorax and median segment rather coarsely punctured. Abdomen sparsely and finely punctured; first tergite much broader than long; pygidial area long and narrow, gradually narrowed from the base and very narrowly rounded at the apex.

♂. Clypeus subcarinate longitudinally in the middle from the apex to the middle; the apex very shallowly and rather widely emarginate, the angles of the emargination slightly produced. Eyes distinctly divergent towards the clypeus, but not as strongly as in the female; first tergite much broader than long; sixth sternite with a long spine on each side at the apical angles; pygidial area parallel-sided, much longer than broad, truncate at the apex, rugose.

Hab. Calcutta district (*Rothney*), ex coll. Cameron; 1 ♀, 12 ♂♂.

This was identified by Cameron as *C. vigilans*, Sm., to which it bears a strong superficial resemblance; but the

structure is utterly different in many points, especially the form and colour of the clypeus in both sexes, the sculpture of the basal area of the median segment, the form of the pygidial area in the female and the presence of spines on the sixth sternite of the male.

Subfamily *STIZINÆ*.

Stizus anchorites, sp. n.

♂. Niger; labro, scapo subtus, fronte sub antennis, tergitoque tertio fascia basali interrupta flavis; clypeo apice, mandibulis, apice excepto, antennis, intra medium et apicem fuscis, orbitis externis, pronoto margine postico, mesonoto lateribus anguste, tegulis, scutello, postscutello, segmento mediano fascia obliqua utrinque, tergitoque primo basi obscure ferrugineis; genubus, tibiis tarsisque testaceis, posticis supra infuscatis; alis fusco-hyalinis, apice late hyalinis.

Long. 16 mm.

♂. Eyes slightly convergent towards the clypeus. Apical joint of the flagellum scarcely as long as the penultimate, very feebly curved. Clypeus broadly and very shallowly emarginate at the apex, feebly convex, closely microscopically punctured. Thorax and median segment very closely and not very finely punctured. Abdomen closely punctured, finely on the basal, more strongly on the apical segments; seventh tergite broad, rounded at the apex, the sides distinctly sinuate. First transverse cubital nervure slightly curved near the cubitus. The hyaline margin of the wing reaches beyond the third transverse cubital nervure and beyond the second recurrent nervure.

Hab. Maasara, eastern desert, 10 miles south of Cairo, September 19, 1913 (Egyptian Department of Agriculture); 1 ♂.

This belongs to the group of *S. fasciatus*, Fabr., but the colouring is very different and the seventh tergite more distinctly sinuate at the sides. The description of *S. pictus*, Dahlb., taken from a female, somewhat resembles this species, but the three apical abdominal segments are said to be flavo-testaceous. *S. pictus* seems to be unknown to recent authors; it is also an Egyptian species. The tergites of the present species are in certain lights tinted with fusco-castaneous.

Stizus storeyi, sp. n.

♂. Niger; flagello subtus, articulo secundo basi, articuloque apicali, orbitis externis, pronoto, mesonoto lateribus anguste, tegulis,

scutello postscutelloque ferrugineis; clypeo, fronte, scapo subtus, tergitis 3-6, apice anguste fuscis, sternitisque quarto quintoque flavis; tibiis tarsisque anticis, tibiisque intermediis subtus flavo-testaceis; alis infuscatis, apice late hyalinis.

Long. 18 mm.

♂. Eyes slightly convergent towards the clypeus. Apical joint of the flagellum no longer than the penultimate, not much curved. Clypeus subemarginate at the apex, minutely and closely punctured. Mesonotum and scutellum very closely punctured-rugulose and clothed with very short cinereous hairs. Abdomen closely and finely punctured; seventh tergite rounded at the apex, feebly sinuate on the sides. First transverse cubital nervure slightly curved near the cubitus. The hyaline margin of the wing reaches to the apex of the radial cell, enters the third cubital cell, and almost reaches the first recurrent nervure.

Hab. Saqâra, 10 miles south of Cairo, June 8, 1917 (Egyptian Department of Agriculture); 1 ♂.

This seems to belong to the group of *S. fasciatus*, Fabr., but the clypeus and front are distinctly narrower than in that species; the structure of the flagellum is almost the same, also the neuration. The colouring, however, is extremely distinct.

Stizus spinulosus, Rad.

Stizus spinulosus, Rad. Horæ Soc. Ent. Ross. xii. p. 186 (1876). ♀.

Hab. Solloum, on western coastal frontier of Egypt, May 22, 1917 (Egyptian Department of Agriculture); 1 ♂.

Stizus citrinus, Klug.

Larra citrina, Klug, Symbolæ physicæ, tab. xlv. fig. 4 (1845). ♀.

Hab. Kharga Oasis, September 28, 1914 (Egyptian Department of Agriculture); 1 ♂.

As noticed by Handlirsch, this species belongs to the group of *S. tridentatus*.

Subfamily *CRABRONINÆ*.

Crabro. wickwari, sp. n.

♀. Chalybea; mandibulis, apice excepto, scapo, pronoto linea utrinque, callis humeralibus, scutello macula parva angulis basalibus, tergitis 2-5 linea transversa utrinque, tibiis extus linea, femoribus anticis subtus linea basali, intermediis macula

apicali, metatarsisque intermediis posticisque, apice excepto, albo-flavidis; alis hyalinis, venis fuscis; mesonoto antice transverse striato, postice punctato.

Long. 11 mm.

♀. Clypeus with a median carina, bluntly pointed at the apex, and clothed with close silver pubescence; mandibles tridentate, the middle tooth much longer than either the upper or lower. Eyes separated at the base of the clypeus by a distance equal to about one-third of the length of the scape, the facets in front very large. Head rather broader than the thorax, shining, minutely punctured, more closely on the front than on the vertex. Ocelli in a broad triangle; the posterior pair much further from each other than from the anterior one, a little further from the eyes than from each other, and at least half as far again from the hind margin of the head as from each other. Pronotum transverse, almost smooth; mesonotum closely transversely striated on the anterior half; the posterior half finely punctured, with oblique striæ on the sides. Scutellum and pleuræ finely punctured; basal area of the median segment longitudinally striated. Abdomen shining, minutely punctured, pygidial area long and narrow. First and second abscissæ of the radius subequal; recurrent nervure received shortly before the apex of the cubital cell.

Hab. Kandy, Ceylon, September 1918 (*O. S. Wickwar*); 1 ♀.

This belongs to the group of *C. fossorius*, L., and *C. chrysites*, Kohl, but is very distinct in the beautiful steel-blue colour, the less robust form, and the reduced size and pale colour of the markings. The sculpture of the mesonotum is similar to that of *C. chrysites*, but is stronger than in that species. Superficially this species resembles *Gorytes cærulescens*, Turn., the colouring in both species being unique in the genus.

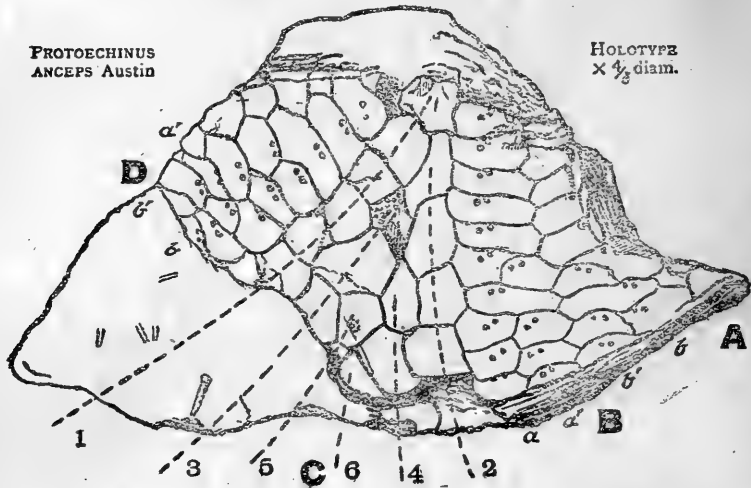
XXXV.—*Pholidocidaris anceps*: a Correction.

By F. A. BATHER, F.R.S.

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IN attempting to interpret the structure of Austin's holotype of *Protoëchinus* (Jan. 1918, *Ann. & Mag. Nat. Hist.* ser. 9, vol. i. p. 40) I fell into the very mistake that I was trying to

avoid—a mistake due to the fact that the specimen is seen from the inside. In numbering the columns of interambulacra I forgot to reverse my tracing, as I had intended, with the result that the numbers on the diagram (p. 48) are wrong. This was pointed out by my friend Dr. R. T. Jackson in a letter of 14th Feb., 1918. As the simplest way of putting the matter right, I avail myself of his kind permission to print some of his informal remarks, and reproduce the diagram with corrected columns and numbers.



Dr. Jackson writes:—

“As regards the numbering of columns in interambulacrum C, as it is an internal view I should have column 1 on the right (compare *Perischodomus*, my plate 64, fig. 2). Column 2 would then come on the left, column 3 would fall to the right, with the second plate truncating its dorsal border as usual. Column 4 would then start in a plate which is practically pentagonal and on the right of the centre. This, which I call the initial plate of column 4, does not make a very good plate for the second plate in column 3, following your lettering. Column 5 starts with a pentagon, and, as I imagine, passes through the small fragmentary plate on the dorsal border of the initial pentagon. The plate on the left (if there are two plates, which looks probable to me) would apparently then be the initial plate of column 6, which falls to the left of the centre (right of the centre as seen from the outside). All this something as I show in *Hyattechinus*

rarispinus, plate 23, fig. 1, area I. This is an external sandstone mold of the ventral side seen from above, and is therefore reversed, as is your specimen of *Pholidocidaris anceps* seen from within.

"I found in the great preponderance of cases in Palæozoic Echini that odd-numbered columns, while starting in the centre, passed upwards to the left of the centre. On the other hand, even-numbered columns usually start on the right of the centre and maintain that position throughout their extent. Such being the case, I feel that such is the probable course in any given specimen until it proves itself exceptional.

"This internal and external view business and molds of exterior and interior seen in reverse are the most confusing things to keep true orientation straight in that I ever tackled."

XXXVI.—*Fossil Arthropods in the British Museum.*—I.

By T. D. A. COCKERELL, University of Colorado.

THE British Eocene insects hitherto described consist of three species of Coleoptera, one of Isoptera, and one of Odonata. The two latter, published in recent years, are in the British Museum. Dr. F. A. Bather has kindly transmitted to me the undescribed Eocene material belonging to the Museum, and included with it I find the type-specimens of two of the already-named Coleoptera. These were figured by Westwood in 1854, without names; in 1856 names were supplied by Giebel.

In the present paper I complete the account of the Eocene material, aside from the Coleoptera, which will be discussed separately. Six species are described, more than doubling the list, and adding three orders. The ants are the oldest Old-World species. The Fulgorid represents a type of broad-winged moth-like Homoptera, well developed to-day in the Oriental region, but especially prominent in the Eocene fauna of the Rocky Mountains, as I shall show in a paper now awaiting publication. So far as can be seen, the English insect belongs to one of the American genera. The most remarkable find, however, is a large wing belonging to the Mesozoic family Pseudosiricidæ. Its discovery is almost as startling as that of a Tertiary dinosaur; but after careful study I cannot separate the species from the Mesozoic group, and, indeed, it is very close to the genus *Formicium*.

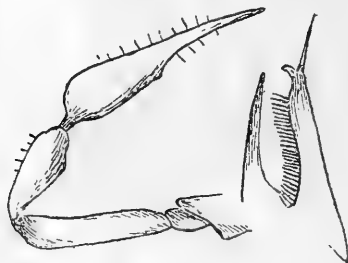
The specimens in Burmese amber (burmite) are also of Tertiary age, and were sent by Mr. R. C. J. Swinhoe, of Mandalay, who kindly presents them to the British Museum. The character and age of the beds has been discussed in earlier papers, particularly Amer. Journ. Science, Aug. 1916, p. 135.

PSEUDOSCORPIONIDA.

Garypus burmiticus, sp. n. (Fig. 1.)

Legs and pedipalpi intense black; apparently no trochantins. Pedipalp with coxa elongated, produced apically; femur ordinary, rather stout, about $450\ \mu$ long; tibia about $350\ \mu$ long, very stout, obtusely angulate on inner side; hand long (about $800\ \mu$), with a narrow neck, followed by a broad

Fig. 1.



Garypus burmiticus, Ckll.

base which tapers gradually to the apex, the outer margin beyond the basal curve being practically straight; the pedipalp has very few hairs, longest on the hand. Jaw with a long serrula, not detached apically; no flagellum; stylet present.

Burmese amber, from R. C. J. Swinhoe.

Represented by a cast skin, about 6 mm., from the type of *Epyris atavellus*. The serrula, shown in the figure, is about $70\ \mu$ long.

I concluded that this could go in *Garypus*, and, sending a copy of my figures to Dr. N. Banks, am informed by him that, so far as these go, there is no reason for objecting to the reference. Among the species of Baltic amber there is a resemblance in the pedipalp to *Obisium rathkii*, Koch and Berendt, though in our *Garypus* the hand is conspicuously more attenuate.

INSECTA.

ORTHOPTERA.

Pycnoscelus (?) *gardneri*, sp. n. (Blattidæ).

Tegmen about 30 mm. long and 12 broad; marginal field broad, with elevated and broadly rounded base, the width (depth) of the field near base 3 mm.; subcosta and branches of radius very oblique; subcosta running parallel with first branch of radius (its total length from base of tegmen 12·7 mm.), giving off a branch about 4·2 mm. from end, and another, rudimentary, one about 1·5 mm. earlier; radius with very numerous superior branches, first simple, second and third with long forks, fourth with short fork, fifth with two long branches, sixth and seventh each with a long fork, the forked branches with long stems; radial sector arising about 11·5 mm. from base of tegmen; media and cubitus between them with about nine principal branches, between which are conspicuous supplementary veins; cross-veins present. The inferior basal area of tegmen is lost.

Bagshot Beds, Bournemouth (*J. S. Gardner*). British Museum, In. 19030.

This agrees with the modern *Pycnoscelus surinamensis* (L.) in the broad marginal field, general size of tegmen, two-branched subcosta, general character of branches of radius, early origin of radial sector, and numerous branches of media, with supplementary veins between. There are no visible differences which could possibly be regarded as of generic value; but as we have only an incomplete tegmen, the generic reference must be considered provisional. The amber Blattidæ are very different.

Allopterites (gen. nov.) *multilineatus*, sp. n. (Gryllidæ).

Lower wing as preserved 19 mm. long, but probable total length about 23 mm.

Costa nearly straight; subcosta, radius, and media running parallel below it, the intervals between them less than the width of the veins; media giving off very numerous (many more than in *Gryllus*) oblique branches, which are directed toward the apex of the wing; all these veins are ferruginous as preserved, and the branches of the media are obliquely crossed by numerous (four in 2 mm.) continuous veins of the same colour, directed upward and outward (like the cross-veins in *Mantoida*), forming angles of about 45° with the branches. These oblique cross-veins abruptly cease at the lowest branch

of media, and do not pass on to the cubitus. There are six or more anals close together at base, as in *Gryllus*.

Bagshot Beds, Bournemouth (*J. S. Gardner*). British Museum, In. 19032.

This singular but imperfect wing certainly appears to belong to the Gryllidæ, not very far from *Gryllus*, but it will easily be known by the peculiar markings.

HOMOPTERA.

Hammapteryx anglica, sp. n. (Fulgoridæ).

Anterior wing about 15 mm. long and 7 broad, without markings.

Costa strongly arched, the costal area deep (2 mm. near base), crossed by numerous (about five in 2 mm.) simple veins arising from the subcosta, the first few practically vertical, the others oblique; radius emitting the sector very near (about 2 mm. from) base, as in *Scolypopa*, the sector forking about 3 mm. from its origin; media complex, branching very near base, the upper branch forking 2 mm. beyond level of fork of radial sector, the lower branch forking at same level as fork of radial sector, and the lower division of this again forking. The radius follows a straight course until it reaches the apical third of wing, when it is deflected downward. In the apical third of wing the parallel veins are extremely numerous, about eight in 2 mm.

Bagshot Beds, Bournemouth (*J. S. Gardner*). British Museum, I. 15030.

Differs from typical *Hammapteryx* (North American Eocene) by the broader costal area, but appears to be congeneric.

In. 19031, from the same locality and collector, appears to be the same species, but is too imperfect for positive identification.

HYMENOPTERA.

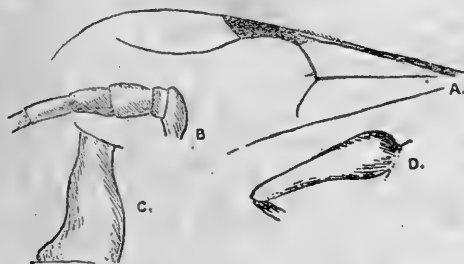
Epyris atavellus, sp. n. (Bethylidæ). (Fig. 2.)

♂.—Length a little over 3 mm.

Black, with the legs dark reddish fuscous. Head oblong, longer than broad; antennæ 13-jointed, extending beyond tegulæ, thick basally, more slender in middle, but broad though flattened apically; second antennæ joint very short, 50 μ long, third 130 μ long. Prothorax very long, distance from tegulæ to base of head almost or quite equal to length of head; thorax not robust, metathorax long. Wings hyaline,

stigma and nervures reddish, the stigma dark; marginal cell open at end, discoidal nervure represented by a stump. Anterior and middle legs ordinary, but hind femora strongly swollen basally. Abdomen fusiform, not very long.

Fig. 2.

*Epyris atavellus*, sp. n.

- A. Anterior wing. B. Base of antenna. C. Prothorax.
D. Hind femur.

Burmese amber, from R. C. J. Swinhoe. In a large slab, 10 mm. from outer margin of obtuse corner of broader end.

This appears to belong to that group of *Epyris* which has sometimes been referred to *Mesitius*, but it is a smaller insect, with much longer prothorax, than *E. deletus*, Brues, from the Florissant Miocene. *Epyris*, taken in the broader sense, is a very large genus, still abundant in most parts of the world, especially in tropical regions. The larvæ are parasitic on Coleoptera.

Ecophylla bartoniana, sp. n. (Formicidæ).

Anterior wing 12.3 mm. long.

Marginal cell very narrow; lower section of basal nervure longest; submarginal cell with its apical angle about a right angle. The following measurements are in μ :—Upper section of basal nervure 640; lower section of basal nervure 800; lower end of basal nervure to transverso-medial 1200; greatest depth of submarginal cell 1250.

Bagshot Beds (Bartonian), Bournemouth (*J. S. Gardner*). British Museum, In. 19036.

Very closely allied to *Æ. perdita*, Ckll., from the Oligocene at Gurnet Bay, but the transverso-medial nervure is much nearer the basal.

Formica heteroptera, sp. n. (Formicidæ).

Anterior wing about 13·5 mm. long; submarginal cell 2 mm.

Marginal cell extremely narrow, formed as in *Colobopsis stricta* (Jerdon); submarginal cell small and narrow; discoidal cell quadrate, higher than long. The following measurements are in μ :—Width (depth) of marginal cell 352; upper portion of basal nervure 480; lower section of basal nervure (which is arched, and not in a straight line with upper portion) 960; discoidal cell on submarginal about 560; lower end of basal to transverso-medial 1120; greatest depth of submarginal cell (at level of end of discoidal) about 800. The terminal section of the medius is strongly arched.

Bagshot Beds, Bournemouth (*J. S. Gardner*). British Museum, In. 19035. The reverse is labelled In. 18587, and should come from Creech according to the accompanying list, but this is evidently an error.

This is a very singular species, combining the characters of *Colobopsis* and *Formica*, but in some respects different from both. When better known it may prove referable to a distinct genus. I do not know the venation of the genus *Glaphyromyrmex*, Wheeler, from Baltic amber.

Megapterites (gen. nov.) *mirabilis*, sp. n. (Pseudosiricidæ).
(Fig. 3.)

So far as the anterior wing shows, the genus is similar to *Formicium*, Westwood, but the first marginal cell is much

Fig. 3.

*Megapterites mirabilis*.

higher than long, much narrowed above, bell-shaped; the anterior and posterior sides of second discoidal cell are not nearly parallel; the transverso-medial has its lower end a little basad of the upper (compare *Teredon*); the vein M_2 leaves second discoidal cell near the lower end of its outer side, and is distinctly arched, as in many ants. The second

submarginal cell is very long and narrow, and the marginal cell appears to be open, as in all *Pseudosiricidæ*.

Length of wing as preserved 45 mm., probable total length at least 50 mm.

Basal nervure falling just short of transverso-medial; lower section of basal nervure arched, 5 mm. long, forming nearly a right angle with the upper section, as in *Formicium*, the upper section 2 mm. long; first discoidal cell 5 mm. long; second 5.5 mm. on upper side and 8 on lower; second submarginal cell about 6 mm. long and hardly 2 mm. wide; marginal cell about 2.4 mm. wide (deep), the marginal nervure (radial sector) perfectly straight. The cubital nervure diverges from the marginal, so that 10 mm. beyond end of second submarginal cell they are 4.3 mm. apart.

Bagshot Beds, Bournemouth (*J. S. Gardner*). British Museum, I. 2596, with reverse.

Related to *Formicium*, Westwood, from the Lower Purbeck at Durdlestone Bay. Handlirsch treats *Formicium* as a synonym of *Pseudosirex*, but it is clearly a distinct genus.

XXXVII.—*A new Three-toed Jerboa from China.*

By ARTHUR DE CARLE SOWERBY, F.Z.S., F.R.G.S.

IN a collection of mammals presented by Mr. J. D. de La Touche to the British Museum are two specimens of a three-toed jerboa belonging to the genus *Dipus*, which were collected by Mr. A. L. Hall at Chih-feng in North-eastern Chihli on or near the Mongolian border. They represent a form closely related to *Dipus sowerbyi*, originally described by Mr. Oldfield Thomas* from specimens collected by myself in the Yu-lin-fu district on the border of the Ordos Desert, some 500 miles to the south-west of Chih-feng; but since they present differences in cranial and body measurements, as well as a slight variation in colour, and having regard to their geographical distribution, they may be considered as belonging to a distinct species, which, in view of the fact that he was the original collector, I propose to name after Mr. Hall:—

Dipus halli, sp. n.

In size this new species is somewhat larger than *D. sowerbyi*, which in turn was described as being larger than

* Ann. & Mag. Nat. Hist. ser. 8, vol. ii. (Sept. 1908).

D. sagitta and *D. deasyi*, B.-Ham. The type-specimen of *D. halli*, measured in the flesh, was 5" or 127 mm., while the largest specimen of *D. sowerbyi* in the British Museum collection, measured in the flesh, was 117 mm., the type-specimen measuring 116 mm. The tail, as judged from the second of the two specimens, that of the type being imperfect, is about equal to that of *D. sowerbyi*. Other measurements were not made in the flesh, but from a comparison of the dried specimens a noticeable difference appears in the relative lengths of the hind feet, that of *D. halli* being some 5 mm. shorter than in the type-specimen of *D. sowerbyi*. The ear, as far as can be judged, is about the same length in the two forms. In colour and markings *D. halli* may be said to be as in *D. sowerbyi*, except that the general shade of the upper parts is less buffy and more drab; but it must be stated in this connection that one specimen of *D. sowerbyi* in the British Museum collection comes very near to *D. halli* in the drabness of its colour. General colour drab-fawn on the head and back, shading to buff-fawn on the sides; outer surface of thighs rich buffy, as in *D. sowerbyi*; tail in second specimen much worn, but apparently much as in *D. sowerbyi*—i. e., "buffy or pale fawn above, white below; the terminal half-inch white, the blackish band preceding it about three-quarters of an inch in length." The whole of the under surface, together with the fore legs, inner surface of thighs, hind feet below the heel, and rump-streak white.

Skull.—Larger, longer, and with smaller bullæ than in *D. sowerbyi*, the nasals also being distinctly longer and slightly broader. In reference to this last characteristic, it may be stated that the muzzle of *D. sowerbyi* was described as broader than in *D. deasyi*. Otherwise the skull of our new species agrees very much with that of *D. sowerbyi*.

Dimensions of type:—

Head and body 127 mm. (5"); tail (imperfect); hind foot (measured in dried specimen) 60; ear (measured in dried specimen) 18.

Skull: greatest length 37; basilar length 28·2; greatest breadth 24·2; nasals 15; breadth of muzzle 5·9; palatilar length 22; palatal foramina 6 × 3; length of upper tooth-row (molars only) 5·8.

Hab. Chih-feng, N.E. Chihli, N. China.

Type. Adult female. B.M. no. 19. 12. 22. 15. Kept in captivity, died and skinned Dec. 1916. Collected by Mr. A. L. Hall, presented by Mr. J. D. de La Touche. Two specimens.

The two specimens were taken by Mr. Hall some time in

1915, and were given to Mr. La Touche, who kept them alive in captivity till December 1916. Unfortunately confinement somewhat damaged the specimens, their hair becoming unduly worn, especially on the tails and hind feet. Nevertheless, I think there can be no doubt about their representing a distinct species. The area in which they were collected is divided from the Ordos Desert, the home of *Dipus sowerbyi*, by a wide stretch of country occupied more or less by mountains and hills, often of a well-wooded nature, where no form of jerboa exists. The discovery of this form in North-eastern Chihli marks a further eastward extension of the known range of *Dipus* by another 500 miles, and it is possible that it extends even further to the extreme eastern edge of the Mongolian desert, where that country comes into contact with Manchuria.

XXXVIII.—*Descriptions of a new Gecko and a new Snake from Sumatra.* By G. A. BOULENGER, F.R.S.

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A SMALL collection made by Mr. C. J. Brooks, the discoverer of the remarkable Bornean Dycophid frog *Colpoglossus brooksii*, described in these 'Annals' in 1904, in Sumatra between 1912 and 1917, and presented by him to the British Museum, contains examples of the following species, some of which (marked with an asterisk) have not been recorded from Sumatra before:—

BATRACHIANS: *Ichthyophis glutinosus*, L., *Bufo jerboa*, Blgr.*, *Rhacophorus leucomystax*, Gravenh.

REPTILES: *Gecko stentor*, Cant., *Gecko brooksii*, sp. n.*, *Ptychozoon homalocephalum*, Crev., *P. horsfieldii*, Gray*, *Draco obscurus*, Blgr.*, *Mabuia rugifera*, Stöl., *Lygosoma vittigerum*, Blgr.*, *Typhlops nigroalbus*, D. & B., *Xenopeltis unicolor*, Reinw., *Tropidonotus trianguligerus*, Boie, *T. conspiciellatus*, Gthr., *Lycodon albofuscus*, D. & B., *Coluber melanurus*, Schleg., *Dendrophis pictus*, Gm., *Simotes purpurascens*, Schleg., *S. octolineatus*, Schn., *Calamaria alidæ*, sp. n.*, *Naiia tripudians*, var. *leucodira*, Blgr.

The locality is Lebong Tandai in Benkoelen.

Gecko brooksii, sp. n.

Body elongate; head once and three-fourths as long as

broad; ear-opening very small, round; limbs bordered by dermal folds; digits strongly dilated, fully half-webbed. Rostral twice as broad as deep, without median cleft, entering the nostril; three nasals, the upper separated from its fellow by a single small shield; 11 upper labials to below the centre of the eye, first entering the nostril; symphysial smaller than the adjacent labials; no chin-shields, small polygonal flat scales passing gradually into the minute gular granules. Upper parts with uniform flat granules, which are very small on the snout and minute on the back of the head, the body, and the limbs; ventral scales larger, subimbricate. Male with a long uninterrupted series of 40 preanal and femoral pores (21-19). Tail somewhat flattened, with small granules above and larger flat scales beneath, divided into segments and defined on each side by a large triangular projecting scale. Pale greyish brown above, with brown dots crowded together to form five festooned bars across the body; lower parts white.

	mm.
From snout to vent.....	58
" " fore limb.....	19
Head.....	14
Width of head.....	8
Fore limb.....	14
Hind limb.....	19
Tail.....	46

A single male specimen.

Two species with half-webbed toes were previously known—*Gecko palmatus*, Blgr., from the Mau Son Mountains, Tonkin, and *G. rhacophorus*, Blgr., from Mount Kina Balu, Borneo. The former differs in the larger, broader head and the presence of chin-shields and of scattered enlarged tubercles on the back, the latter in the same characters and in the remarkable scalloped membrane along the side of the body and the very different shape of the tail.

Calamaria alidæ, sp. n.

Rostral as deep as broad, the portion visible from above one-half its distance from the frontal, which is longer than broad, twice as broad as the supraocular, and shorter than the parietals; no preocular, one postocular; 5 upper labials, third and fourth entering the eye, the diameter of which nearly equals its distance from the mouth; symphysial in contact with the anterior chin-shields. 13 rows of scales. Ventrals 196; anal entire; subcaudals 23. Tail rounded at

the end. Blackish above, with an orange vertebral streak, one scale in width, broken up into three elongate spots on the anterior part of the body, and a pale greyish brown streak on each side; these streaks becoming less distinct on the posterior part of the body; a yellow spot on each of the scales forming the two outer series on each side; ventrals yellow, with a dark brown spot at each end, these spots forming a lateral streak; lower half of upper labials yellow; a dark brown streak between the two series of subcaudals on the second half of the tail.

Total length 220 mm.; tail 20 mm.

A single specimen.

Near *C. sumatrana*, Edeling, which differs in the presence of a preocular, in the pointed tail, in the lower number of ventral shields, and in the coloration.

Named in memory of the late Mrs. Brooks, who helped her husband in collecting in Sumatra.

XXXIX.—*Two new Asiatic Bats of the Genera Tadarida and Dyacopterus.* By OLDFIELD THOMAS.

(Published by permission of the Trustees of the British Museum.)

THE subjects of the two following descriptions have been recently presented to the National Museum by their respective collectors.

Tadarida latouchei, sp. n.

Allied to *T. teniotis*, but conspicuously smaller.

General characters of *T. teniotis*. Colour above near "clove-brown," the hairs whitish at base, their extreme tips pale drab, forming a prominent light ticking. Under surface scarcely paler, the hairs of chin and throat brown to their tips, those of chest and belly light-tipped like those of the back. Ears in general structure like those of *teniotis*, but smaller; internal basal keel scarcely thickened externally, well fringed with hair; tragus smaller than in *teniotis*, about of the same shape, its antero-internal corner with a well-marked tuft. [This description of the ears, being based on dried skins, will no doubt need revision when spirit-specimens are available.]

Skull very similar in shape to that of *teniotis*, but markedly

smaller; not so flattened as in many of the African species. Small anterior premolar well developed, its cross-section about equalling that of the upper incisor. Lower incisors six in number.

Dimensions of the type (barely adult):—

Forearm 56·5 mm.

Head and body 76; tail 43; ear 23; third finger, metacarpal 53, first phalanx 20·5, second phalanx 18.

Skull: greatest length 21·7; condylo-basal length 21·2; zygomatic breadth 12·2; interorbital breadth 4·2; mastoid breadth 12; palato-sinual length 7·1; front of canine to back of m^3 8, front of p^4 to back of m^2 4·9.

Hab. N.E. Chihli, China. Type from Chin-wang-tao, on the sea-coast.

Type. Young adult male (basilar suture not quite closed). B.M. no. 19.12.22.2. Collected 9th September, 1917, and presented by J. D. La Touche, Esq. Two specimens.

This is by far the greatest north-eastward occurrence of the genus *Tadarida*, the nearest locality recorded being that of the *T. teniotis* obtained by Swinhoe at Amoy. Another specimen of the latter, captured at sea in the Formosa Channel, has also been presented to us by Mr. La Touche.

This species, which I have much pleasure in naming after its discoverer, is readily distinguished from *T. teniotis* by its smaller size, as gauged by its smaller skull and smaller teeth.

The second species is a fruit-bat belonging to the genus *Dyacopterus*, hitherto only known from the type-specimen of *D. spadiceus* of Borneo. The latter was a skin with broken ears, no palate-ridges, and imperfect skull, so that Mr. Brooks's perfect specimen, preserved in spirit, is of special value. It proves to be of a species very closely allied to, but different from, *D. spadiceus*, and may be called

Dyacopterus brooksi, sp. n.

Near *D. spadiceus*, but larger and more uniformly coloured.

Size greater than in *spadiceus*, the skull being larger and bulkier in all dimensions, though the forearm is but little longer. Ears short, narrow, pointed, the anterior margin evenly convex, the posterior nearly straight. Neck-tufts not more developed in the male *brooksi* than it is in the female *spadiceus*, little darker than the yellowish fur surrounding it. Edge of upper lips with prominent warts; pad at tip of lower

lips divided in centre. Palate-ridges numerous, closely set, about 17-19 in number, but irregular, not quite corresponding on the two sides; the posterior half of them divided in the centre by a median groove; their pattern widely different from that of any species of the *Cynopturus* group, or, indeed, any other figured in Anderson's Catalogue, but most resembling—allowing for the wide difference in number—those of *Nyctimene cyclotis* (p. 687), though all are equally bowed, instead of there being one or more straight ones anteriorly.

Colour very like that of *D. spadiceus*, brown above and on the sides, dull whitish on the chest and belly. Yellowish area on shoulders of rather larger extent. But the face is not so markedly blackened.

Skull larger and heavier throughout than in *spadiceus*, the zygomatic spread especially notable. Supraorbital foramina similarly minute.

Canines long and strongly grooved. Posterior basal ledges of all teeth rather less developed than in the allied species. Height of premolars greater.

Dimensions of the type (a spirit-specimen) :—

Forearm 82 mm.

Head and body 118; tail 18; ear 19 × 10; third finger, metacarpal 58, first phalanx 38, second phalanx 47; lower leg and hind foot (c. u.) 48.

Skull: greatest length 40·2; condylo-basal length 37; zygomatic breadth 27·4; orbit to nares 9·2; interorbital breadth 8·6; across postorbital processes 15·7; intertemporal breadth 6·6; mastoid breadth 16; palatal length 20·5; maxillary tooth-row 14·2.

Hab. Lebong Tandai, Upper Ketaun River, about 100 miles north of Bencoolen, Sumatra.

Type. Adult male in alcohol. B.M. no. 20. 1. 15. 1. Collected and presented by Cecil J. Brooks, Esq.

Considering that in the *Cynopturus* group, so far as we know, there is practically no difference in size between the sexes, the greater bulk of the Sumatran *Dyacopterus* appears to necessitate its distinction from the Bornean form. Its browner colour and less blackened head also lead to the same conclusion.

Mr. Brooks is to be congratulated on his discovery of this interesting fruit-bat, the second specimen and first male ever recorded of the genus *Dyacopterus*.

XL.—*New Moths in the Joicey Collection.*

By LOUIS B. PROUT, F.E.S.

Family Arctiidae.

1. *Utetheisa dorsifumata*, sp. n.

♂ ♀.—38–42 mm.

Decidedly larger on an average than *pulchelloides*, Hmps., further differing as follows:—

Head more ochreous (less mixed with white). Abdomen dorsally with strong smoky suffusions.

Fore wing with the black lines macular, but strongly thickened, the spots usually in part confluent; a characteristic longitudinal black white-ringed spot behind the end of M and the base of M¹; red spots more quadrate in form, more completely (though very slenderly) dark-edged; terminal black spots more consistently and uniformly continued across cilia.

Hind wing of ♂ with a black-grey streak (1 or 2 mm. in length) along middle part of the ridge which overhangs the inner-marginal pocket; hair-pencil apparently less developed and whiter; discal mark in both sexes varying in development (strong to obsolescent), perhaps stronger in the ♀ than in the ♂; apical border rather broad; hamate patch with its posterior edge longer than its anterior, produced to a proximal point on or just behind M¹; dark terminal markings between fold and tornus better developed.

Fore wing beneath with the white parts suffused with smoke-colour, except for a clear patch at and sometimes beyond end of cell. Hind wing beneath with the dark markings enlarged.

Angi Lakes, Arfak Mtns., North Dutch New Guinea, 6000 ft., Jan.–Feb. 1914 (A., C., & F. Pratt); 3 ♂ ♂, 3 ♀ ♀.

The increase of black more recalls *salomonis*, Rthschd., and *ruberrima*, Rthschd., but they have both more nearly the ♂ antenna of *pectinata*, Hmps. The group still needs careful revision on extensive material, but the present species is sufficiently outstanding.

Family Hypsiidae.

2. *Nyctemera pellex pervecta*, subsp. n.

♂ ♀.—37–41 mm.

On an average smaller than the other races of *pellex*, Linn.,

but distinguished at once by having the large roundish or oval discal patch of the fore wing prolonged into a band which reaches the costal margin (except for a brown line along the costal margin itself) and also reaches SM^2 , sometimes continuing to the hind margin. This band varies in width and exact shape, but may always be characterized as sinuous-edged proximally, projecting in middle distally, and more or less attenuated posteriorly. Proximal hind-marginal white patch of fore wing reduced or almost wanting, proximal white spot in cell occasionally (as also in other races) minute or obsolete.

Tenimber Islands: Yamdena (*W. J. C. Frost*), type ♂, allotype ♀, and others in coll. Joicey. Also in coll. Tring Museum.

3. *Nystemera albipuncta zoilides*, subsp. n.

♂.—36 mm.

Head and body as in *a. albipuncta*, Druce (P. Z. S. 1888, p. 573).

Fore wing with the subbasal white patch wanting, that in the middle of the wing much reduced, forming a roundish spot of less than 3 mm. diameter, anteriorly reaching middle of cell, posteriorly just crossing M^2 ; all the submarginal spots reduced, the second and fourth thus becoming mere dots.

Hind wing with the black costal border uniform, reaching SC; distal border broadened, the contained white spots somewhat reduced.

Rook Is., Aug. 1913 (*A. S. Meek*). Type in coll. Joicey.

The mimetic resemblance to the Rook Island form of *Tellervo zoilus*, Cram., is rather striking.

4. *Pericopsis tricolor albisarta*, subsp. n.

♀.—74–80 mm.

Fore wing with the oblique pale transverse band and the half-band beyond it both well-developed and very white, only anteriorly and at extreme edges powdered with dark scales, vein M^1 between them scarcely bordered by any dark irroration.

Hind wing with an additional patch of very pale yellow scales at end of cell, of which *t. tricolor*, Sulz. (Gesch. Ins. t. xxii. fig. 5), shows no trace.

Bolivia: Mapiri (type); Prov. del Sara (paratype).

5. *Phalœ isosoma*, sp. n.

♀.—56 mm.

Head black, spotted with white, conspicuous being a more or less triangular white spot at each corner of face, the upper pair the larger; postorbital rim white. Palpus black, somewhat marked with white near base; third joint elongate. Antenna black, the pectinations about as long as diameter of shaft. Thorax above brown-black, anteriorly dotted with white. Abdomen above and beneath white, with narrow dark segmental rings, an ill-defined, interrupted, narrow median dorsal stripe and a rather less narrow lateral one. Legs longitudinally striped black and white.

Fore wing brown-black, not quite opaquely scaled; veins black; a red line or narrow streak from base in front of C, about 8 mm. in length; an oblique pale band from costa before middle running in direction of tornus, but ending at fold, white at costal end, otherwise pale brownish grey, subtranslucent; a subtranslucent (but whiter) subapical patch from SC⁶ to near R³, narrowing posteriorly.

Hind wing with M¹ stalked with R³, as in *patula*, Walk., *trötschi*, Druce, *veronia*, Druce, etc., but not in the genotype; predominantly white, becoming translucent in end of cell and outwards, from R¹ to behind M² (possibly here rubbed, but quite uniform on the two wings); a small slight dark basal patch; a black distal border of about 5 mm. breadth, slightly broader apically and narrower near tornus, its proximal border slightly crenulate, especially in posterior half; a minute white terminal mark between SC² and R¹, extending on to the fringes.

Fore wing beneath with the red costal streak rather broader and brighter, proximally slightly underlined with white on C; median band white; subapical patch nearly as above; a white streak behind cell, interrupted near base and not reaching base of M²; a white terminal spot between the medians. Hind wing beneath white, with the subtranslucent patch as above; veins somewhat blackened, especially C and SC and the space between them prior to their divergence; black border as above, but with the spot between SC² and R¹ rather larger, an abdominal white terminal spot about M² and a very fine white terminal line between fold and SM².

Chanhamayo, E. Peru.

Near *patula*, Walk. (List Lep. Ins. ii. p. 349), distinguished by the red costal streak, the central band of fore wing

more oblique, shadowy, not yellow, border of the hind wing narrower, anal end of abdomen (from seventh somite) not blackened. Perhaps, as in that species, the colour of the hind wing may vary between yellow and white.

6. *Asota talboti*, nom. nov.

Asota intermedia, Joicey and Noakes, Trans. Ent. Soc. Lond. 1915, p. 197, t. xxi. fig. 3 (nec Rthschd.) (Biak).

My attention has been drawn to the fact that the name of *intermedia* is preoccupied in this genus by *Asota plana intermedia*, Rthschd., Nov. Zool. iv. p. 359 (1897). I have therefore pleasure in renaming it after my friend Mr. Talbot, who I understand worked out its distinctions for the authors.

7. *Cerura ejecta*, sp. n.

♂.—40 mm.

Face black. Head whitish. Antennal pectinations dark brown. Thorax and underside of abdomen ochreous whitish, abdomen above mixed white and black (largely abraded). Legs largely whitish, fore leg and tarsi partly darkened.

Fore wing thinly scaled; dirty white, with pinkish reflections; anteriorly (on C or between C and SC¹) with black dots and dash, the latter occupying approximately the second fifth of C; transverse markings (and in posterior part of wing a little irroration) fuscous; antemedian line obsolescent, best developed in cell; orbicular and reniform stigmata white, very ill-defined, finely and incompletely outlined, the former accompanied proximally by a longitudinal blackish-fuscous mark; median line double, slightly dentate outwards on veins, arising from the distal edge of orbicular and proximal edge of reniform, incurved between M² and SM², darker behind M², reaching hind margin well beyond middle; postmedian rather thicker and stronger, more deeply incurved behind M² (consequently here approaching the median), then oblique outwards to hind margin near tornus; traces of a fine and incomplete duplicating line distally to and parallel with postmedian; subterminal line also nearly parallel with these, but formed of interneural wedges (anteriorly), dash (between R² and R⁴) or dots (posteriorly), the dot between R³ and M¹ and two nearly at tornus being large; termen with interneural wedges pointing inwards.

Hind wing white, at abdominal margin smoky; a smoky mark on termen and fringe between M² and SM².

Underside similarly but more weakly marked, only the fore wing with large costal spots.

Key Is., Jan.-March, 1916 (*W. J. C. Frost*).

Excepting the large white species of the *australis* group, in which SC^2 of the fore wing arises from the (rather large) areole, this is the first far-eastern species of the genus known to me. Areole small, SC^2 arising from stalk of SC^{3-5} , as in European and N.-American species. The hind wing has a weak connecting-bar between C and SC, but I believe this is here, as elsewhere, inconstant; SC^2-R^1 well-stalked.

Family Geometridæ.

Subfamily *ÆNOCHROMINÆ*.

8. *Eumelea rosalia marginata*, subsp. n.

♂ ♀.—Differs from *rosalia rosalia*, Stoll (Pap. Exot. iv. t. 368 E, Amboina), in having the apex of the fore wing to a width of about 3 mm. clear yellow without rosy irroration and the entire termen more narrowly yellow, though with some irroration or strigulation; apex of hind wing also narrowly clear yellow. The ♀ is more mixed with yellow than any of the ♂♂, though the latter show variation in this respect.

Soela Is., June, July, September 1918 (*W. J. C. Frost*); 6 ♂♂ (including the type) and 1 ♀ (allotype) in coll. Joicey. Also 2 ♂♂, 2 ♀♀ from Soela Mangoli, Oct.-Nov. 1897 (*W. Doherty*), in coll. Tring Museum.

Stoll's very unsatisfactory figure shows very *narrowly* yellow apices, and the transverse lines obliterated; I have not seen similar examples, though occasional aberrations from Celebes and other localities do show a tendency to become yellow apically, thus foreshadowing the peculiarity which becomes racial in the Soela Islands.

Subfamily *HEMITHEINÆ*.

9. *Pingasa floridivenis*, sp. n.

♀.—49 mm.

Head ochreous, with the upper part of the face black. Palpus with third joint slightly longer than second; greyish ochreous, the first and second joints broadly and the third joint proximally more narrowly white beneath. Thorax above bright ochreous, beneath whitish. Abdomen above whitish irrorated with olive-grey and ochreous, the latter

forming bright but slightly interrupted bands posteriorly on the segments; crests light greyish ochreous; sides of base blackish; underside white. Fore and middle legs largely blackened, the femur and part of tibia remaining white on outer sides; hind leg whiter, but irrorated or clouded with grey.

Fore wing broad; SC^2 wanting (sport?); white, irrorated with olive-grey and very sparsely with black, the proximal and distal areas also with bright ochreous, the veins in these areas broadly, in the median area very slenderly, bright ochreous; an ill-defined blackish band or shade close to base, not reaching costa; antemedian line thick, black, at little beyond one-fourth, very gently curved, at M and SM^2 very slightly dentate inwards; median area more olivaceous costally and with long, not very strong, olive-grey cell-mark; postmedian line black, from beyond two-thirds costa to about three-fifths hind margin, strongly dentate outwards on most of the veins, feebly so on SM^2 , nearest the termen at R^3 and the medians, retracted behind M^2 ; subterminal white line distinct between M^2 and hind margin, running obliquely towards tornus, very faint in the rest of its course; some ill-defined whitish dots to termen.

Hind wing with subbasal shade slight, antemedian line wanting, no ochreous proximal area; hairs of median area bright ochreous; postmedian line finer than on fore wing, otherwise similar; distal area nearly as on fore wing.

Underside dirty white, with rather broad black borders containing large white terminal spots, so that the black only runs to the termen between the radials, around M^2 (in both these places more narrowly on hind wing), and at tornus; base, especially at costa, bright yellow; fore wing with a rather large dark discal mark.

A'koon, Gold Coast, 17th Jan., 1919 (*C. Harrison*).

The first-known African species of the genus to approach in colour *P. venusta*, Warr. The blackish subbasal markings also distinctive.

10. *Gelasma* (?) *triplicifascia*, Prout, ♀.

My type ♂, described in Wytsman's 'Genera Insectorum,' fasc. 129, p. 149 (1912), from a single somewhat damaged ♂ in the British Museum, has hitherto remained unique. A ♀ from Tananarive, recently acquired by Mr. Joicey, is somewhat larger (33 mm.), rather broader-winged, the termen slightly more waved, that of the fore wing a little more convex (compare the sexual difference in *G. spumata*, Warr., and

other allies), otherwise quite similar to the ♂. Its fresher condition allows me to add, however, that the ground-colour is really white with green irroration and the bands grey-green, and that the abdomen has two small brown dorsal spots. The antenna is serrate and the palpus is short, thus aberrant for the genus.

11. *Gelasma versicauda*, sp. n.

♂.—43-47 mm.

Larger than *protrusa*, Butl. Face deeper black (less tinged with red). Palpus with third joint rather shorter, though not quite as short as in *illitirata*, Walk.

Fore wing darker, bluer green; terminal line and dots obsolete; proximal part of fringe less tinged with reddish—dark grey with vaguely darker spots opposite the veins.

Hind wing with tail longer than in *protrusa*, directed rather markedly outward—i. e., with the posterior half of the distal margin (from tornus to tip of tail) comparatively straight; concolorous with fore wing; terminal line fine and weak or almost obsolete; fringe nearly as on fore wing, the proximal dark part rather narrow, the pale distal (whitish ochreous) part ample.

Koshun, Formosa. Type and another in coll. Joicey; also in Coll. Tring Museum from the same locality.

Subfamily GEOMETRINÆ.

12. *Amnemopsyche charmione lufira*, subsp. n.

♂ ♀.—39-41 mm.

On an average smaller than *c. charmione*, Fab., from W. Africa.

Fore wing with the white markings in general reduced, much more shaded with orange, which broadly borders the discal band and almost entirely fills the subapical spot; discal band continued almost to hind margin, confluent proximally with the yellowish hind-marginal streak from base.

Hind wing with the black border continued narrowly along abdominal margin, invaded by a small orange projection from the ground-colour between fold and SM²; orange subterminal spot between R³ and M¹ generally small.

Congo Free State; Lufira River, affluents Kikura and Buluo Rivers, near Likasi Copper Mines, 4000 ft., 28th Feb.—15th April, 1919; 5 ♂ ♂, 1 ♀ (T. A. Barns).

Family *Uraniidæ*.13. *Acropterus parvidentata moluccana*, subsp. n.

♂ ♀.—47–53 mm.

Distinguished from *D. parvidentata*, Warr. (Nov. Zool. iv. p. 199, Lombok and Celebes), as follows:—

Fore wing with the costal edge more weakly and minutely dotted, the dots in general wanting entirely from middle to near apex; particularly noticeable is the great reduction of the apical dots. The double lines from hind margin towards apex generally remaining well separated at the point at which they fade out near apex. Both wings with the markings on an average slightly greyer than in *p. parvidentata*, the terminal line in the typical (Obi) form obsolescent or strongly interrupted, but much better developed in that from the S. Moluccas, which might perhaps be again separated racially.

Obi, July–September, 1918 (*W. J. C. Frost*); 4 ♂♂ (including type) and 1 ♀ in coll. Joicey. Also from Amboina, Ceram, and Gisser Island (near Ceram), in coll. div.

XLI.—*Odonata* collected in Mesopotamia by the late Major R. Brewitt-Taylor, R.A.M.C. By KENNETH J. MORTON, F.E.S.

[Plate XIV.]

JUST after the completion of my notes on "*Odonata* from Mesopotamia" ('Entomologist's Monthly Magazine,' 3rd ser. vol. v. pp. 143–151, 183–196, 1919), Dr. Gahan kindly gave me the welcome opportunity of examining another large collection of these insects from the same region, brought together by the late Major R. Brewitt-Taylor, R.A.M.C., presented to the British Museum by Mrs. Brewitt-Taylor.

Major Brewitt-Taylor was apparently a novice as far as dragon-flies were concerned, but he had taken up the subject with a rare enthusiasm and with some originality, and his notes and descriptions made from the living insects gave promise of better things if he had been spared to continue the work. Preservation of the striking colours of the living insects had evidently been one of his chief aims, and in this he succeeded in quite a marked degree, to this end a large number of his captures having been carefully eviscerated. As a result of this treatment, for example in the case of

Lindenia tetraphylla, quite a different conception of what the insect is like is given when a prepared specimen is compared with the usual dried ones. But for the reason above mentioned the characteristic parts of the second abdominal segment in the male and the valvula vulvæ in the female have not been regarded, and have been sometimes completely removed or obliterated.

In point of number of species, Major Brewitt-Taylor's captures are less extensive than the combined collections previously dealt with, and only one additional species falls to be noticed, namely the wide-spread *Pantala flavescens*, which was rather unexpectedly wanting in the collections of Captain Evans and Captain Buxton. All are from Basra and Amara, the bulk of them being from the former locality, and the time covered comparatively short, the extreme dates being 6th May to 14th August, 1916.

A good series, in excellent preservation as to colour, of the small *Crocothemis*, which I had previously referred to *C. erythræa*, leads me to consider the Mesopotamian insect as distinct from that species, although decidedly belonging to the *C. erythræa* group.

In the following list, to save undue multiplication of dates when the number of examples is large, each month has been divided into three equal parts, only the first and the last date in each part being quoted.

Dr. Gahan, in forwarding the dragon-flies, also communicated Major Brewitt-Taylor's note-book, from which I have made a number of extracts relating to the habits and the colours of the living insects. These are not only of interest and of use, but their preservation in this form may also serve as a small tribute to the memory of the collector.

Ischnura evansi, Morton:

1 ♂, 18. vi.; 2 ♀ ♀, 9-15. v. (Basra).

Apparently not separated by the collector from the following species.

Ischnura bukharensis, Bartenef.

6 ♂ ♂, 8-9-13-26. v., 14. vi.; 9 ♀ ♀, 8-9, 11-13, 25-26. v., 4. vi. (Basra).

Six of the females of the orange form; three without orange, having the lower part of the thorax pruinose, one of them with imperfect black shoulder-stripes.

Stated to be very common on banks of streams, and that both sexes come to light at night.

Lindenia tetraphylla, Lind.

11 ♂♂, 12 ♀♀, 6-9. v., 13-15. v., 25-31. v., 1-5. vi. (Amara).

In life this is evidently a very remarkable-looking and beautiful insect. The long description of the adult male in the 'Mon. des Gomphines,' p. 559, is in some respects a little difficult to follow, and although there may be variation in the extent of the dark markings according to locality, it would appear to have been taken either from an exceptionally dark individual or from one in which the colours had deteriorated. For example, the abdomen is stated to be blackish with obscure yellow markings, while in the diagnosis in the 'Revue des Odonates,' p. 102, the abdomen is described as yellow spotted with black laterally, which seems to be the normal condition. In fully mature specimens, pruinescence tends to obscure the dark brown or blackish markings, especially of the thorax. The male is stated by the collector to be scarcer than the female.

The following is a brief description compiled from the collector's MS. notes on the living insect, combined with his prepared specimens. The female is taken as the model, as his remarks on the male are comparative therewith.

♀. General tint pale greenish marked with orange on the second and part of third abdominal segment.

Vertex greenish, black anteriorly, which colour is continued on the frons, forming a broad line produced slightly in the middle; base of antennæ greenish; occiput yellow; frons (except as above), clypeus, labrum, genæ, and labium shining whitish, mandibles darker shining black at apex. Back of head black, outer lower part, including greater part of the temples, yellowish. Eyes in life shining pale green inclined to bluish towards the lower surface. Pronotum mostly blackish, pale at the sides. Thorax yellowish green, paler beneath, with dark brown or blackish markings; two large median lines, broadest anteriorly, divided only by the median suture, and not quite reaching the anterior margin; antehumeral lines in contact, or almost, with the median, a narrow pale space being thereby enclosed through the curvature of the median; three lateral lines, one on each lateral suture and one between, the first widest in the middle and continued ventrad and caudad towards the middle one, which is interrupted and expands at the stigma, the third continued ventrad to near the hind coxæ. Legs yellowish, femora with a long wedge-shaped black marking above, the middle pair with the trochanters and the femora on their inner surface blackish;

tibiæ and tarsi black, claws reddish with darker tips. Wings: costa yellow, pterostigma yellow bounded by black veins.

Abdomen with dilated basal segments yellowish green; 1st above mainly black from the presence of two large spots, a narrow dark anterior lateral line; 2nd above with two rather broad widely-separated orange bands, darker anteriorly, running along the whole segment (and continued on the 3rd) and at the posterior margin continued ventrad alongside the similarly coloured anterior lateral margin of the 3rd. The general colour of the rest of the abdomen pale greenish or blue-green; 3 to 6 with narrow dark markings at distal end, bearing projections on each side of the dorsal carina and with lateral linear cephalad prolongations thereof of somewhat varied intensity and length—these may be interrupted in the middle of the segment by a vertical streak; 7th with two usually roughly triangular markings at distal end; 8th a large triangular marking covering greater part of dorsum and hardly divided on the carina; 9th somewhat similar; 10th more or less dingy, sometimes definitely brownish; foliaceous expansions of 7th showing darker on distal portion. Appendages yellowish. Under surface of abdomen paler, with a black median line.

♂. General tint darker bluish green. Differs from the ♀ in the following:—Frons more bluish white; occiput usually darker, tending to blackish at the sides. Eyes a little darker. Thorax bluish green. Pterostigma yellowish as a transparency, but becomes grey. Costa pale bluish. Dilated segments of abdomen not yellowish but blue-green like the rest of the abdomen, except under surface, which is paler; the markings on the 2nd and 3rd segments appear to be coloured similarly to those on the other segments and not orange. Appendages blackish.

Anormogomphus kiritshenkoi, Bartenef.

3 ♂♂, 3 ♀♀, 3. viii. (Amara). Appears to have been taken also at Basra, but no specimens are included in the collection.

This curious little Gomphine is of a yellowish-green colour, becoming more decidedly yellow on the last four segments; 7 to 9 are gradually slightly dilated. The eyes in life are stated to be yellow-green slightly darker at the upper poles; when dry they become dark chocolate-brown. The ocelli very conspicuous; dark markings otherwise practically confined to brown streaks on the femora and sometimes on the tibiæ; also usually two mostly quite small dots on the

dorsum of segments 2 to 6 or 7 towards their distal end, with traces of dark lines on the last segment in the male.

Anax parthenope, Selys.

18 ♂♂, 13 ♀♀, 24-31. v., 1-9. vi., 12-20. vi., 22-28. vi. (Basra).

A fine series, of which all the males have the wings suffused more or less with yellowish on the distal two-thirds, some of them clearer at the tips. The females show two forms, those with hyaline wings and the base of the abdomen intensely blue, and others in which the blue generally is absent and replaced by a greenish colour, the wings in this form being tinted with brown of varying degrees of intensity, the brown colour increasing in depth distally and most conspicuous between the nodus and the distal end of the pterostigma but sometimes extending further, the apex, however, being usually clear.

Ris ('Die schweizerischen Libellen,' p. 28, 1885) says that in Switzerland there are two forms of the female: the one (probably younger examples) coloured very like the male, particularly with the base of the abdomen intensely blue, and the wings hyaline; the other (probably comprising examples which have flown longer) is, with the exception of the black markings, uniformly yellow-brown, without blue at the base of the abdomen, and with the wings more or less, often very strongly, tinted with brown. Thus, Ris seems to suggest that these two forms may be phases of the same thing, an explanation that does not appear to have been offered in connection with the blue and the green forms of the female in certain species of *Æschna*. Brewitt-Taylor in his notes evidently considered that there were two forms—one yellowish green with dark wings, another blue with hyaline wings or only with a trace of clouding. In his series none of those with intensely blue base of the abdomen appears to be old, so far favouring Ris's view. However, Brewitt-Taylor states that he had seen coupled pairs in which the respective females were of the blue and the greenish-yellow form, so that the blue appears to be sexually mature. He records that on the evening of the 22nd June he "caught in all four yellow-green females and one blue." These examples, I assume, are now before me, but it is difficult to gauge the extent to which the colours may have been affected by post-mortem changes. None of them can be considered very old; the dark markings on the abdomen are chocolate-brown, not black. The example with hyaline wings has the base of the abdomen bright

blue; of two examples with the wings moderately tinted with brown one gives an impression that it may have been blue, the other is greenish; the other two, the oldest of the five, have the wings more strongly tinted and the colour greenish. Whether we have to do with two different forms or merely with a matter of age I do not venture to decide, but think there are most probably two forms.

With regard to the habits of the species, Brewitt-Taylor writes: "This species is not rare, but is very difficult to catch. I have never seen it settled. It is to be seen in the day flying rapidly in the palm swamps, but does not remain in any one spot. At sundown—about half an hour after sunset—it can best be caught while hawking the little swarms of insects. It then often comes quite low down. Often a dozen or so can be seen together at a height of about 20 feet hawking amongst a group of gnats. This I have seen only at dusk." In a later note he says: "On 24th June I watched a yellow-green female ovipositing at 1.30. She settled on a reed or grass lying on the water and pushed her abdomen down sometimes quite $1\frac{1}{2}$ inches under water. [This explains why the females often have muddy bodies.] The frogs frequently attempted to catch her, but she was far too quick for them. They approached cautiously towards her and snapped at her."

[Re-examination of one of Evans's *Amara* specimens (22. v.), which is evidently very young, clearly shows the beginning of the darker clouding, but it is not possible to say what the colour of the abdomen at the base may have been. When these large insects are at rest, the greenish form one would imagine would be less conspicuous than the blue. Can it be that a less proportion of the latter reach mature age?]

Orthetrum sabina, Drury.

8 ♂♂, 6 ♀♀, 7-11-31, v., 1-10. vi., 13-16. vi. (Basra).

I may take occasion to refer again to this species when dealing with Odonata received from Captain Buxton, taken by him in N.W. Persia.

Orthetrum trinacria, Selys.

2 ♂♂, 1 ♀, 5. vii. (Amara).

Crocothemis erythræa chaldæorum, subsp. n.

Crocothemis erythræa, Morton, E. M. M., 3rd ser. vol. v. p. 186 (1919).

5 ♂♂, 7 ♀♀, 2-15. vi. (Basra) (*Brewitt-Taylor*).

1 ♂, 28. iv. 1918; 2 ♀ ♀, 23. iii., 15. v. 1918 (Amara);
1 ♂, 7 ♀ ♀, 26-29. iii. 1919 (Basra) (Evans).

Like a small *C. erythraea*, but with the venation opener, and except at the extreme base almost entirely black; ante-humeral lines and pale inter-alar line not noticeable in the material examined; no trace of yellow in the fore-wings; basal patch in hind wings small, sometimes traces of yellow in the basal cellule between Sc and R + M, yellow not extending beyond Cu₁ and the inner boundary of anal loop and hardly to the anal angle. In discoidal field of fore-wings usually only two rows of cells near the triangle: in four males and females, cells between M⁴ and Cu¹

♂ ♂.	$\frac{22222}{22222}$	·	$\frac{22223}{22222}$	·	$\frac{22223}{22223}$	(Basra),	$\frac{32223}{32223}$	(Amara).
♀ ♀.	$\frac{32333}{32233}$	·	$\frac{22223}{22223}$	·	$\frac{32223}{32223}$		$\frac{22233}{22233}$	

Anq. ♂ ♂, $7\frac{1}{2}$ · $7\frac{1}{2}$ - $7\frac{1}{2}$ · 8 - $8\frac{1}{2}$ · $8\frac{1}{2}$, $8\frac{1}{2}$ · $8\frac{1}{2}$.

♀ ♀, $7\frac{1}{2}$ · 8 - 7 · $7\frac{1}{2}$ - $8\frac{1}{2}$ · $8\frac{1}{2}$, $7\frac{1}{2}$ · $7\frac{1}{2}$.

Pterostigma $2\frac{1}{2}$ -3 mm. Length of hind wing about 25 ♂, 26 mm. ♀.

The following remarks on the colours are mainly from Brewitt-Taylor's notes on the living insects:—

♂ (adult). Eyes: upper two-thirds cherry-red, blue below. Face brick-red; mandibles dirty yellow. Thorax olive-brown, legs concolorous. Abdomen above glowing cherry-red; segments 8-9 on the dorsal carina with black markings which are broadest posteriorly; appendages brick-red, paler at the tips; ventral surface dirty reddish yellow with black median line.

♀ (juv.). Eyes above red-brown, lower part bluish; face pinkish, mandibles white. Thorax pale brown above, whitish beneath. Abdomen pinkish brown with fine black carina, markings above-mentioned distinct on 8-9; segments finely margined with black lines and a small black dot on each side of dorsal carina on posterior part of 4-7; segment 10 and appendages pinkish brown, underside pale pink with black median line.

(B.-T. adds that the ♀ does not differ much from the ♂, but is perhaps a little more salmon-pink in colour. There seems, however, to have been some confusion with regard to the sex of some of his younger specimens.)

♀ (more adult). Eyes: upper half dark red-brown, lower part bluish. Face brownish, lower part whitish; thorax olivaceous, sides bluish (?slightly pruinose); abdomen above

olive-brown, each segment with a lateral salmon-tinted sub-crescentic portion.

B.-T. writes, June 10th: "This species is becoming common. More restless than the other brown dragon-fly and does not take possession of a definite perch. Some males are browner red than the typical glowing red, which is most beautiful. Rather wary and flits from grass to grass by the side of water." The brown dragon-fly alluded to appears to refer to a condition of *Trithemis annulata*.

Crocothemis servilia, Brullé.

24 ♂♂, 11 ♀♀, 7 v., 14-17 v., 25 v., 1-10 vi. (Basra).

The shoulder-stripe has only become faint in a few of the most mature examples.

In attempting to arrive at a more satisfactory understanding regarding the distinctive characters of these species of *Crocothemis*, a partial study of the genitalia of the second abdominal segment of the male has been made by removing the parts from a number of specimens and mounting them in balsam. The results may be briefly summed up as follows:—

(1) The preparations confirm the accepted view that the outer branch of the hamule is more pointed in *C. erythræa* than in *C. servilia*, in which it is more truncate. These flat preparations, however, do not give an altogether satisfactory idea of the form of the branch, the position being not quite a natural one. The shape is better understood when the hamule is viewed from the side.

(2) The apex of the inner branch of the hamule appears to be different in the two species. In the Madagascar preparation of *C. erythræa* (Pl. XIV. fig. 3) the extreme apex is seen to be slightly notched with a strong subapical tooth. After examination of a number of dried specimens of *C. erythræa* from widely separated localities, I can say positively that in these the toothed or bifid condition is invariably present, and it is interesting to mention that an example from Cherrapunji in my collection included by Ris (Coll. Selys, p. 540) under *C. servilia* as transitional towards *C. erythræa* is, in respect of the hamule, true *C. erythræa*. The evidence regarding *C. servilia* should perhaps be stated in a more negative form. In none of the examples of *C. servilia* examined have I been able to confirm the existence of any tooth, the apex apparently being always simple. These critical characters are, however, somewhat elusive, and unless the hamule is in exactly the right position the tooth may be overlooked. In the preparation from which fig. 1 (Pl. XIV.)

was taken the tooth was distinctly visible before the cover-glass was put on the slide, but the slight pressure altered the position, throwing the tooth nearly out of view or leaving visible only a minute elevation which in reproduction may be quite lost. The character seems to be good, but it would not be surprising if in two such closely-allied species it sometimes failed as an absolute test by itself. The hamules sometimes require to be freed from adhering matter before examination.

(3) The apex of the penis in the preparations is different in the two species (see Pl. XIV. figs. 1 & 4). In dried specimens this part is not always easy to examine. Preparations of *C. erythræa* from Arles, Madagascar, and Mesopotamia, and of *C. servilia* from Mesopotamia and Bengal serve to confirm.

Sympetrum decoloratum, Selys.

2 ♂♂, 2 ♀♀, 8. v., 25. v., 9. vi. (Basra).

All more or less immature, and, as the collector records nothing regarding habits, probably casual captures. The following short descriptions are based mainly on his notes:—

♂. Eyes: upper half brown-red, lower greenish. Vertex, frons, clypeus, and genæ bluish white, a small black spot in front of median ocellus and also blackish about lateral ocelli and antennæ; labrum and labium white. Thorax pale greenish yellow, more pallid beneath with brown antehumeral streaks, brownish at extreme anterior margin and with small brown marking on either side of median suture next to the brownish edging; lateral sutures very slightly black. Legs yellow; femora and tibiæ with a black line, tarsi annulated with black. Pterostigma dirty whitish. Abdomen: dorsum yellowish orange, darker orange on the carina and slightly darker on the posterior end of each segment, with faint indication of a dot on either side; traces of lateral lines slight (see ♀); underside paler, with black median line.

♀. Eyes: upper half very pale brownish, lower bluish green. Head and thorax very similar to ♂. Abdomen: dorsum dark yellow, carina dark orange; sides greenish fading into the dorsal yellow. Lateral blackish streaks on each segment broadest and most complete on 3, gradually diminishing in extent on the following segments; lateral carina, especially of anterior segments, finely black; dorsal carina of 2-3 distinctly blackish, also a black line at the junction of 1-2; narrowly marked with black on each side of dorsal carina of 8-9.

Sympetrum fonscolombei, Selys.

1 ♀, Amara, 12. viii.

Brachythemis fuscopalliata, Selys.

15 ♂♂, 10 ♀♀, 6-9. v., 12-17. v., 25-31. v., 2-4. vi., 13-21. vi., 14. vii. (Basra); 4 ♂♂, 4-8. vii. (Amara).

Fully adult males from Basra May 6th to June 20th, a few examples which have not attained full coloration May 7th to June 21st. None of the Amara specimens are fully coloured, that of July 8th being apparently the youngest in the collection. All the males included show the dark wing-marking in some degree. In its beginning it seems normally to be most concentrated on the middle of the wings, forming somewhat of a brownish transverse band extending to beyond the nodus, darkest on its outer edge; the dark colour appears to grow more rapidly to the base of the hind wings than of the fore wings, gradually increasing in intensity in both and finally reaching in the latter to the costal field, which may be only partially coloured in quite adult individuals. After the colour has become fairly mature at the base of the fore wings, the body-markings become gradually obliterated and have entirely disappeared by the time the full adult wing-coloration is reached.

From Brewitt-Taylor's notes: "21. vi. 16: I have noticed that both males and females of this species are smaller now than they used to be in April. . . ."

"Species found only on banks of streams and stagnant waters. Males very active towards evening when they flit about and hover over the streams. Flight very rapid, and difficult to catch. . . ."

"The male seems to hover over the female while latter is ovipositing and keeps off other males. Female oviposits by hovering over reed ['floating object'—these words deleted] and continually touching it with the tail.

"At dusk male and female sometimes leave vicinity of water and hover about ground in open spaces.

"Females easily caught settled on grass on margin of stream.

"During heat of day males perch on branch of tree or on grass on edge of stream and are easily taken. When perched the tail is held up at an angle, and the wings slightly above the horizontal.

"Arrived at Amara on July 2nd. Here the common form of the male has a distinctly brown-speckled abdomen and only slightly clouded wings. Very black specimens occur, but are uncommon; the females are as at Basra. The habits are distinctly different, however, and here the species is very common and easy to catch as they fly about the grass. They frequently shelter in our tent."

As mentioned above, Brewitt-Taylor's Amara specimens are not fully mature, and his remarks point to an emergence of the species having recently taken place there.

Trithemis annulata, Beauvais.

23 ♂♂, 18 ♀♀, 6-8. v., 13-19. v., 25-26. v., 2-9. vi. (Basra).

The collector refers to the abdomen of the ♂ in different specimens as brownish red, crimson-red, yellowish purple, purple-red, and plum-coloured, and of the ♀ as yellowish, greenish yellow, and brownish red, these variations no doubt marking different stages of maturity. In some of the females the amber colouring of the wing-base is continued to the nodus in the anterior part of the hind wings, and the apex of the wings is sometimes tinted.

"The insects sit on palm-leaves, the wings drooped downwards and forwards, the abdomen being slightly raised, and they are very quick."

Pantala flavescens, Fabr.

1 ♂, 1 ♀, 14. viii. (Amara).

Selysiothemis nigra, Lind.

25 ♂♂, 20 ♀♀, 7. v., 13-16. v., 25-27. v., 1-9. vi. (Basra).

"This species occurred abundantly for about three or four days (May 14th to 17th). I think it was the same species which similarly suddenly appeared in large numbers on April 20th. It was more numerous than the swarms on 14th-17th. The species does not frequent waterways, but is found in open spaces, settling on stunted grass. It occasionally comes to light. June 8th: Very abundant. There is great variation in the amount of black. Males generally darker, and all blue-black specimens are males. June 10th: The species has practically disappeared again; has lasted from 4th to 10th." (*Brewitt-Taylor*.)

EXPLANATION OF PLATE XIV.

- Fig. 1.* *C. erythræa chaldæorum* (Basra, Evans). As explained above, the tooth is present, but was thrown out of view by pressure.
Fig. 2. The same (Basra, Brewitt-Taylor). Hamule only. To bring out the tooth clearly the hamule was tilted in the preparation, with the result that the base was thrown out of focus.
Fig. 3. *C. erythræa* (Madagascar). Hamules only. The left-hand one in the preparation shows the tooth very clearly.
Fig. 4. *C. servilia* (Bengal).

(I am indebted to Mr. Martin E. Mosely for the excellent photographs of the preparations, and also for his expert assistance in remounting the hamule shown in fig. 2.)

XLII.—*Four new Squirrels of the Genus Tamiops.*

By OLDFIELD THOMAS.

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AMONG some mammals collected in Yunnan by Mr. George Forrest, and presented to the British Museum by Col. Stephenson Clarke, C.B., there occur examples of two species of *Tamiops*, both distinct from any as yet described. In working these out, two other species of the genus, one also from Yunnan and the other from S.E. Siam, prove to need description. The first of Mr. Forrest's two species is one of the handsomest of the genus, as it combines the greater size of *T. swinhoei* with the brightly contrasted coloration of some of the smaller species. It may be called

Tamiops clarkei, sp. n.

Size large, practically as in *T. swinhoei*, therefore conspicuously larger than in any of the other species, which are all more or less subequal in this respect. Coloration brightly contrasted, very different from the dull tones of *swinhoei*. Ground-colour of crown, nape, and fore-back pale buffy olivaceous, paler than Ridgway's "buffy olive." Median dark stripe not commencing anterior to the lateral ones, all three deep black, sharply defined. Inner light lines olivaceous buffy, paler than the fore-back. Outer light lines quite white, broad and conspicuous, ending anteriorly level with the median dark stripe, not continuous with the subocular light stripe. Outer black stripe fairly well developed. Under surface white, not yellowish—in fact, whiter than in any other species known to me; the hairs of the chin white to their roots, those of belly with slaty bases. Head with the usual markings strongly developed, the main light subocular stripe broad, white, and shown up by a darkening of the edge of the ground-colour above it. Eyelids white. Ears not heavily tufted, their edges white, their backs black, the hairs behind the tips with white ends. Hands and feet greyish buffy, becoming lighter terminally. Tail rather slender, the hairs about 13 mm. in length, each buffy at base, then black, broadly tipped with whitish.

Skull nearly agreeing in size with that of *T. swinhoei*.

Dimensions of the type (measured on the remade skin):—

Head and body (c.) 154 mm.; tail 112; hind foot 32.

Skull: tip of nasal to front of interparietal 36; basilar

suture to gnathion 27; zygomatic breadth 23.7; nasals 12.2×5.2 ; interorbital breadth 13.5; breadth of brain-case 18.7; palatilar length 15.5; upper tooth-series, exclusive of p^3 , 6.6; upper molars only 5.

Hab. Northern Yunnan, in the Yang-tse Valley, at $27^{\circ} 20'$ N., and about 101° E. Alt. 8000'.

Type. Adult, but not old, male. B.M. no. 20. 1. 16. 6. Original number 9. Collected September 1918 by George Forrest. Presented by Col. Stephenson Clarke. Three specimens, two adult and one young.

As shown by a representative specimen received from the Paris Museum the *T. swinhoei* of Moupin is a far larger animal than any of the other species as yet described. Now this handsome *T. clarkei* turns up, equalling *T. swinhoei* in size, but widely different from it in its conspicuously contrasted coloration, paler general tone; and white belly. No other species appears to need comparison with the new form.

Tamiops maritimus forresti, subsp. n.

Very similar to the form to which Bonhote* applied the name "*Sciurus maccllelandi swinhoei*, M.-Edw.," the medium-sized strongly striped *Tamiops* of South-eastern China. But in the first place there is no doubt that the Chinese forms, with interrupted subocular stripe, should be separated specifically from *maccllelandii*, so that that name disappears, and, secondly, it has since proved that the true *swinhoei* is the much larger species of Sze-chuen, equalling in size *T. clarkei*, and hence the smaller species is certainly not *swinhoei*.

But it has also been found out that in this genus, at least in some of its forms, the blackness of the subdorsal dark stripes is not valid as a specific character, being a seasonal one, though not occurring in every individual. The same phenomenon is also found in certain forms of *Funambulus*.

In consequence, the two Chinese subspecies called by Bonhote "*S. maccllelandi maritimus*" and "*S. maccllelandi monticolus*" should apparently bear the names of *Tamiops maritimus maritimus* and *T. maritimus monticolus* respectively, while his *swinhoei* is the black-striped phase of the latter.

On this basis I may describe Mr. Forrest's Yunnan specimens as follows:—

Like *T. maritimus monticolus* when with three well-marked

* "On Squirrels of the *Sciurus maccllelandi* Group," Ann. & Mag. Nat. Hist. (7) v. p. 50 (1900).

black dorsal lines, these lines being probably absent at the opposite season. General tones of colour similar throughout, but the under surface white instead of pale buffy. Subocular stripe also white, scarcely more buffy anteriorly; in *monticolus* it is pale buffy behind, strongly buffy in front. Tips of tail-hairs whiter and less buffy, also rather longer, making the tail more bushy.

Median black line running from the nape to the base of the tail. Lateral light stripes strong and prominent, buffy whitish.

Skull as in *monticolus*.

Dimensions of the type (measured on skin):—

Head and body 127 mm.; tail (c.) 100; hind foot 30.

Skull: condylo-incisive length 31·5; zygomatic breadth 21·5; nasals 10·5; interorbital breadth 12·5; breadth of brain-case 17·6; palatilar length 14; upper tooth-row exclusive of p^3 6; molars only 4·3.

Hab. Yunnan. Type from the Lichiang Range, at 27° 20' N. Alt. 11,000'.

Type. Old male. B.M. no. 20. 1. 16. 4. Original number 1. Collected July 1918 by Mr. George Forrest. Presented by Col. Stephenson R. Clarke. Two specimens.

From any of the forms of *Tamiops* found further west this *Tamiops* is distinguished by the complete interruption between the subocular and light lateral dorsal lines, this interruption being a characteristic of the Chinese members of the genus.

Tamiops inconstans, sp. n.

A small species with dull upper surface and bright yellow belly.

Size among the smallest of the genus. General colour greyish olivaceous, the markings less conspicuous than in any species known to me. Fore-back and the strip internal to the lateral light lines, where the subdorsal dark lines usually are, practically concolor, pale greyish olivaceous, the median dark line broad but little darker than the general dorsal colour, and margined on each side with inconspicuous buffy bands. Outer light bands the only ones which are really distinct, and these only short and narrow, not reaching the subocular lines; buffy whitish. Crown rather more buffy than back. Orbital rings and subocular stripe strong buffy. Hairs of ear as usual black, but those of the chief tuft on the back of the ear are not only white at tip, but white to their bases.

Under surface, in marked contrast to the inconspicuously

coloured upper surface, bright buffy from chin to anus, the colour as bright as in *T. barbei*, though rather less ochraceous. Upper surface of feet grizzled buffy. Tail slender, its hairs about 10 mm. in length, their tips white, not buffy.

Dimensions of the type (measured on skin):—

Head and body 114 mm.; tail 103; hind foot 26.

Skull: greatest length 33; condylo-incisive length 29; zygomatic breadth 19.4; nasals 8.8; interorbital breadth 11.6; palatilar length 13.6; upper tooth-series exclusive of p^3 5.1; molars only 3.7.

Hab. Southern Yunnan.

Type. Old male. B.M. no. 12. 7. 25. 31. Original number 22. Collected 31st January, 1910, by H. Orii. Purchased of K. Kobayashi. Two specimens.

This very distinct little squirrel is characterized by its unusually inconspicuous striping above and by the strong yellowish buffy of its lower surface—in fact, it is above one of the dullest and below one of the brightest of the genus. It does not appear to be nearly related to any described species.

Tamiops lylei, sp. n.

Near *T. barbei*; greyer on sides, more buffy on nape.

Size about as in *barbei*. General appearance of light lines rather uniform, the inner and outer subequal in intensity. Subocular and external light lateral lines continuous over shoulder, as in *barbei*, differing in this respect from *T. rodolphei*, in which the lines are interrupted. Median dark line, as in *rodolphei*, with a narrow thread of pale brownish along its centre, so that, as a dark line, it is not truly and literally "median"; the present species and *rodolphei* are the only members of the genus in which this character is found. Crown and fore-back "tawny-olive" or dark "clay-colour," a ready distinction from *barbei* and *leucotis*; behind this colour darkens into the outer dark lines of back, but is not known to occur truly black. Inner light lines strong buffy, outer whitish buffy. Outside them an inconspicuous dark edging. Sides and hips pale olive-grey ("light greyish olive") which is continued down to the ankle. Under surface ochraceous buffy, richest on the chest, more grey-mixed on the belly. Proectote of ear black, with a well-developed white tuft at tip, the hairs of the latter white nearly or quite to their bases. Hands and feet grizzled buffy. Tail slender, the tips of the hairs white.

Skull as usual.

Dimensions of the type (measured in flesh):—

Head and body 105 mm.; tail 114; hind foot 28; ear 14.

Skull: greatest length (c.) 31; zygomatic breadth 19·6; interorbital breadth 11·8; palatilar length 12·3; upper tooth-row without p^3 5·4; molars only 3·8.

Hab. S.E. Siam. Type from the sea-coast 50 miles south of Bangkok; another specimen from Lem Ngop (*C. B. Kloss*).

Type. Young adult male. B.M. no. 6. 10. 7. 9. Original number 211. Collected 5th August, 1906, and presented by Th. H. Lyle, Esq. Three specimens in all.

This *Tamiops* is more or less intermediate between *T. rodolphei* of Cochin China and Annam and *T. barbei* of Tenasserim. From the former it differs by its external light line being continuous with the subocular line, by the dorsal lineation running further forward, and by its less warm ground-colour. From the latter by the central division of the "median" dark line, by the more buffy fore-back, by the much paler grey of the flanks, hips, and legs, and by the more equal prominence of the outer and inner pale dorsal lines.

XLIII.—*The Subspecies of Paraxerus flavivittis, Peters.*

By MARTIN A. C. HINTON.

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WHEN describing his *Paraxerus flavivittis mossambicus* last July * Mr. Thomas was not aware of the fact that Mr. Lovelidge had collected ten other examples besides the type at Lumbo, Portuguese East Africa. This additional material, which we owe to the generosity of Lord Swaythling, has now arrived in the British Museum. It was all collected on a single day nearly two months earlier than the date on which the type-specimen was captured, and it forms a very beautiful and instructive series, well worthy of somewhat detailed notice.

The new specimens show most clearly that, as in many other Sciuridæ, the coloration in *P. flavivittis* is subject in each individual to periodical changes of a complex character. At one stage these squirrels have dark grey backs associated

* Ann. & Mag. Nat. Hist. (9) iv. p. 31 (1919).

with pure white lateral stripes; but when this dark pelage is worn out it is replaced by another in which the hairs have bright ochraceous tips, the general dorsal colour being brightened to a golden or fulvous hue. In this bright coat the ochraceous pigment invades or infects the lateral white stripe to a greater or less extent. The type of *P. f. mosambicus* may be cited as a perfect example of the dark phase, while the subject of the figure of *P. flavivittis* given by Peters* is no less definitely illustrative of the bright coat.

The material now before me indicates that in *P. f. mosambicus* the outer surfaces of the fore limbs are at all times ochraceous. The account of the type given by Thomas is an excellent description of the dark phase; but even in the type, with the aid of the new material, the beginnings of the changes leading to the bright coat may be recognized. The ochraceous tint of the fore limbs gradually becomes more intense, and, creeping upwards over the shoulders and withers, it forms a bright-hued mantle covering part of the neck and the thoracic region of the back. As the mantle is perfected, the ochraceous tint invades the foremost part of each lateral stripe. The ochraceous grizzle noted by Thomas on the top of the muzzle in the type becomes also more evident as the change proceeds; this grizzle gradually extends upwards and backwards until the whole top of the head acquires an ochraceous hue; but the region between the ears and the nape remains grey long after other parts of the dorsal surface have become ochraceous. From the posterior edge of the perfected thoracic mantle ochraceous-tipped hairs are gradually developed backwards over the lumbar region and the rump, until finally the whole mid-dorsum, the deep-tinted band (which on each side intervenes between the lateral dorsal stripe and the flank), the flanks, and the outer surfaces of the thighs become fulvous—the tint, however, continuing to be brightest in the region covered by the mantle. The occipital patch and the lighter grey flank-areas are the last regions affected by the change.

The tail-hairs appear to be subject to similar changes, but far more extensive material is required before this part of the subject can be elucidated. The type in full grey pelage has the ventral surface of the tail strongly ochraceous; this is true also of nos. 80, 81, and 82 in the bright coat. Other specimens, as nos. 87, 88, and 89, with coats in an intermediate condition, have the lower surface of the tail grey, but on parting the ventral hairs many deeply hidden ochraceous hairs are revealed.

* 'Reise nach Mossambique,' 1852, i. Taf. xxix.

In the following table the Lumbo specimens are arranged in what, judging by the teeth, appears to be the order of individual age, commencing with the youngest. Specimens marked "G" or "B" are in grey or bright coats respectively; the unmarked items are in intermediate stages of coloration:—

Sex.	No.	Date.	Head and body.	Tail.	Hind foot.	Ear.	Condylar-incisive length.	Dentition.
	86	July 10, 1918	157	160	40	15	34.2	<u>mp. 4</u> still in use.
	88	" " "	145	140	35	15	35.8	Do.
B	85	" " "	160	170	40	20	35.8	<u>p. 4</u> not quite in place.
	87	" " "	150	145	37	18	36.7	<u>p. 4</u> slightly worn.
	89	" " "	138	138	37	16	31.8	Do.
B	80	" " "	176	160	40	15	37.3	Do.
G	202	Sept. 4, "	175	175	40	18	36.7	Do.
B	81	July 10, "	175	170	35	15	36.8	<u>p. 4</u> moderately worn.
G	84	" " "	165	..	40	..	36.1	<u>p. 4</u> about half-worn.
G	83	" " "	170	170	40	18	35.6	Do.
B	82	" " "	175	..	40	17	..	<u>p. 4</u> much worn.

From this table it appears that the gradual change of colour described is not connected merely with differences of individual age. It seems also improbable that the change is a purely seasonal one. One may suspect, perhaps, that in this species each individual is subject to a constantly recurring cycle of colour-change, the incidence of which cycle depends rather upon the physiological condition of the individual than upon any general or extrinsic factor.

P. f. mossambicus is certainly very closely related to, if it be not identical with, true *flavivittis*. Thomas mentions that the nasals of his type are considerably broader behind than in the skull of *flavivittis* figured by Peters; this difference, although visible in some of the newly-arrived specimens from Lumbo, does not appear to be constant. In the bright phase of coloration *mossambicus* now seems to differ from *flavivittis* merely by having the posterior half of each lateral dorsal stripe white instead of yellow; but, having regard to the difference in locality, this fact will perhaps justify us in retaining *mossambicus* as a distinct subspecies pending the arrival of specimens from Mossimboa.

In another way the fine series from Lumbo is of great utility, since it enables us to appreciate the constancy of certain features in the pattern (apart from colour) of the coat. Peters's figure shows an animal with very definite facial markings in the region between and below the eye and the ear, and with a single light-coloured, very broad, long, and well-defined stripe bordering the back on each side. These features are faithfully reproduced in each of the Lumbo specimens, and there is no reason to doubt that they are essential and characteristic elements of the coat-pattern in both *P. f. flavivittis* and *P. f. mossambicus*. In other species of *Paraxerus*, as now understood, the facial markings are quite inconspicuous or absent, while the lateral dorsal stripe on each side is reduced to such a degree that it is almost imperceptible.

Two specimens in the British Museum come from localities considerably to the north of Lumbo (15° S.) and Mossimboa (11° S.), one coming from Kilwa Kisiwani (9° S.), the other from Mombasa (4° S.). Differing from each other, as well as from true *flavivittis* and *f. mossambicus*, the northern specimens appear to represent two subspecies of *flavivittis*, interesting both as members of a continuous series of geographical races and as subspecies which tend to lessen the gap between true *flavivittis* and more normal species of *Paraxerus*. They may be described as follows:—

Paraxerus flavivittis exgeanus, subsp. n.

Hab.—Kilwa Kisiwani, ex-German East Africa.

Type.—An adult male in bright pelage (B.M. 19. 4. 14. 3), collected March 8, 1918, and presented to the British Museum by Major C. H. B. Grant.

This form differs from both the southern subspecies by having the lateral dorsal stripe on each side much narrower and the thoracic ochraceous mantle much less developed.

Upper surface (top of head and the whole back to root of tail) clothed with a fine grizzle of black or dark brown and dull ochraceous, the general effect being, in the lumbar region, near mummy-brown. On the top of the muzzle and towards the root of the tail the ochraceous hair-tips are more abundant, sensibly brightening the general colour; in the neighbourhood of the shoulders and withers they are still more extensively developed, producing a perfectly distinct though not a conspicuous dorsal mantle. The lateral stripe on each side of the back is much narrower and somewhat shorter than in *mossambicus*; where broadest it measures no more than 5 mm., instead of 9 or 10 mm. as in the southern form; the colour of the stripe is white posteriorly, faintly

tinged with yellow anteriorly. Outer surfaces of limbs, particularly of the fore limbs, greyer and less ochraceous than in the southern forms. Inner surfaces of limbs and the underparts pure white. Dorsal surfaces of feet dull ochraceous buff. Tail normal, many ochraceous hairs appearing on ventral surface; the terminal hairs rufous.

Collector's measurements.—Head and body 161 mm.; tail 120; hind foot 36; ear 18.

Skull: condylo-incisive length 36 mm. (ca.); dental length 18.5; zygomatic breadth 23; cranial width 19.1; upper cheek-teeth (crowns) 7.6; $\underline{p.4}$ in place, about half-worn.

Paraxerus flavivittis ibeanus, subsp. n.

Hab.—Mombasa, British East Africa.

Type.—A skin (B.M. 80.11.30.6) collected and presented to the British Museum by Dr. (afterwards Sir. J.) Kirk.

Size and general characters as in other subspecies of *flavivittis*.

General dorsal colour strong fulvous ochraceous, somewhat lighter, yellower, and less rich over shoulders and rump. Shoulder-mantle quite inconspicuous, represented merely by the lightening in the general hue just mentioned. Lateral dorsal stripe pale yellow, somewhat broader than in *exgeanus*, but still shorter; the band between the light stripe and the grey flank on each side concolor with mid-dorsum, narrow. Facial markings inconspicuous. Upper surfaces of hands and feet buff; underparts white. Tail normal.

XLIV.—*Three new Subspecies of Spalax monticola.*

By MARTIN A. C. HINTON.

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LIKE other strictly fossorial mammals, mole-rats of the genus *Spalax* show a well-marked tendency to develop local races characterized by more or less obvious differences. No doubt, that form of segregation which must result from a very limited area of individual distribution and local differences in soil and food are to be looked upon as constituting together the mainspring of this variability. The differences between race and race in such cases are apt to be very small and trivial; but, nevertheless, they show frequently a remarkable constancy in their occurrence.

Though in some ways paralleled in its variation by such genera as *Ctenomys* and *Tachyoryctes*, *Spalax* is peculiar in showing in nearly all forms a monotonous uniformity of external appearance. With the material now available no satisfactory outward difference can be detected between the various subspecies of *S. monticola* described or mentioned below; and, since much of the material before me is unaccompanied by collector's measurements, further reference to the pelage may be omitted. The differential characters are to be sought in the skulls and deep down in the alveoli of the cheek-teeth. They require a great deal of patient work for their discovery and elucidation; and we are above all indebted to Professor M  hely for the provision of such a wide basis for further work upon this most difficult genus as is afforded by his monograph.

Of his section *Mesospalax* M  hely recognizes two species, viz., *S. monticola* and *S. hungaricus*. In *monticola* $\overline{m.3}$ has two re-entrant enamel folds, one from the labial and one from the lingual side, in young stages of wear; while in *hungaricus* only the labial fold is present. When, therefore, in adult stages of wear, the folds are converted into enamel islands, which are long persistent, two are present upon the surface of $\overline{m.3}$ in *monticola*, but one only in *hungaricus*. The three new forms described below agree in this matter with *monticola*, of which, accordingly, they are treated as subspecies.

1. *Spalax monticola thermaicus*, subsp. n.

Hab.—The neighbourhood of Salonica.

Type.—An adult male (B.M. 17. 11. 19. 1; skull, no skin) from the west bank of the Struma River, 12 miles south of Serres; collected and presented to the British Museum by Captain H. S. Hollis, R.A.M.C.

Material examined.—Six, represented by five skulls and three skins; of the skulls two are old, one adult, and two young, one of the latter being in fragments.

Description.—This is a medium-sized subspecies with a skull which agrees in most respects with that of *S. m. turcicus*, M  hely. *S. m. thermaicus* differs from *turcicus* chiefly by the more reduced condition of its molar roots, and to a slighter degree by some features of the molar crowns as well as by some peculiarities of the skull and mandible.

Skull.—A detailed comparison of the skull with the careful description of *turcicus* given by M  hely (*op. cit.* p. 115) shows that the skull of *thermaicus* differs in only two respects from that of *turcicus*. In *thermaicus* at all ages the parietals are

longer and narrower than in *turcicus*, and the palate does not extend quite so far backwards. The parietals in *thermaicus* have a posterior breadth of 13 mm. in the young and 10 mm. in the old skulls; in the young the length of each parietal exceeds the lambdoid breadth by one-fourth, in the old by one-third. In *turcicus* the posterior parietal breadth ranges in adults between 11.2 and 13.2 mm., and each parietal is only slightly longer than its lambdoid breadth. The palate of *thermaicus* usually does not reach and never extends behind a line connecting the hinder edges of the alveoli of the last molars; in *turcicus* the termination of the palate is always distinctly behind that line. The posterior median spine of the palate ("kräftig entwickelt" in young *turcicus*, reduced to a "stumpfe Ecke" in adults) is represented at all ages in *thermaicus* by a minute process of each palatine bone, the pair being separated by a small median cleft. In all other respects Méhely's description of *turcicus* may be read as applying to *thermaicus*. For measurements see table at p. 320.

Mandible.—The lower jaw of *thermaicus* differs from that of *turcicus* in having the coronoid process more strongly recurved and the angular process a little more reduced. Méhely says that the coronoid process in *turcicus* is "ebenso sanft nach hinten gekrümmt" as in *S. ehrenbergi*; in *thermaicus* it is more sharply recurved than in the latter species. Méhely describes the angular process as being most closely similar to that of *S. m. anatolicus*, "deutlich flügelförmig und vom Körper des Unterkiefers weggespreizt"; in *thermaicus* the "angulus anterior" (to use Tullberg's nomenclature) is nearly obsolete, although rather more of it remains than in *S. m. captorum* described below; and the flattened "angulus posterior" lies close to the base of the alveolar process of the incisor. The alveolar process is largely developed, the alveolar length of the jaw being conspicuously greater than the condylar length, the difference between these two dimensions becoming more marked with advancing age.

Dentition.—*Incisors*: the upper incisors have the enamel faintly tinged with yellow in young specimens, but the staining becomes more intense with age. The anterior surface shows in certain lights a very faint trace of a median longitudinal concavity, in which the yellow stain seems chiefly to collect. The lower incisors are white or very feebly and irregularly stained with yellow at all ages; their anterior surfaces are like those of the upper teeth, but in two cases they show more definite traces of a narrow median

groove. Of the faint costæ found frequently in *turcicus* by Méhely I can see no trace in *thermaicus*.

Cheek-teeth.—In adult stages of wear the patterns of the cheek-teeth are exactly similar to those of *turcicus*. The anterior sulcus separating the two tubercles of which the front lobe of $\underline{m.1}$ is originally composed (cf. Méhely, Mamm. p. 296, fig. 9) is always ephemeral in *thermaicus*, though sometimes persistent in *turcicus*. In *thermaicus* the young $\underline{m.2}$ is quite like $\underline{m.1}$, having three re-entrant enamel folds on the labial side instead of the single "zweibuchtige" fo'ld found in *turcicus*; the posterior or third labial fold is very small, it is quickly reduced to an islet, which, in turn, speedily disappears: $\underline{m.1}$ and $\underline{m.2}$ have each to begin with three lingual re-entrant folds (in addition to the labial fold); but the posterior labial "fold" commences as an islet in the posterior lobe of the tooth; the two anterior labial folds have a common mouth on the side of the tooth and are separated from each other internally by a small saliency formed by the posterior horn of the half-moon-shaped anterior moiety of the young tooth. In the $\underline{m.1}$ of my youngest specimen this saliency appears as a separate tubercle not yet united with the main mass of the tooth.

Molar roots and the alveoli.—The molar roots tend to be reduced by fusion in *thermaicus*, while they remain free and distinct in *turcicus*. In the latter $\underline{m.1}$, according to Méhely, is always distinctly three-rooted, having two labial roots and a lingual root, which tends to be forked; correspondingly the alveolus has three distinct cells, that for the lingual root showing two depressions. In *thermaicus* the anterior labial root is very short and it is completely fused with the lingual root, being separated from the latter merely by a faint crease; a furrow also divides superficially the large lingual root into two parts; the posterior labial root is completely free, though short. The alveolus has a special cell with complete walls only for the posterior labial root; its remainder shows three depressions—a shallow one for the anterior root and two deeper ones for the lingual root. In *thermaicus* $\underline{m.2}$ is similar to $\underline{m.1}$ as regards roots and the alveolus; but the division of the lingual root only becomes perceptible towards the tip, and in the alveolus the septum dividing the cell for the posterior labial root from the remainder of the alveolus is lower and thinner. In *turcicus* this tooth has three distinct roots, of which the lingual is always more or less distinctly forked, while the alveolus is correspondingly four-celled. In *turcicus* $\underline{m.3}$ also is provided with three completely free roots,

and it has a three-celled alveolus. In *thermaicus* $\overline{m.3}$ has two roots only, the anterior labial root being in this tooth free though very short, whilst the posterior labial and the lingual roots are fused into a single fang; the alveolus is two-celled, the cell for the anterior labial root being very shallow. The lower molars in *thermaicus* have two roots each, as in *turcicus*, but the anterior root is in each tooth shorter and thinner, while in $\overline{m.2}$ and $\overline{m.2}$ it shows far weaker traces of a more primitive division into an inner and an outer fang. Each alveolus is divided into two cells by a continuous transverse septum, but in each case this, on comparison with Méhely's illustration (Taf. xxiv. fig. 5), would appear to be lower and thinner than in *turcicus*.

2. *Spalax monticola corybantium*, subsp. n.

Hab.—Murad Dagh; type from a spot 15 miles N.E. of Eushak, and about 150 miles E. of Smyrna.

Type.—An adult (?sex) collected and presented to the British Museum by Mr. A. Buxton (B.M. 8. 11. 21. 1). No other specimen known.

Description.—*Skull*: the skull is larger than in *anatolicus*, *cilicicus*, and *captorum*, about as large as in *turcicus* and *thermaicus* (condylo-basal length 51.3 mm.). It has two characters which readily distinguish it from the skulls of any of its nearest geographical allies; the parietals are very narrow in the adult and very irregularly overlapped by the frontals and squamosals, each being conspicuously longer than broad; the posterior ends of the short anterior palatal foramina are very nearly in line with the hinder borders of the maxillary zygomatic processes. In other respects it resembles one or other of the various subspecies mentioned in this paper. Snout broad and heavy, rather wider at middle than at base; nasals with an anterior constriction and reaching back as far as the level of the hinder margins of the infraorbital foramina or a little beyond, although barely equal in length to the frontal and parietal combined; processus naso-basalis well-developed, reaching centre of infraorbital foramen; supraoccipital very short, much shorter than the fronto-parietal length (height of skull contained 2.07 times in length lambda to nasal tips); infraorbital foramina relatively large; lachrymal distinctly visible from above as a large rectangular ossicle measuring 2.6 mm. in length; ascending ramus of maxillary zygomatic process slender; external auditory meatus wide; anterior part of palate shorter than hinder part, its length decidedly

greater than the distance between the anterior and the posterior palatal foramina; posterior border of palate situate behind level of alveoli of $\overline{m.3-m.3}$, straight, and without median spine; postpalatine foramina slightly in advance of the septum between $\overline{m.2}$ and $\overline{m.3}$; pterygoid and paroccipital processes as in *anatolicus*.

Mandible.—The lower jaw shows a decided tendency to assume the form characteristic of *Macrospalax*; it is very large and robust; the coronoid process is very powerful and erect; the incisura between the coronoid process and the condyle is very long and flatly rounded; alveolar process very large and heavy, the corono-alveolar incisura wider, though as rounded as in *anatolicus*; angular process about as in *anatolicus*, with well-marked and definitely inflected angulus anterior; the alveolar and condylar lengths about equal.

Dentition.—*Incisors*: upper incisors faintly yellow, the colour most intense along middle line; lower incisors nearly white. Upper and lower incisors with faint traces of median groove.

Cheek-teeth.— $\overline{m.1}$ of normal pattern, anterior labial fold represented by an islet, the second labial and the lingual fold still open; $\overline{m.2}$ exactly similar; $\overline{m.3}$ with a single circular islet. The right and left lower molars show a curious difference in their respective states of wear; $\overline{m.1}$ with labial fold, simple anterior lingual fold, the posterior lingual fold represented by a very small islet (L.), already gone (R.); $\overline{m.2}$ (R.) with labial and anterior lingual folds still open, the posterior lingual fold entirely gone, (L.) similar, but anterior lingual fold just insulated; $\overline{m.3}$ (R.) with an anterior lingual islet, the labial fold still open and deep, (L.) with merely a central triangular islet and no other complication.

Molar roots and alveoli.— $\overline{m.1}$ has merely one root, the large lingual element being fused throughout with both the labial elements, the only interval being that left between the two labial portions; alveolus very simple, its sole complication being the vestigial labial septum which fits into the interspace between the two labial elements of the single fang; $\overline{m.2}$ and $\overline{m.3}$ quite similar to $\overline{m.1}$ in these respects. In the lower jaw $\overline{m.1}$ has two large roots, and its alveolus is divided by a complete though thin septum; in $\overline{m.1}$ the anterior root shows traces of a lingual and a labial element, but it is partially fused on the lingual side with the posterior root, and in the alveolus therefore the transverse septum is incomplete.

3. *Spalax monticola captorum*, subsp. n.

Hab.—Kanghri (Changria), Asia Minor.

Type.—A middle-aged female (B.M. 19. 9. 20. 23; original no. 18; contained "4 fairly well-developed embryos") collected March 20, 1918, by Captain F. J. Patmore; presented to the British Museum by Captain Patmore and Captain Phillips.

Material examined.—Four from type-locality (2 ♂, 2 ♀).

Description.—This subspecies is most nearly allied to *S. m. anatolicus* and *S. m. cilicicus*, presenting some characters common to the two forms named, others possessed by one or other of them, besides certain features peculiar to itself.

Skull.—The following characters are common to the skulls of *captorum*, *anatolicus*, and *cilicicus*:—Medium size; the form of the rostrum, which is of medium length, rather narrow, though somewhat stouter than in *S. ehrenbergi*; each frontal with a well-developed processus naso-basalis; naso-frontal suture more or less concave anteriorly; parietals remaining broad in advanced age; supraoccipital measured from foramen magnum to lambda shorter than the fronto-parietal length (lambda-nasal length ÷ height of skull = 2.02–2.05); wide meatus auditorius externus (greatest diameter about 3 mm.); short anterior palatal foramina, their hinder ends falling considerably short of a line connecting the posterior edges of the maxillary zygomatic processes; anterior portion of palate shorter than hinder portion, the posterior palatal border without a median spine; post-palatine foramina placed in advance of the septum between *m. 2* and *m. 3*.

In the following respects *captorum* agrees with *anatolicus* and differs from *cilicicus*:—Nasals rather narrow anteriorly, with a more or less evident constriction of the middle part of the anterior widened portion; processus naso-basalis reaches only to middle of the infraorbital foramen; infraorbital foramen of medium size; ascending branch of maxillary zygomatic process narrow; pterygoid and paroccipital processes relatively slender, as in *S. ehrenbergi*.

In the following points *captorum* agrees with *cilicicus* and differs from *anatolicus*:—Nasals do not or scarcely reach a line connecting the hinder edges of the infraorbital foramina; parietals rather long, each being considerably longer than its breadth at lambda.

In *captorum* the palate terminates posteriorly in front of instead of behind a line connecting the hinder edges of the alveoli of *m. 3–m. 3*; the lachrymal is constantly visible from above as a minute ossicle (in *anatolicus* this bone was similarly

visible in two out of thirteen skulls examined by Méhely, and I have seen it in several of the topotypical skulls in the British Museum; not visible in *cilicicus*).

Mandible.—The angular process is more specialized than in *cilicicus* or *anatolicus*; in *cilicicus* it is not reduced, but agrees in form with that of *S. ehrenbergi*; in *anatolicus* it is a little reduced, although the angulus anterior is still prominent; in *captorum* the angulus anterior is obsolete, the angulus posterior approximated to the alveolar process of the incisor. The alveolar length of the jaw is about equal to, or rather shorter than, the condylar length, instead of being somewhat longer as in *anatolicus* and *cilicicus*.

Dentition.—*Incisors*: in the young specimen the incisors are white, a tinge of faint yellow appearing towards the alveolus; they are stained yellow in the adults; in the upper incisors dirt collects along the middle of the anterior face, forming a streak which indicates the presence of a slight groove; in the lower incisors there is a distinct median vestigial groove, but no trace of ribs. In these respects the new form agrees with *cilicicus*.

Cheek-teeth.—The patterns of the worn molars and their roots and alveoli are exactly as in *anatolicus*. Some slight differences are observable in the youngest stage of wear available. In this $\overline{m.1}$ has one lingual fold and two labial folds, there being no trace at all of the posterior or third labial fold found in young teeth of *anatolicus* (cf. Méhely, Taf. viii. fig. 1); the anterior lobe of the tooth is formed by two cusps—a large inner and a smaller outer,—which are separated anteriorly by an ephemeral sulcus. Of the three islets present in the adult tooth, the posterior labial derived from the second labial fold is the last to close. In $\overline{m.2}$ the anterior islet is developed from the deepest part of the lingual fold, as in *S. ehrenbergi*, and not from a T-shaped labial fold, as in *anatolicus*. In the lower jaw the young $\overline{m.1}$ is closely similar to Méhely's fig. 19 of Taf. viii., but the "accessory" islet stands in more obvious relation with the outer branch of the anterior lingual fold than in the figure cited; $\overline{m.3}$ has only one lingual fold in addition to the labial fold, the posterior lingual fold seen in the young $\overline{m.3}$ of *anatolicus* being absent.

Remarks.—Captain Phillips and Captain Patmore were among the unfortunate men captured by the Turks at the fall of Kut. During their captivity they found great solace in their love for natural history. Devising their own traps and other apparatus, they managed in the face of great difficulties and hardships to make a very respectable collection of mammals, thus proving once again that ability is the only indispensable equipment. On their return to this country they presented their collection to the British Museum.

Skull-measurements (in millimetres).

	<i>Spalax monticola thermaicus</i> .			<i>S. m. corybantium</i> .		<i>S. m. captorum</i> .		
	$\frac{17}{5.25}$ 1	$\frac{17}{9.21}$ 2	$\frac{18}{6.23}$ 1	Type.	Type.			Type.
Condyllo-incisive length	35.4	39.6	46.3	47.1	48.3	40.8	42.5	42.9
Condyllo-nasal	38.7	43	50.6	51.2	51.3	44.1	46.3	46.4
Lambdoidal suture to nasal tips	31.4	34.6	39	39.8	40.2	35.5	37.5	36.9
Height (alveolus $m.3$ to crista sagittalis)	14.3	16.7	17.1	17.7	19.5	17.6	17.6	18
Length of supraoccipital	11.5	13.3	14.8	14.6	15.6	13.2	....	14.7
Lambdoidal suture to coronal suture	8	10.2	8.1	8.3	9.6	9.2	....	9.8
Lambdoidal suture to fronto-nasal suture	16.8	18.9	21.2	21.5	20.8	18.8	21	19
Nasals, length "	15.6	17.2	19.3	20	20.2	17.5	17.8	18.4
" breadth	5.1	6.2	7	7.1	6.8	5.6	6.1	6.1
Zygomatic breadth	26.2	31	....	37.6	38.2	30.9	....	32.8
Isthmus frontalis	8.4	8.2	7.3	6.7	7.2	7.1	....	7.8
Rostral breadth	8.5	9	10	11.2	11.2	8.6	8.8	8.7
Dental length *	21	23.7	28	29.2	29.9	25.6	26.4	27
Greatest infraorbital breadth	13.8	14.9	16.9	18.3	18.1	14.7	....	15
Least "	7.8	8.5	8.4	9.1	8.7	7.8	....	8.2
Width of masseteric plate	2.6	2.8	3.9	4.2	3.7	3.1	3	3.5
Diastema	11.4	13.2	16.7	18.1	18.7	14.8	15.9	16.1
Length of anterior part of palate (to hind border of anterior palatal foramen)	8.5	9.6	11.6	12.4	12.7	10.5	10.2	10.6
Length of posterior part of palate (from hind border of anterior palatal foramen)	9.9	11.7	13.3	13	14.4	11.2	12.6	12.9
Molar length (base of crowns)	7.1	7.8	7.6	7.6	7.1	7.4	7.2	7.5

* The measurement from the anterior face of the incisor to the hinder edge of $m.3$ (mentioned in my paper on *Chricetomys* last October) may be called the "dental length." The "greatest infraorbital breadth" is the distance measured anteriorly between the inner surfaces of the outer walls of the two infraorbital canals; "least infraorbital breadth" is the least distance between the two canals in front. In a paper now in preparation the significance of these and other measurements is discussed from a wider standpoint; I therefore offer no further remarks about them on the present occasion.

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No. 28. APRIL 1920.

XLV.—*A List of the Endomychid Coleoptera of Indo-China, with Descriptions of new Species.* By GILBERT J. ARROW, F.Z.S., F.E.S.

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AMONGST the extensive collections of Coleoptera from the province of Tonkin and the Upper Mekong River sent to me by Monsieur R. Vitalis de Salvaza, who has so greatly increased our knowledge of the insect fauna of that region, is an important series belonging to the beautiful and interesting fungus-feeding family Endomychidæ, a very large proportion of which were previously unknown and are here described. All the types are in the British Museum, which is greatly indebted to the collector for this valuable addition to the collection.

Up to the present time not more than two or three species of Endomychidæ in all have been recorded from Indo-China, although Gorham's enumeration of those found in Burma, published in the Annals of the Genoa Museum for 1896 (vol. xxxvi.), amounts to twenty-nine. This number is exceeded in the list which follows, which includes no less than seventeen species hitherto entirely unknown.

Spathomeles decoratus, Gerst. This striking insect is abundant at Luang Prabang on the Upper Mekong.

Ann. & Mag. N. Hist. Ser. 9. Vol. v. 22

Amphisternus corallifer, Gerst. Found less commonly in the same locality as the last.

Amphisternus bellicosus, Gerst., var. nov. *laotinus*. Nam Mat, Upper Mekong. This variety differs from the typical form in the red-tipped elevation rising from the middle of each elytron not being produced to a sharp point. *A. bellicosus* was originally recorded from Sumatra and Penang, but it appears to be a rather wide-ranging species with numerous local races.

Amphisternus pustulifer, Gorb. Xieng Khouang. Only the female of this has been described. The male has much more slender antennæ and legs, the front tibia bearing a very slight tooth in the middle of its inner face, and from that point to the end being compressed and clothed internally with close fine pubescence. The last ventral segment is broadly emarginate.

Engonius gratus, Gorb. Luang Prabang: Paklay. Cambodia: Kompong Kedeh. Gorbham gives the range of this species as from Bengal to Tenasserim.

Engonius opimus, Gorb. Luang Prabang. Also found in Burma.

Engonius similis, sp. n.

Niger, vel nigro-violaceus, elytris utrinque maculis transverse subovatis duabus læte flavis ornatis, prima post-humerali paulo obliqua fere ad marginem externum attingenti, secunda antepicali breviori; elongatus, pronoto modice transverso, lateribus antice convergentibus, postice leviter divergentibus, angulis anticis prominentibus, posticis acutis; elytris sat crebre et distincte punctatis, modice convexis, extus anguste marginatis, lateribus haud fortiter arcuatis:

♂, tibia antica medio fortiter spinosa, intermedia post medium bene excisa, haud dentata, segmento ultimo abdominali fortiter haud late exciso.

Long. 10–11 mm.; lat. max. 5 mm.

SIAM,^o LAOS: Vientiane (*R. Vitalis de Salvaza*, June), Pak Leung (*R. V. de Salvaza*, Feb.).

Engonius similis is closely similar to *E. klugi*, Gerst., and indeed almost identical in colour and markings, but it is a little more elongate, the prothorax less transverse, the elytra

less convex, less rounded at the sides, and with much less distinct lateral margins. The club of the antenna also is rather narrower.

In the male the tooth of the front tibia is strong, the middle tibia is excised at its inner edge, but without a distinct tooth at the upper limit of the excised part, and the terminal segment of the abdomen is less broadly bilobed than in *E. klugi*.

Engonius opacicollis, sp. n.

Niger, opacus, elytris æneo-nigris, nitidis, singulo fasciis duabus pallide flavis ornato, fasciis irregularibus, angustis, anteriori posthumerali, fere ad marginem externum attingenti, posteriori subapicali; oblongus, convexus, pronoto sat lato, subtiliter punctato, medio longitudinaliter sulcato, lateribus medio paulo dilatatis, antice et postice leviter convergentibus, angulis anticis productis, obtusissimis, posticis fere rectis; elytris ubique crebre punctatis, antennarum articulo tertio quam quarto haud duplo longiori, tibiis 4 anterioribus valde arcuatis:

♂, tibia antica apice intus excisa, femoribus et tibiis posticis intus longe ciliatis, segmenti ventralis ultimi spatio mediano quadrato abrupte elevato et utrinque carinato.

Long. 9 mm.; lat. max. 5 mm.

Xieng Khouang (May, December).

Nearly related to *E. signifer*, Gorb., and with almost the same elytral pattern, the two irregular transverse bars being merely a little narrower. It differs most markedly from that species in the opaque pronotum, which is also very much more finely and sparingly punctured and proportionally broader, with the front angles still more produced and blunt. The distinctive features of the male are as in *E. signifer*, but the elevated plate upon the last ventral segment is larger and more quadrate. In both species there is also a pair of minute accessory tubercles at the posterior margin of the preceding segment.

Engonius brevipes, sp. n.

Niger, nitidus, singulo elytro fasciis duabus transversis rufis ornato, anteriori post-humerali, fere ad marginem externum attingenti, medio constricta, posteriori antepicali angusta, undulata; oblongus, modice convexus, pronoto lato, nitidissimo, medio haud sulcato, antice subtilissime punctulato, lateribus postice rectis, fere parallelis, antice regulariter arcuatis, angulis anticis obtusis, posticis fere rectis, foveis basalibus fortiter impressis; fere ad medium attingentibus; elytris ubique crebre

punctatis, lateribus ad post medium parallelis, deinde leviter arcuatis; antennis pedibusque brevibus, illarum articulis 4°-8° transversis :

♂, tibiis omnibus latis, apicem versus latioribus et dense sericeo-vestitis, intermediis postice posticisque antice arcuatis.

Long. 5.5 mm.; lat. max. 3 mm.

Xieng Khouang (April).

I have seen only a single male of this species, the smallest yet known of its genus. It is of a peculiarly compact oblong form, with a strongly transverse prothorax, whose greatest width is equal to that of the elytra, and narrowing very little to the shoulders. It is very smooth and shining, with a deep basal furrow, no longitudinal channel, and basal foveæ strongly impressed and extending almost to the middle. The elytra scarcely taper behind, and are closely and evenly punctured, but smooth and shining. The legs and antennæ are short and stout, the third joint of the latter conical in shape and little longer than it is broad at the outer end, the succeeding joints all transverse.

The tibiæ of the male are not toothed, but broadly dilated a little beyond the base and clothed with close silky pubescence towards the extremity. The hind tibiæ are especially broad from the middle (where they are strongly curved) to the extremity. The middle tibiæ are incurved just before the end.

Eumorphus austerus, Gerst. Nam Tiene, Upper Mekong. This species ranges from Assam to Cambodia.

Eumorphus sanguinipes, Guér. This was found by M. Vitalis in the same locality as the last, and has a similar range northwards, but I have not seen it from farther south.

Eumorphus quadriguttatus, Illig. Vientiane, Pak Pha; Annam; Tonkin. This is an extremely common insect throughout its range, which extends to Java, Sumatra, and Borneo.

Eumorphus simplex, sp. n.

Niger, nitidus, elytris violaceo-nigris, singulo maculis 2 flavis parvis ornato; sat elongatus, pronoto transverso, angulis omnibus productis, posticis acutis :

♂, tibia antica bisinuata, dente valido armata, postica recta, apice paulo excisa, abdominis subtus segmento penultimo nudo, ultimo

lateraliter subtiliter sericeo, medio nudo, apice haud profunde exciso :

♀, elytris haud productis, abdominis subtus apice haud exciso.
Long. 11.5 mm. ; lat. max. 6 mm.

INDO-CHINA, LAOS : Luang Prabang, Lat Ham (*R. Vitalis de Salvaza*, March).

This species can only be distinguished from the common *E. quadriguttatus*, Ill., by a careful examination of the secondary sexual characters. In size, shape, and coloration it agrees exactly with it, but the male has the front tibia a little bisinuated, with the tooth stouter and more prominent, the abdomen is without the pad of dense erect hairs occupying the middle of the two terminal segments beneath, and the last ventral segment is much less deeply emarginate at the apex. The female has the extremities of the elytra less produced, and the apex of the abdomen is without the triangular excision found in that of *E. quadriguttatus*. There is an even closer relationship between this species and the Malayan *E. sybarita*, Gerst., but our form is a little smaller, less glossy above, and decorated with smaller spots, the posterior ones being separated by an interval about twice the diameter of each, whereas in *E. sybarita* it is of about equal diameter. The male has the front tibia more slender, the tooth less stout, and not followed by a distinct emargination.

Eumorphus calcaratus, sp. n.

Niger vel violaceo-niger, nitidus, elytris quadripustulatis, maculis parvis, flavis, rotundis, prima post-humerali aliaque antepicali ; parum elongatus aut convexus, corpore supra minute punctato ; prothorace transverso, lateribus leviter bisinuatatis, angulis posticis vix acutis, haud productis, foveis basalibus bene impressis, fere ad medium attingentibus, elytris angustissime marginatis, haud productis ; antennis sat gracilibus, clava angusta :

♂, tibia antica dente tuberculiformi haud acuminato armata, tibia postica apice lamina ciliata interna instructa, abdominis segmentis subtus medio erecte ciliatis, ultimo apice acute inciso.

Long. 7 mm. ; lat. max. 4 mm.

INDO-CHINA : Vien Poukha, Upper Mekong R. (May), Sala Pang Yok, Luang Prabang (March), Ban Sai, Xieng Khouang (Feb.).

This species is small and compact in shape, entirely

shining above and decorated with four spots a little larger than those of *E. subguttatus*, Gerst., and not raised above the general surface. The antennæ are not very slender, and the club is narrower than in any other known species of the genus.

Various features, most of them peculiar to the male sex, distinguish this species from all others. The front tibiæ in that sex are straight and furnished beyond the middle with a blunt hairy tubercle instead of the usual sharp spine. The hind tibia is produced inwards at its extremity as a triangular plate, semi-translucent and closely fringed at its edges. The terminal ventral segment is broadly emarginate and acutely notched, and all the segments bear tufts of erect hairs along the middle line, forming together a longitudinal ventral crest.

In the female the terminal process of the hind tibia is shorter than in the male, and the hairs upon the abdomen are distributed over the ventral surface and not massed along the middle line as in the male.

Eumorphus nanus, sp. n.

Niger, nitidus, singulo elytro flavo-bimaculato, maculis haud minutis, rotundatis, anteriori fere ad humerem attingenti; parvus, oblongus, pedibus gracilibus, femoribus clavatis; pronoto transverso, subtiliter parce punctato, lateribus postice paulo contractis, angulis anticis prominentibus, posticis acutiusculis; clytris modice convexis, nitidis, sat fortiter et crebre punctatis, lateribus anguste marginatis:

♂, tibia antica fere recta, medio fortiter spinosa, abdominis segmento ultimo leviter emarginato.

Long. 5-5.5 mm.; lat. max. 3 mm.

TONKIN: Hanoi (Feb.).

This is by far the smallest known species of the genus. It belongs to the *quadriguttatus* group, but is more shining and without any purplish tinge. The elytral spots are, relatively to the size, about as large as in *E. quadriguttatus* and larger than in *E. calcaratus*, but the anterior ones are situated farther forward. The pronotum is rather broader than in the former species, rather less so than in the latter, and the elytra are much more strongly punctured than in either. In the rather thickened femora, as in general appearance, there is an obvious approximation to *Indalmus*, but the antennæ, which are quite those of *Eumorphus*, will serve to distinguish it.

Eumorphus subguttatus, Gerst. Luang Prabang, Ban Silah, Nam Mat, etc. Taken in abundance together with the following species, which very closely resembles it. It is also found in Borneo and Sumatra.

Eumorphus vitalisi, sp. n.

Niger, opacus, singulo elytro maculis parvis duabus pallide flavis ornato, prima posthumerali, secunda anteapicali; corpore elongato, pronoto crebre parum perspicue punctato, lateribus antice contractis, angulis acutis, postice fere parallelis, angulis haud productis; elytris lateraliter leviter arcuatis, angustissime deplanatis, postice paulo latioribus, apicibus haud productis, humeris leviter sed haud acute carinatis; antennis modice robustis:

♂, tibiis anticis rectis, post medium acute dentatis, intermediis apice incurvatis.

Long. 6.5-8.5 mm.; lat. max. 3-4 mm.

INDO-CHINA, LAOS: Ban Nam Mo, near Luang Prabang (March); Ban Na Gnao (February).

BURMA: Karen Hills (*Doherty*), Tenasserim (*E. T. Atkinson*).

M. Vitalis de Salvaza has found this species in abundance.

It is very closely related to *E. subguttatus*, Gerst., which is found in the same localities, although less abundantly. It differs from that species in having the pronotum more closely punctured and its sides regular in outline (and not ragged as in the other form), contracted in front and parallel behind. The hind angles are not produced in either sex. The elytra are not sharply carinate at the shoulders and are less produced at their extremities. The antennæ are rather shorter and stouter. The front tibiæ of the male are straight and slender (not distorted), the tooth is slighter and more acute, and arises beyond, instead of before, the middle. The size is a little smaller on the average than that of the other species.

Eumorphus ocellatus, sp. n.

Niger, nitidus, femoribus apicem versus rufis elytroque singulo punctis tribus elevatis pallide flavis ornato, una posthumerali prope marginem externum, secunda inter illum et suturam tertiamque anteapicali; elongatus, pedibus antennisque gracilibus, pronoto transverso, nitidissimo, lateribus medio leviter angulatis, antice paulo convergentibus, postice paulo divergentibus, angulis anticis haud acutis, posticis fere rectis, foveis basalibus profundis, ultra medium attingentibus; elytris subtiliter sat crebre

punctatis, maculis 6 elevatis autem lævissimis, sicut vitreis, stria juxtasaturali impressa marginibusque externis anguste depressis; clava antennali angusta.

Long. 9 mm.; lat. max. 5 mm.

TONKIN: Chapa.

This species is described from a unique female specimen. It is remarkable as being, with the exception of *E. bipunctatus*, Perty, the only known species of this large genus in which the pattern is not confined to two pale patches upon each elytron. Here there are three small elevated shining spots of a translucent yellow colour resembling ocelli, the two anterior ones rather smaller than the third, the outer one of the two placed a little behind the humeral callus close to the external margin and the inner one midway between it and the suture. The third spot occupies the usual position. The fine puncturation covering the remaining surface of the elytra is absent from these spots. The terminal parts of the femora extending beyond the sides of the body are bright red, and the anterior angles of the thorax are also red in the single type-specimen, but this may not be a constant feature.

Eumorphus inflatus, sp. n.

Niger, nitidus, singulo elytro maculis 2 magnis pallide flavis ornato, maculis transverse ovalibus, prima humerali, paulo post basin sita, ad marginem externum sed haud in epipleuram producta, secunda anteapicali, vix ad marginem externum attingenti; brevis, convexus, pronoto haud lato, punctato, lateribus lævissime bisinuatis, angulis paulo productis, acutis, foveis basalibus ad medium protractis; elytris distincte sat crebre punctatis, ad humeros inflatis, obtuse dilatatis, lateribus postice anguste explanatis, apicibus separatim rotundatis, haud productis:

♂, tibia antica post medium haud acute dentata, intermedia leviter arcuata:

♀, segmento 5° apice arcuatim emarginato.

Long. 9.5 mm.; lat. max. 5.5 mm.

XIENG KHOUANG; Ban Sai, Muong Pek (December).

There is no species with which this has any considerable degree of affinity. By its short and convex shape, as well as its size and coloration, it resembles *E. westwoodi*, Guér., but the angular dilatation of the elytra at the shoulders is quite peculiar and makes it the most isolated species in the genus. This conformation is exactly as in *Eucteanus humeralis* and related species and, in association with an almost

identical coloration, produces a marked resemblance to that genus, although the relationship is remote.

The pronotum is relatively rather narrow, with the sides approximately parallel, very feebly curved but a little dilated towards the base, and all the angles slightly produced. The four pale elytral spots are similar in size and shape to those of *E. westwoodi* and *alboguttatus*, but rather more transverse. The narrow elytral margins are as in those species, but the greatest width of the elytra is across the dilated shoulders.

In a single specimen from Pou Bia the pale spots are reduced to narrow transverse bars.

Indalmus kirbyanus, Latr. Luang Prabang, Pak Lay, Xieng Khouang, etc. This is a common species, widely distributed in India and the Malay Peninsula.

Ancylopus melanocephalus, Oliv. Although M. Vitalis has only found a single specimen, this is probably the commonest of all the Endomychidæ, found almost all over the Old World.

Cymbachus elegans, sp. n.

Niger, nitidus, elytris violaceis, utroque maculis magnis duabus flavis ornato, prima humerali aliaque subapicali, his maculis rotundatis, vix ad margines externos attingentibus; ovalis, convexus, pronoto subtiliter irregulariter punctulato, lateribus leviter bisinuatis, angulis productis, anticis haud acutis, posticis acutis, foveis basalibus subtilibus; elytris paulo fortius punctatis, humeris modice prominentibus, lateribus leviter arcuatis, apicibus paulo attenuatis; antennis haud gracilibus, clava lata.

Long. 7 mm.; lat. max. 4 mm.

INDO-CHINA: Upper Mekong R., Nam Long (*R. Vitalis de Salvaza*, April).

Only one specimen of the species has been found.

The body is less short and broad than in either of the two species of *Cymbachus* hitherto known. The pronotum is narrower, with all the angles rather more produced, but the front ones blunter. The elytra have the shoulders only moderately prominent and the sides gently and regularly curved, widest at the middle and tapering behind. The whole upper surface is very smooth and shining, finely punctured, as in *C. pulchellus*, less strongly than in *C. formosus*. The antennæ are not very slender, but all the joints preceding the club are a little elongate, the 3rd not as long as the 4th

and 5th together. The club is short and broad. The elytra are deep violet in colour and ornamented with four large rounded yellow patches, which are separated in the longitudinal direction by an interval about half as wide as one of them, and in the transverse direction by a narrower interval.

Dryadites vitalisi, sp. n.

Niger, pronoti lateribus late elytrorumque disco toto rubris, hujus parte suturali antice et postice late producto; ovalis, convexus, pronoto sat angusto, medio modice punctato, marginibus elevatis, postice parallelis, antice fere abrupte contractis, angulis approximatis, productis, angulis posticis etiam acuminatis; elytris fortiter irregulariter seriato-punctatis, lateribus anguste reflexis, antennis modice gracilibus, clava minuta, articulo 9° triangulari, haud transverso, 10° et 11° valde transversis, connatis.

Long. 7 mm.; lat. max. 5 mm.

LAOS: Luang Prabang, Don Khoua (November).

There are two specimens, which I believe to be male and female, but which are identical externally.

There is a close resemblance to *D. borneensis*, but the new species is considerably larger, the red patch upon the elytra is more extensive, although exactly similar in outline, and not divided along the line of the suture, the sides of the pronotum are less regularly curved, the front angles more abruptly contracted, nearer together and more acute, the lines of punctures upon the elytra much more irregular and the antennæ more slender, with a less abrupt club, the ninth joint not broader than long.

Lycoperdina mandarinae, Gerst. This widely-distributed species has been recorded from Tonkin by Fairmaire, but I have received no specimens from the region.

Saula fuscicornis, Fairm. Tonkin: Hoabinh. The antennæ of M. Vitalis's specimens are black except at the base, and not brown, but this is not a distinction upon which it is safe to rely, as Cziki has done in his key to the species.

PSEUDINDALMUS, gen. nov.

Corpus oblongum, glabrum, pedibus parum elongatis, femoribus paulo clavatis. Pronotum transversum, lateribus incrassatis, foveis basalibus fere parallelis lineaque recta basali profunde impressum, antice membrana stridulatoria instructum. Elytra

anguste marginata. Prosternum postice productum, paulo deplanatum, apice truncatum. Mesosternum leviter excavatum, antice angustatum, truncatum. Antennæ parum graciles, articulo 2° globoso, 3°-8° subæqualibus, perpaulo decrescentibus, 9°-11° intus leviter productis, transversis, ultimo truncato. Mandibula lata, apice minute fissa. Maxillæ lobus externus latus palpusque elongatus, acuminatus. Submentum fortiter transversim carinatum; palpi labiales brevissimi, articulo ultimo late cupuliformi. Maris antennarum articulus 9 quam 10 major.

This genus forms an interesting link between *Mycetina* and the apparently very dissimilar *Danae*, to which it is evidently related by the peculiar male character mentioned above, viz. the enlarged 9th joint of the antenna. It has a superficial resemblance to *Indalmus*, but is easily distinguished by the very differently formed antenna, with its strongly asymmetrical club and non-elongate third joint. Its nearest relationship is with *Mycetina*, from which it differs in the shape of the mesosternum as well as the sexual feature referred to.

Pseudindalmus tonkinensis, sp. n.

Niger, sat nitidus, utroque elytro bimaculato, maculis sanguineis, obliquis, anteriori posthumerali, posteriori prope suturam paulo dilatato; oblongus, pronoto subtiliter punctato, lateribus antice arcuatis, angulis prominentibus, postice fere parallelis, angulis acutiusculis, marginibus incrassatis; elytris ubique crebre haud fortiter punctatis, lateribus bene arcuatis, marginibus distincto reflexis:

♂, antennarum articulo 9° paulo inflato.

Long. 6.5 mm.; lat. max. 3.5 mm.

TONKIN (June): Upper Mekong R., Muong Sing (April).

This is entirely black above and beneath, except the four blood-red elytral spots, which are of rather more irregular shape than in the previous species, the anterior one just touching the humeral angle and produced obliquely inwards and backwards, the posterior one rather quadrate but produced forward a little parallel with the suture. It is a little larger than a second species, which I propose to describe under the name of *P. andamanicus*, with the elytra more distinctly dilated and margined at the sides, less shining, and rather less strongly but fairly closely punctured.

In the male the ninth joint of the antenna is distinctly larger than the tenth or eleventh.

Encymon cinctipes, Gorh. Laos. Previously recorded from Burma.

Encymon ferialis Gorh. Muong Sing and Vien Poukha. This was originally recorded from Borneo. I have not seen the type.

Stenotarsus fuscicornis, Gorh. Ban Na Gnao. Hitherto known only from Pegu and Tenasserim.

Cyclotoma indiana, Gorh. Muong Pek, Xieng Khouang, Nam Mat, Upper Mekong. This species ranges as far as the Darjeeling district.

Milichius ornatus, sp. n.

Niger, modice nitidus, ubique crebre punctatus, elytris maculis duabus magnis pallide flavis ad margines externos fere attingentibus utrinque ornatis, prima basali, puncto parvo nigro humerali interrupta, secunda anteapicali, subrotundata, postice minute excisa; modice convexus, subglobosus, pronoto brevi, crebre punctato, lateribus arcuatis, recurvatis, angulis anticis vix acutis, posticis rectis, basi utrinque subtiliter lineato-impresso; elytris fortiter, minus crebre, punctatis, late marginatis, callis humeralibus haud valde prominentibus, antennis haud longissimis, articulo 9° paulo elongato, 10° vix longiori quam latiori, 11° elongato-ovali.

Long. 5-6 mm.; lat. max. 4 mm.

INDO-CHINA: Laos, Ban na Lane (*R. Vitalis de Salvaza*, Jan.).

In its larger size, coloration and comparatively short antennæ this is an aberrant species showing a transition to the genus *Bolbomorphus*. It is black, with four large roundish patches upon the elytra, those on each side a little more widely separated from each other than from those of the other side, the anterior ones nearly reaching the base and outer margins, but with a small contained black spot at the humeral angle. The entire surface is strongly punctured, the elytra rather less shining and less convex than in the other species of the genus and with rather more distinctly reflexed lateral margins. The antennæ are about twice the length of the pronotum. The lower surface, like the upper, is closely and strongly punctured.

Beccaria longicornis, sp. n.

Nigra, nitida, pronoti lateribus vage rufescentibus, elytris irregulariter flavo-bifasciatis, fascia antica basali, ad suturam interrupta, macula nigra humerali aliaque juxta-scutellari includente, postica anteapicali, fasciis antice et postice longe bihamatis, inter se fere connexis; hemisphærica, convexa, capite subtiliter punctato, sericeo; pronoto sat fortiter et crebre punctato, lateribus bene marginatis, leviter arcuatis, angulis omnibus acutis, basi trisinuato, subtiliter marginato, foveis basalibus profundis, ad pronoti longitudinis partem tertiam æqualibus; elytris ubique æqualiter fortiter punctatis; antennis gracilibus, quam corporis dimidium longioribus.

Long. 5 mm.; lat. max. 4 mm.

INDO-CHINA: Upper Mekong R., Houei Sai (*R. Vitalis de Salvaza*, May).

I have seen only a single specimen, presented to the British Museum by its discoverer.

In its markings *B. longicornis* is not unlike *B. cardoni*, Gorh., but the orange-coloured fasciæ are more extensive, only slightly interrupted at the suture (the posterior one scarcely at all), and almost connected together by the two converging finger-like processes emitted by each. The prothorax is much broader than it is represented in the figure of that species and the whole outline is much more circular. The puncturation of the upper surface is very closely and evenly distributed and that of the elytra very deep and strong, especially upon their median part. The antennæ are very slender and their three terminal joints form about one-third of the total length.

Beccaria brevicornis, sp. n.

Nigra, nitida, elytris irregulariter flavo-bifasciatis, fascia antica basali, ad suturam late interrupta, utrinque maculis duabus nigris includente, exteriori humerali aliaque approximata, fascia postica anteapicali, antice et postice longe hamata; late ovalis, convexa, capite crebre punctato; pronoto parum lato, ubique crebre punctato, lateribus leviter arcuatis, angulis anticis rectis, posticis acutis, basi trisinuato, foveis basalibus brevibus; elytris bene punctatis, punctis majoribus et minoribus intermixtis; antennis sat brevibus, ad corporis tertiam partem longitudine æquali, articulo tertio elongato, 4°-6° minutis, 7° et 8° majoribus, clava quam partem tertiam multo longiori.

Long. 6 mm.; lat. max. 4-5 mm.

INDO-CHINA: Upper Mekong R., Houei Sai (*R. Vitalis de Salvaza*, May).

Two specimens found by M. Vitalis de Salvaza are all that are yet known of this species.

It is the largest of the genus known to me and is rather less hemispherical in shape, with shorter antennæ, than its congeners. It is, however, allied to *B. longicornis*, and has closely similar markings. The pale fasciæ are more distinctly interrupted at the suture and the inner black basal spot is nearer to the shoulder than to the scutellum. The pronotum is relatively longer, more contracted in front, less distinctly margined at the sides, with feebler basal foveæ. The elytra are less strongly and regularly punctured, and the punctures are large and small intermixed. The last three joints of the antenna form more than a third of its total length and the two preceding joints are distinctly larger than the three immediately before them.

Endomychus divisus, sp. n.

Fulvus, capite, prothorace, scutello, pedibus antennisque nigris; sat late ovatus, convexus, pedibus antennisque parum gracilibus, pronoto breviter transverso, nitidissimo, medio subtilissime punctulato, lateribus subparallelis, marginibus elevatis, angulis anticis rotundatis, late excavatis, posticis acutis, basi stria profunda marginato, foveis basalibus profundis ad medium attingentibus; elytris ubique distincte sat æqualiter punctatis, convexis, ad humeros latis; antennarum clava laxè articulata, longitudine ad articulos 5 præcedentes æquali, his moniliformibus. Long. 4.5-5 mm.

INDO-CHINA: Luang Prabang (March), Upper Mekong, Pou Hai Katoui (*R. V. de Salvaza*, April).

This has a rather close resemblance to the Japanese *Phæomychus rufipennis*, Mots., with which it is identical in size and coloration, but differs in the absence of a stridulating apparatus upon the head and of sexual difference in the front tibiæ. In actual relationship it appears to be nearest to *E. (Cænomychus) plagiatus*, Gorb., but it is a more stoutly-formed insect, with less slender legs and antennæ and broader prothorax. The pronotum is exceedingly finely and scantily punctured, distinctly margined at the sides, with the front angles rounded and broadly hollowed out, the hind angles acutely produced and the basal impressions broad and deep. The elytra are distinctly punctured, a little broader at the shoulders than the pronotum, and only very little wider behind the middle.

PARARHYMBUS, gen. nov.

Corpus hemisphæricum, supra pubescens. Pronotum toto circummarginatum, basi medio lobato, foveis basalibus lineiformibus, ad medium attingentibus. Elytrorum epipleuræ latissimæ apicesque producti. Prosternum angustum, postice productum, acutum; mesosternum intra coxas quadratum, antice tuberculatum; metasternum antice rotundatum, fortiter marginatum. Pedes tenues, tarsi longibus, filiformibus, tri-articulatis. Horum articulus secundus quam primo brevior, tertius quam secundus duplo longior. Ungues graciles, basi fortiter lobati. Antennæ longæ, graciles, articulo primo crasso, 2° elongato, 3° ad 8° tenuissimis, 9° ad 11° magnis, laxè articulatis.

Pararhymbus longicornis, sp. n.

Fusco-brunneus, capite, pronoti et elytrorum marginibus corporeque subtus rufescentibus, vel totus rufescens, pedibus antennisque flavis, harum articulo ultimo fusco; late hemisphæricus, modice convexus, supra sat dense griseo-pubescens, capite lato, parce punctulato et hirsuto, oculis sat magnis, parum grosse granulatis; pronoto parce et subtilissime punctulato, toto marginato, lateribus fortiter arcuatis, angulis anticis obtusis, posticis obsoletis, scutello minuto; elytris fortiter æqualiter punctatis, basi quam pronoto multo latioribus, humeris obsoletis, lateribus regulariter arcuatis, apicibus productis.

Long. 2.5 mm.; lat. max. 2 mm.

TONKIN: Hoabinh (August).

A series of specimens was found by M. Vitalis.

This is an addition to the very insufficiently known group of forms allied to the genus *Clemmus*, in which the tarsi are filiform and consist of only three joints, apparently through the complete fusion of the 1st and 2nd. *Pararhymbus* differs from the latter genus by the less prominent and less coarsely granulated eyes, the very slender 11-jointed antennæ, of which all the joints except the penultimate one are elongate, the absence of lateral prothoracic ridges due to the production of the basal foveæ in *Clemmus* to the front margin, and the more broadly dilated elytra, with produced apical angles.

The upper surface is clothed with a fine and not very close greyish pubescence, which is almost absent from the middle of the prothorax and the region of the scutellum. The elytra are everywhere strongly and regularly punctured.

It is very deep brown in colour, with the lower surface, the front of the head, the legs, and antennæ red, but the last

joint of the antenna is dark. The sides of the pronotum and elytra are also tinged with red and some specimens (probably immature) are entirely red.

The tibiæ and tarsi are very slender, as in allied forms, and the claws also are slender and strongly curved, with large basal lobes, from the sides of which the claws are separated only by narrow intervals. The antennæ are also slender, but the two first joints are a little thicker, the 3rd rather longer than those that follow, and the three forming the club very loosely attached to one another.

XLVI.—Cicadidæ from Indo-China.

By W. L. DISTANT.

IN my last enumeration of the species belonging to the Homopterous family Cicadidæ received from Indo-China by the efforts of Mons. R. Vitalis de Salvaza (Ann. & Mag. Nat. Hist. (9) iii. p. 43, 1919) no fewer than seventy-six species had been recorded. I am now enabled, by the continued assistance of the same entomologist, to add three more species to the list, thus bringing up the total to seventy-nine.

Mogannia aliena, sp. n.

♀. Head and abdomen black; pronotum castaneous, posterior margin ochraceous; mesonotum castaneous, with two central obconical spots on anterior margin and the lateral margins (more or less) black; abdomen above black, more or less ochraceously pilose; body beneath black; legs more or less castaneous; lateral areas of pro- and mesonota and abdomen (especially on lateral areas) ochraceously pilose; anterior area of head above thickly longly ochraceously pilose, eyes dull dark ochraceous; tegmina pale hyaline, the venation and costal area pale castaneous; an oblique dark castaneous fascia, enclosing a transverse, waved, pale, linear fascia commencing at upper end of radial area and terminating on claval area; wings hyaline, the veins pale, castaneous; the anterior area of head prominent.

Long., excl. tegm., ♀, 20; exp. tegm. 44 mm.

Hab. Indo-China; Tonkin (*R. V. de Salvaza*).

Allied to *M. formosana*, Mats.

Mogannia distinguenda, sp. n.

Body above bright emerald-green, eyes blackish; body beneath ochraceous; face and anterior legs pale castaneous, intermediate and posterior legs ochraceous; base of face emerald-green; tegmina and wings hyaline; tegmina with the costal area to just beyond apex of radial area sanguineous, veins on basal half emerald-green, remaining venation more or less fuscous; wings pale hyaline, narrowly sanguineous at base, the venation greenish on about basal half, remainder fuscous; head conically produced in front, eyes and ocelli fuscous; opercula and lateral areas of sternum with a pale greenish tint; abdomen beneath with a central longitudinal carination; opercula small, not covering the cavities, which are dark fuscous.

Long., excl. tegm., ♂, 14; exp. tegm. 40 mm.

Hab. Indo-China; Haut Mekong, Muong Sing (*R. V. de Salvaza*).

Mogannia obliqua.

Mogannia obliqua, Walk. List Hom., Suppl. p. 39 (1858).

Hab. Indo-China; Haut Mekong, Muong Sing.

A single specimen of this species, not uncommon in India, Burma, Malay Peninsula, and Java, has now been received from Indo-China.

XLVII.—*New or little-known Tipulidæ (Diptera)*.—II. *Ethiopian Species*. By CHARLES P. ALEXANDER, Ph.D., Urbana, Illinois, U.S.A.

THE crane-flies described in this instalment were included in material sent to me for study by Dr. Hugh Scott of the University Museum, Cambridge, and Rev. J. A. Reis of the Cameroun. Dr. Scott has requested that the types of the new species described from the material submitted by him be deposited in the British Museum. The other types are preserved in the collection of the author. I am indebted to Prof. Lamb, Dr. Scott, and Reverend Reis for the loan of this material.

Dicranomyia marshalli, sp. n.

Wings very long and narrow, vein *Sc* short; general
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coloration of the body greyish; halteres long and slender; fore femora dark brown, the other femora paler.

Female.—Length 7·8–8·4 mm.; wing 9–10 mm.

Rostrum rather long for most species of this genus of flies, about equal to half the length of the head or to the antennal scape, dark brown, including the palpi. Antennæ dark brown, the flagellar segments long-oval, with a short white pubescence and a few curved verticils. Head black, grey-pruinose.

Thorax dark grey, the præscutum with the stripes indistinct or lacking. Halteres long and slender, pale, the knobs brown. Legs with the coxæ small, dull yellow, the outer face of the fore coxæ infuscated; trochanters pale yellowish brown; fore femora dark brown, with only the extreme base pale; middle and hind femora yellowish; tibiæ light brownish yellow, the tips narrowly darkened; tarsi dark brown. Wings very long and narrow, somewhat as in the Holarctic *Dicranomyia longipennis* (Schummel), pale yellowish grey, the stigma and veins pale. Venation: *Sc* short, *Sc*₁ ending about opposite or slightly beyond the origin of *Rs*, *Sc*₂ removed a short distance from the tip of *Sc*₁, the latter alone being about equal to two-thirds the basal deflection of *Cu*₁; basal deflection of *R*₄₊₅ about one-half the sector; basal deflection of *Cu*₁ far before the fork of *M*, the fusion of *M* and the deflection of *Cu*₁ being usually about one-half the length of the latter alone; cell 2nd anal long and narrow, conforming to the elongate shape of the wing.

Abdomen dark brown, the ovipositor yellowish horn-colour. Tergal valves of the ovipositor slender, divergent, gently upcurved; sternal valves much higher, compressed, the tips subacute.

Hab. Rhodesia.

Holotype, ♀, Salisbury, Mashonaland (*G. A. K. Marshall*).

Paratopotypes, 3 ♀.

Type in the collection of the British Museum; paratypes in the collections of Cambridge University and the writer.

Dicranomyia fuscopleura, sp. n.

Size very small (wing of male about 4 mm.); antennæ dark brown, the flagellar segments with a short basal pedicel; mesothorax dull brownish yellow, the pleura with a broad, dark brown longitudinal stripe; wings faintly tinged with grey, the stigma brown; vein *Sc* long, cell 1st *M*₂ closed.

Male.—Length about 2·8–3 mm.; wing 3·9–4 mm.

Rostrum and palpi dark brown. Antennæ dark brown, the flagellar segments oval, the intermediate segments with an indistinct basal pedicel. Head dark brown.

Mesonotum dull brownish yellow, the præscutum without distinct stripes. Pleura somewhat brighter yellow, with a broad brown longitudinal stripe extending from the cervical sclerites to the base of the abdomen, passing immediately beneath the base of the halteres. Mesosternum brownish. Halteres long, light brown, the knobs and the end of the stem darker brown. Legs with the coxæ and trochanters dull testaceous yellow; remainder of the legs broken. Wings with a faint grey tinge, the stigma rounded-oval, brown; veins dark brown. Venation: *Sc* long, *Sc*₁ extending to slightly beyond mid-length of the long sector, *Sc*₂ at the tip of *Sc*₁; *r* at the tip of *R*₁, bisecting the stigma; *Rs* long, more than twice the basal deflection of *R*₄₊₅; cell 1st *M*₂ closed, large, longer than vein *M*₃ beyond it; basal deflection of *Cu*₁ just beyond the fork of *M*.

Abdomen dark brown.

Hab. West Africa.

Holotype, ♂, Lonji, about 50 miles north of Kribi, near the Ulou River, Cameroun, altitude about 1000 feet, July 18, 1919.

Dicranomyia fuscopleura is a tiny fly that is readily told from related described species by the size and conspicuously striped thoracic pleura.

Dicranomyia recedens, sp. n.

Antennal scape dark brownish black, the basal flagellar segments yellowish, the remainder of the antennæ dark brown; thorax and abdomen dark brownish black; legs brown, the tarsi pale; wings hyaline, the caudal half darkened, the costal margin with six large dark brown blotches; *Sc* long, *r* some distance from the tip of *R*₁.

Male.—Length 4·8 mm.; wing 5 mm.

Female.—Length 6 mm.; wing 5·7 mm.

Rostrum and palpi dark brown. Antennæ with the scape dark brownish black, the basal flagellar segments yellowish, soon passing into dark brown. Head dark.

Mesothorax dark brownish black, the types mouldy, without distinct markings on the præscutum. Halteres black, only the extreme base of the stem paler. Legs with the coxæ and trochanters blackish; femora brownish, with an indistinct pale subterminal ring; tibiæ brown, the tips

pale brown; tarsi pale brown, only the terminal two or three segments darker brown and somewhat inflated; claws long and slender, with a very long, erect basal tooth and a shorter appressed tooth beyond mid-length. Wings with the cephalic half hyaline, the caudal cells strongly suffused with brownish grey, the membrane with a heavy dark brown pattern including six costal blotches; costal cell largely darkened; cell *Sc* largely pale, traversed by the first, third, and fourth brown blotches; the first of these areas occupies the arculus; the third at the origin of *Rs*, almost reaching vein *M*; the fourth, largest, occupies the end of vein *Sc* and passes through cell 1st *R*₁ to beyond the fork of the sector; the fifth blotch occupies the end of vein *R*₁ and *r*, and attains vein *R*₄₊₅; the last blotch occupies the ends of cells 2nd *R*₁ and *R*₃; slightly paler but broad seams along the cord and outer end of cell 1st *M*₂ and as seams along veins *R*₄₊₅, *M*, and *Cu*; dark clouds at the ends of veins *Cu*₁, *Cu*₂, 1st *A* and 2nd *A*, and in the anal angle of the wing; veins dark brown. Venation: *Sc* very long, *Sc*₂ ending just before the fork of *Rs*, *Sc*₂ at the extreme tip of *Sc*₁, and exceeding it in length; *Rs* long, strongly arcuated at origin; *r* retreated back from the tip of *R*₁, so that *R*₁ beyond *r* is about half again as long as *r*; cell 1st *M*₂ closed; basal deflection of *Cu*₁ before the fork of *M*.

Abdomen dark brown. Male hypopygium rather large and complicated in structure for this genus of flies. Ovipositor with the valves short, the tergal valves slender, strongly upcurved; sternal valves transversely flattened and connected with one another by a membrane.

Hab. West Africa.

Holotype, ♂, Lonji, about 50 miles north of Kribi, near the Ulou River, Cameroun, altitude about 1000 feet, July 17, 1919 (*J. A. Reis*).

Allotopotype, ♀.

This handsome fly is undoubtedly related to *D. recurvans*, Alex. (Los Islands), but is readily told by the wing-pattern and venational details. The two species form a distinct group of the genus, in which *r* is at some distance from the tip of *R*₁, and the female ovipositor shows a peculiar specialized structure. The recently described *D. trigonia* (Edwards) of Sumatra (*Journ. Fed. Malay States Mus.* vol. viii. pt. 3, pp. 15, 16; July 1919) is evidently another member of this peculiar group.

Geranomyia (Geranomyia) mashonica, sp. n.

General coloration brown, the thoracic pleura plumbeous; rostrum yellowish; wings pale subhyaline, the stigma small, rounded-oval, pale brown, vein *Sc* long.

Male.—Length (excluding rostrum) 5 mm.; wing 6.5 mm.; rostrum about 2.3 mm.

Rostrum moderately elongate, light brownish yellow throughout. Antennæ with the scapal segments pale brown, the flagellum darker brown, oval-cylindrical. Head light grey, the genæ more yellowish.

Mesonotum plumbeous brown, possibly discoloured, as there is an irregular median yellowish area on the præscutum. Pleura dark plumbeous. Halteres rather short, pale yellow, the knobs scarcely darker. Legs with the coxæ dark plumbeous; trochanters yellowish brown; remainder of the legs broken. Wings pale yellowish subhyaline; stigma small, rounded-oval, pale brown; veins pale. Venation: *Sc* long, extending to nearly opposite three-fourths the length of *Rs*, *Sc*₂ not far from the tip of *Sc*₁, *Sc*₁ alone being a little shorter than *m*; *r* at the tip of *R*₁; basal deflection of *R*₄₊₅ a little less than one-half the long sector; *r-m* short, less than *m*; cell 1st *M*₂ rather long, the portion of *M*₁₊₂ between *r-m* and *m* being about equal to or a little longer than that portion beyond *m*; basal deflection of *Cu*₁ at the fork of *M*.

Abdomen reddish yellow, especially the broad posterior margins of the tergites. Hypopygium reddish, the ventral pleural appendages long, greatly exceeding the short pleurites; dorsal appendages relatively small, the tip suddenly narrowed and acute.

Hab. Rhodesia.

Holotype, ♂, Salisbury, Mashonaland (*G. A. K. Marshall*). Collector's No. 23.

Type in the collection of the British Museum.

Geranomyia mashonica requires comparison only with *G. maculistigma* (Enderlein) of Madagascar. The latter is a differently coloured fly with the stigma dark brown, the basal deflection of *R*₄₊₅ very short and cell 1st *M*₂ small and subquadrate.

Ceratocheilus flavirostris, sp. n.

Rostrum almost as long as the body, light yellow, the extreme base abruptly blackened; antennæ with the basal

segments light yellowish, the flagellar segments dark brown; general coloration of the body black, the sides of the mesonotal præscutum reddish brown; halteres black; legs with the coxæ black, the apical tarsal segments pale; wings subhyaline with a heavy dark brown pattern; vein R_{2+3} straight, perpendicular to the sector; basal deflection of Cu_1 at about mid-length of cell 1st M_2 .

Male.—Length (excluding rostrum) 6.8 mm.; wing 4.5 mm.; rostrum alone 6 mm.

Rostrum elongate, in the male sex at least, nearly as long as the body, the extreme base brownish black, the remainder of the organ very pale yellow. Antennæ with the enlarged basal segments conspicuously light yellow, the flagellum dark brown, the distal segments provided with very long hairs. Head dark brownish black, possibly discoloured, paler adjoining the inner margin of the eye.

Mesonotal præscutum dark reddish brown, the lateral margins very narrowly paler, the dorso-median area darker; remainder of the mesonotum black. Pleura black. Halteres black. Legs with the coxæ black; trochanters pale testaceous yellow; femora brown, paler at the base; tibiæ and tarsi darker brown, the apical tarsal segments pale whitish brown, the claws reddish. Wings greyish subhyaline, with a heavy dark pattern, arranged as follows: the single dark brown spot is located at Sc_2 , immediately above the origin of R_s ; less intense brown spots on R_{2+3} continued along the cord to the fork of Cu ; a similar but narrower seam at the outer end of cell 1st M_2 ; a very small cloud at the origin of R_s ; a large blotch at the base of M ; large spots in the cells, as follows: two in cell R , the outermost much the larger, subequal in size to the seam on R_{2+3} ; four equidistant marks in cell M , each of these divided into two unequal parts by a longitudinal obliterative streak in this cell; two spots in cell R_3 , the proximal one larger; a large blotch at the end of vein 2nd A , entirely traversing the cell; a small blotch in the middle of cell 1st A ; brown clouds at the ends of veins M_3 , Cu_1 , and Cu_2 ; the apex of the wing in cells R_3 , R_5 , and M_2 milky white; the dark areas on the wing are produced by the concentration of the microscopic setæ which cover the membrane at these points; vein R_1 yellow, the remaining veins dark brown. Venation: Sc_1 ending just beyond the origin of R_s , Sc_2 being almost exactly at this point; R_s evenly and gently arcuate; R_{2+3} perfectly straight and perpendicular to the end of R_s , so that cell R_1 is almost a triangle; cell 1st M_2 closed;

basal deflection of Cu_1 at about mid-length of the lower side of cell 1st M_2 .

Abdomen black, the penultimate segment brighter.

Hab. West Africa.

Holotype, ♂, Lonji, about 50 miles north of Kribi, near the Ulou River, Cameroun, altitude about 1000 feet, July 17, 1919 (*J. A. Reis*).

Paratype, ♂, Grande Bassan, Jonchier, Ivory Coast, 1903 (*R. Blanchard*), in the Paris Museum.

Ceratocheilus flavirostris is readily told by the dark colour of the body, the pale yellow rostrum, and the very heavily spotted wings. The short straight R_{2+3} and the position of the basal deflection of Cu_1 is distinctive of this species.

RHAMPHIDINA, subgen. nov.

Rostrum long and slender, longer than the head. Antennæ with 16 segments. Wings with Sc moderately elongate, ending about opposite mid-length of Rs and not close to R_1 at the wing-margin; Sc_2 at the extreme tip of Sc_1 ; R_{2+3} sinuate, diverging from the almost straight R_{4+5} ; cell 1st M_2 open by the atrophy of M ; basal deflection of Cu_1 before the fork of M .

Type of the subgenus.—*Rhamphidia (Rhamphidina) camerounensis*, sp. n. (Cameroun).

Rhamphidia (Rhamphidina) camerounensis, sp. n.

General coloration dark brown, the thoracic pleura more yellowish; halteres brown; wings hyaline, the stigma pale brown; cell R_1 narrowed before its outer end; cell 1st M_2 open.

Male.—Length about 4.2 mm.; wing 3.8–4 mm.

Rostrum long and slender, longer than the head, dark brown; palpi dark brown. Antennæ dark brown. Head dark brown.

Mesonotum brown, the lateral portions and the pleura dull yellowish testaceous. Halteres dark brown, the stem pale. Legs with the coxæ brownish testaceous; trochanters testaceous; femora dark brown; tibiæ dark brown, the tip and all the tarsi broken. Wings hyaline, the stigma pale brown; veins dark brown. Venation: Sc rather short, Sc_1 ending just beyond mid-length of Rs , Sc_2 at the extreme tip of Sc_1 and exceeding it in length; Rs long, almost straight; R_{2+3} long, gently sinuate; cell R_1 narrowed

before its outer end; cell 1st M_2 open by the atrophy of m ; basal deflection of Cu_1 a short distance before the fork of M , this distance usually a little less than the length of the deflection of Cu_1 alone.

Abdomen dark brown. Male hypopygium with the pleurites rather stout, broad at the base, the inner face set with abundant erect spinous setæ; two pleural appendages, the outer appendage short, heavily chitinized, the tip indistinctly bifid; inner appendage long, broad at the base, suddenly narrowed to the slender curved tip, which bears a single long bristle at its apex; along the cephalic or proximal margin of this appendage at about mid-length a group of about seven stout erect setæ. Gonapophyses appearing as flattened blades whose posterior lateral angle is produced into a long acute point; penis-guard curved at the tip.

Hab. West Africa.

Holotype, ♂, Lonji, about 50 miles north of Kribi, near the Ulou River, altitude about 1000 feet, July 18, 1919 (*J. A. Reis*).

Paratopotype, ♂.

RHAMPHIDIOIDES, subgen. nov.

Rostrum nearly as long as the head. Antennæ with 16 segments, the scapal segments enlarged; flagellar segments slender, with appressed verticils. Legs long and slender; claws simple. Wings with vein Sc long, ending nearly opposite the fork of the long sector, Sc_2 far before the tip of Sc_1 ; Sc_1 and R_1 close together at the wing-margin, the space on costa between them about equal to the basal deflection of Cu_1 ; r lacking; veins R_{2+3} and R_{4+5} strongly divergent at their outer ends, cell R_3 being very broadly trumpet-shaped outwardly; cell 1st M_2 closed; basal deflection of Cu_1 far before the fork of M . Male hypopygium with the pleurites long and slender; two pleural appendages. Ovipositor with the valves very long and slender, the tergal valves especially so.

Type of the subgenus.—*Rhamphidia* (*Rhamphidioides*) *venustissima*, sp. n. (Cameroun).

The habitus of this beautiful little fly is quite unlike typical *Rhamphidia*, and it is probable that the similarity that seems to exist between the two groups will be found to be superficial only when more material is obtained. The legs are long and slender; the wings with Sc very long and close to R_1 at the wing-margin and with Sc_2 far back from

its tip, cell R_3 very wide at the wing-margin, and the basal deflection of Cu_1 before the fork of M all indicate a rather isolated group. *Leiponeura alluaudi*, Riedel, is very probably a member of this subgenus. The biological notes by the collector add another genus and species to the list of spider-web Tipulidæ and, curiously enough, this species, like the others, has white feet.

Rhamphidia (Rhamphidioides) venustissima, sp. n.

Rostrum brown; antennæ with the four basal segments yellow, the remainder of the flagellum dark brown; mesonotum dark brown, the sides of the præscutum yellowish; pleura yellow, spotted with brown; legs dark brown, the tips of the tarsi white; wings subhyaline with a heavy dark brown and grey pattern; basal deflection of Cu_1 before the fork of M ; abdomen yellow, the intermediate segments with two transverse brown bands that produce a close banded appearance.

Male.—Length about 4.3 mm.; wing 3.5 mm.

Female.—Length about 5.3 mm.; wing 3.9 mm.

Rostrum moderately elongated, nearly as long as the head, dark brown; palpi small, yellow basally, the tips brown. Antennæ with the four basal segments bright yellow, the remainder of the flagellum dark brown. Head dark brown.

Pronotum dull yellow. Mesonotal præscutum deep yellow, dark brown medially; remainder of the mesonotum dark brown. Pleura dull yellow, spotted with brown. Halteres dull yellow, the knobs dark brown, a more or less distinct dark brown band beyond the base of the stem. Legs with the fore and middle coxæ marked with brown on their outer faces, the hind coxæ entirely yellow; trochanters brown; femora and tibiæ dark brown, the extreme base and tip of the latter pale; tarsi with the metatarsi dark brown, on the outer half passing into creamy white; remainder of the tarsi creamy white. Wings subhyaline with a heavy dark brown pattern, consisting of five large radial blotches; a sparse grey clouding in the posterior cells; cell C yellow, unmarked except for the narrow seam at h ; subcostal cell yellow, dark brown at the base and tip, and at Sc_2 ; the five dark brown areas are as follows: at arculus; at the origin of R_s , extending completely across cell R ; the stigmal blotch, extending to cell 1st M_2 ; a large area at the end of vein R_{2+3} extending caudad to vein R_{4+5} ; end of cell R_3 ; the grey seams in the posterior cells include the remainder

of the cord; cell 1st M_2 ; in the ends of the anal cells; in the end of cell Cu_1 and very faintly across the posterior cells in alignment with the fourth and fifth radial blotches described above; veins C , Sc , and R yellow; remaining veins dark brown. Venation: Sc_2 retracted far back from the tip of Sc_1 , lying about midway between the origin of R_s and the tip of Sc_1 ; R_s long, arcuated at origin; cell R_3 very wide at the wing-margin; basal deflection of Cu_1 some distance before the fork of M , in some specimens this distance being greater than the deflection of Cu_1 , in others less.

Abdominal tergites yellow, the intermediate segments with two broad brown cross-bands, one basal, the other postmedial, about equal in width to the yellow apices and much broader than the yellow band between them; the first segment has only the apical yellow band; the apical segments are uniformly darkened; sternites similar to the tergites, but the brown markings less clear-cut. Male hypopygium with the pleurites very long and slender, narrowed to the tip; pleural appendages two, the outermost slender, arcuated, chitinized; inner appendage longer, stout at the base, narrowed to the tip which is slightly expanded. Gonapophyses in the form of flattened yellow curved hooks that are acutely pointed at their tips. Ovipositor with the tergal valves exceedingly long and slender, slightly upcurved at their tips; sternal valves long, the tips acutely pointed.

Hab. West Africa.

Holotype, ♂, Lonji, about 50 miles north of Kribi, near the Ulou River, Cameroun, altitude about 1000 feet, July 17, 1919 (*J. A. Reis*).

Allotopotype, ♀.

Paratopotype, ♂.

"Resting on spider-webs in between the roots of trees."

Paratropeza (Gymnastes) teucholaboides, sp. n.

General coloration black, two spots on the vertex, the dorso-pleural membranes of the thorax and the apices of the halteres yellow; femora with the tips swollen, black, with a narrow subapical yellow ring; wings dark brown, the base and two narrow cross-bands hyaline.

Male.—Length about 4.7 mm.; wing 5 mm.

Female.—Length 6 mm.; wing 5.6 mm.

Rostrum and palpi black. Antennæ black, the flagellar segments oval. Head black, the anterior part of the vertex silvery pruinose and with a large yellowish spot at the inner

margin of the eye, these marks but narrowly separated by a capillary median brown line.

Prothorax black. Mesothorax black, the dorso-thoracic membranes light sulphur-yellow. Halteres black, the tips of the knobs conspicuously yellow. Legs with the coxæ and trochanters black; femora dark brown, the tips broadly swollen and blackened, immediately before the enlargement with a narrow yellow ring; tibiæ brown, the tips broadly blackened; tarsi dark brown, the base of the metatarsus yellow, this broadest on the hind legs. Wings narrow, dark brown; base of the wing and two narrow cross-bands pale, the first of these cross-bands before the cord, the second just beyond the outer end of cell 1st M_2 . Venation: *Sc* ending just before mid-length of *Rs*; only the extreme base of R_2 preserved, and this in alignment with the subatrophied *r* so as to appear as a single weak cross-vein; *r-m* connecting with *Rs* before its symmetrical fork; cell 1st M_2 long and narrow, broadened outwardly, the basal deflection of Cu_1 about at the fork of *M*.

Abdomen black, in the male with the posterior margins of the tergites very narrowly and indistinctly yellow. Ovipositor horn-coloured, the valves rather long and slender.

Hab. Rhodesia (Melsetter District).

Holotype, ♂, Chirinda Forest, October 1905 (G. A. K. Marshall).

Allotopotype, ♀.

Type in the collection of the British Museum.

By means of the existing keys, *Paratropeza teucholaboides* would run to the genus *Teucholabis*, Osten-Sacken, but a comparison with certain Oriental species of *Paratropeza*, such as *P. ornatipennis* (de Meijere) and *P. flavitibia*, Alexander, convinces me that we have here to do with a highly specialized member of *Paratropeza*, which gives us a distinct clue as to the manner in which the reduced radial venation of *Teucholabis* has been evolved. This is produced by the atrophy of the tip of R_2 beyond the radial cross-vein and the straightening out of the base of R_2 into alignment with *r*. In the Oriental species of *Paratropeza*, including *P. pictipennis* (Edwards), in addition to the two species mentioned above, the tip of R_2 is preserved, but the entire branch is small, nearly vertical in position and often with the radial cross-vein inserted near the middle of its length. It may become necessary to relegate *Paratropeza* to subgeneric rank under *Teucholabis*, giving us a case entirely comparable to *Gonomyia* and its reduced subgenus *Leiponeura*.

Trentepohlia (Trentepohlia) fuscoapicalis, sp. n.

General coloration dark brown, the thoracic pleura and abdominal sternites dull yellow; tarsi and most of the tibiæ whitish; wings greyish subhyaline, the wing-tip dark brown; petiole of cell R_5 nearly one-half the length of this cell.

Male.—Length 5.2 mm.; wing 4.8 mm.

Rostrum yellow; palpi dark brown. Antennæ dark brown, unusually long for a member of this genus, if bent backward extending beyond the wing-base; verticils long, especially a single verticil on each segment, arranged in a single second row. Head dark brown, brighter on the occiput.

Mesonotal præscutum dull brownish yellow, dark brown medially; remainder of the mesonotum dark brown. Pleura dull brownish yellow. Halteres short, dark brown. Legs with the coxæ and trochanters dull yellow; femora pale brown; tibiæ similar, soon passing into white; tarsi white; femora with three short black spines near the base, these possibly lacking on the posterior femora which are concealed in the type. Wings greyish subhyaline, the wing-tip and narrow seams along the veins dark brown; stigma scarcely darker than the wing-tip; costal and subcostal cells, the stigma, cell 2nd R_1 , all of R_2 , the outer third of R_3 , and the tip of R_5 darkened; narrow brown seams along all the radial veins, along M_{1+2} , and on Cu and its branches; veins dark brown. Venation: R_{2+3} beyond r a little shorter than r alone, and about one-third to one-fourth the length of R_2 ; petiole of cell R_5 between one-third and one-half the length of this cell and considerably longer than the basal deflection of R_{4+5} .

Abdominal tergites uniformly dark brown, the sternites dull yellowish.

Hab. West Africa.

Holotype, ♂, Lonji, about 50 miles north of Kribi, near the Ulou River, Cameroun, altitude about 1000 feet, July 17, 1919 (*J. A. Reis*).

Trentepohlia fuscoapicalis is a small species of the subgenus that is apparently closest to *T. curtispennis* (Speis.), likewise from Cameroun. This latter species is rust-yellow with the abdominal segments narrowly ringed with brown; the wings with a large brownish-yellow stigma and with the apex suffused with yellowish.

Tipula mashona, sp. n.

Belongs to the *oleracea* group; close to *T. soror*, Wiedemann; antennal flagellum dark brown; general coloration grey, the præscutum with three pale stripes that are margined with dark brown, the median stripe split by a dark brown line.

Male.—Length about 21 mm.; wing 20 mm.

Rostrum light grey above, the sides brown; nasus with long yellow hairs. Antennæ with the first and second segments pale brownish yellow, sparsely grey-pruinose, third segment yellowish brown, darker at the end, remaining segments dark brown, the basal swelling moderately prominent. Head light grey.

Mesonotal præscutum grey with three indistinct greyish stripes that are distinctly margined with dark brown, the median stripe split by a double capillary brown line; lateral stripes with the brown margins becoming obliterated on the lateral side; scutum grey, the lobes with brown markings anteriorly; remainder of the notum light grey. Pleura pale, light grey-pruinose, the dorso-pleural membranes dull buffy yellow. Halteres long, the knobs dark brown. Legs with the coxæ yellowish, the mesocoxæ and metacoxæ sparsely grey-pruinose; trochanters dull brownish yellow; femora brown, the tips darker; tibiæ pale brown, the tips narrowly darkened; tarsi long, dark brown, the base of the metatarsi a little paler. Wings pale grey, the costal region brown, including cells *C*, *Sc*, 1st *R*₁, and 2nd *R*₁; a broad subhyaline streak, including most of cell *R*, the anterior portion of *M*, the base of *R*₃ and almost all of *R*₅; a brown seam along *Cu*. Venation: cell *R*₂ small, narrow at the base, *R*₃ almost in alignment with *R*₂₊₃.

Abdomen discoloured; the tergites apparently dark brown with a distinct blackish sublateral mark on either side, the lateral margins broadly pale. Hypopygium pale. Male hypopygium with the ninth tergite about as in *T. soror*, broad and flattened; the caudal margin with a broad median lobe that is feebly notched medially, the lobes roughened and with the outer angle a little produced, smooth; viewed caudally, each of these lobes is seen to be produced ventrally into a flattened blade whose caudal margin is densely covered with blackened spinules. The pleural appendages are almost as in *T. soror*. Ninth sternite strongly carinate, the dorsal inner angle with a dense tuft of yellowish hairs directed inward. Eighth sternite unarmed.

Hab. Rhodesia.

Holotype, ♂, Salisbury, Mashonaland, March 1905 (G. A. K. Marshall).

Type in the collection of the British Museum.

Tipula mashona is very closely allied to *T. soror*, Wiedemann, but may be distinguished by the dark brown antennal flagellum, the clear grey coloration of the head and thorax, and other characters.

Nephrotoma mossambica, sp. n.

Close to *N. unicingulata*, Alexander; præscutal stripes very broad, confluent or nearly so; legs brownish black, the femoral bases paler; wings with the apical cells sparsely pubescent, *Rs* short and straight; abdominal tergites one to five with a black median mark, segments six to eight ringed with black.

Male.—Length about 13 mm.; wing 15 mm.

Female.—Length about 18 mm.; wing 16 mm.

Frontal prolongation of the head dull yellow; nasus long and slender. Palpi pale brown. Antennal scape orange; flagellum black; antennæ moderately elongate, if bent backward, extending about to the base of the abdomen. Head orange, the occipital mark elongate, dull brown.

Pronotum light yellow. Mesonotal præscutum pale whitish yellow with three very broad black stripes that are almost confluent, the humeral angles of the ground-colour; scutum black with only a narrow yellowish median line; scutellum brownish testaceous; postnotum yellow with about the posterior two-fifths brownish testaceous. Pleura whitish, indistinctly marked with yellowish. Halteres brown, the knobs yellowish. Legs with the coxæ and trochanters pale yellowish; femora dark brownish black with the base paler, more brownish, this narrowest on the fore legs, more extensive on the hind legs; remainder of the legs dark brownish black, less intense on the basal half of the tibiæ. Wings with a strong brownish-yellow tinge, the wing-apex passing into brown; cell *Sc* yellowish brown; stigma dark brown; an indistinct brown seam along the cord extending to cell 1st *M*₂; veins dark brown. Apices of cells *R*₃, *R*₅, and *M*₁ sparsely pubescent. Venation as in *N. unicingulata*, but *Rs* shorter and straighter, almost in alignment with the deflection of *R*₄₊₅; cell *M*₁ more broadly sessile.

Abdominal tergites orange-yellow, the first tergite largely black; tergite two with a linear black mark on the basal half and a similar mark on the apical half; segments three

to five each with a similar mark occupying the apical two-thirds of the segment; segments six to eight with a conspicuous black ring as in *N. unicingulata*, this including all of segments six to eight excepting the basal half of the sixth sternite, which is orange; sternites unmarked. Hypopygium reddish orange; ninth tergite with a broad, rounded posterior notch; outer pleural appendage tapering to a long point.

The female is generally similar to the male, but the occipital mark is less distinct, the præscutal stripes confluent, the scutellum and posterior margin of the postnotum darker brown, the pleural markings darker. The tergal valves of the ovipositor are long and straight.

Hab. Rhodesia (Merset District).

Holotype, ♂, Chirinda Forest, October 1905 (G. A. K. Marshall).

Allotopotype, ♀.

Type in the collection of the British Museum.

Nephrotoma mossambica is closely related to *N. unicingulata*, Alexander (Transvaal to Cape Colony), in the cingulated abdomen and the apically pubescent wings. It is readily told by the much more extensive black areas on the mesonotum, the darker legs, the darker wings with the sector short and straight, and by the narrow black markings on abdominal tergites one to six.

XLVIII.—*Notes on certain British Freshwater Entomostraca.*

By ROBERT GURNEY, M.A.

THE following notes refer to a few species taken during the past summer, mainly in Norfolk, some of which have not previously been found in Britain :—

1. *Chirocephalus diaphanus* (Prevost) *.

On Sept. 12, 1919, I found a number of specimens of the Fairy Shrimp in a small pool on Bratley Heath by the

* Daday, in his "Monograph of the Phyllopora Anostraca" (Ann. Sci. Nat. xi. 1910, p. 206), adopts the specific name *stagnalis*, Shaw. As a matter of fact, Shaw is antedated by King (1767), but in either case the name is inadmissible for this species under Article 31 of the Rules of Nomenclature (see Int. Rev. Hydrob., Suppl. vi. 1914, Heft 2). Had it not been so, there would be three species in closely-allied genera to all of which the same specific name might be attached. Fortunately, only one of them (*Tanymastix stagnalis*, Linn.) can properly claim that name.

Lyndhurst-Ringwood road. There are several small ponds along this road within a short distance of each other, but this one alone contained the *Chirocephalus*. All the ponds have a gravel bottom covered with grassy weed, and the only respect in which the pond in question differed from the others was in the presence of a thick growth of *Polygonum hydropiper*. None contained Cladocera of any kind, but, whereas the other ponds examined produced only *Diaptomus castor* and *Cypris virens*, the *Chirocephalus* was accompanied by *Cyclops agilis* and *C. vicinus*, *Diaptomus vulgaris*, and *Cyprinotus incongruens*.

The first record of the occurrence of *Chirocephalus diaphanus* in Britain is that of King, who found it near Norwich in 1762. Baird, in 1850, was able to give several records of its occurrence, and in 1862 it was found by Mr. A. Brady at Tillmire, near York. From that date till 1891 it was apparently not met with, but since then it has been seen in about twenty places, nearly all in the South of England. It is possible that the absence of records of the occurrence of *Chirocephalus* (with the exception of that of 1862) from 1850 till 1891 may be due to lack of search for it, but it seems more probable that it actually disappeared in the same way as *Apus cancriformis* became extinct. The latter appeared again in 1907, but did not establish itself; whereas it seems that *Chirocephalus diaphanus* has not only re-established itself, but is becoming comparatively common.

Its most northern locality in England corresponds almost exactly with its northern limit (50° N. lat.) in Europe, and its range extends South to the maritime regions of Algeria and Tunisia. It does not, so far as I know, occur in the Hauts Plateaux of Algeria or at Biskra. Daday quotes my authority for its occurrence at Biskra, but this is an error on his part, as the only species found there by me was *Branchipus pisciformis*, Schaeffer.

Chirocephalus diaphanus ranges in size from 37 mm. down to 12 mm., and Simon * states that there are two distinct races—a large and a small—which do not intermingle. My specimens from Bratley Heath, though fully mature, measure only about 16 mm., but much larger specimens occur in this country. I have a female, taken in Cornwall, of 30 mm., and Mr. Scourfield informs me that he has one from Christchurch nearly 34 mm. long, though the largest specimens from Claygate do not exceed 19 mm. Both races are recorded by Simon from North Africa, and I have

* Ann. Soc. Entom. France, ser. 6, vi. 1886, p. 397.

found the large race (exceeding 20 mm.) the commoner in Tunisia; but on one occasion the specimens taken in a small rain-pool near Tunis included both large and small individuals, and were separable into three groups. Out of 15 males measured, 12 ranged from 24 to 22 mm., two were intermediate (19 and 16 mm.), and one very small (12 mm.). The species is found both in muddy temporary pools—such as cart-tracks at Claygate—and also in clear, weedy water as on Bratley Heath. Brauer gives it as an example of a Branchipod of clear water, associated commonly with *Lepidurus apus*, as compared with *Branchipus pisciformis*, Schaeff., which is found in muddy places in company with *Apus cancriformis*; but this distinction does not hold good in my experience, since in Tunisia it was generally found in muddy pools, and more than once in company with *Apus cancriformis*. Brauer has also pointed out that the association with *Apus* and *Estheria* is of direct benefit to the Branchipods, since *Apus* and *Estheria* stir up the mud and so distribute food. It seems to me that there is no dimorphism in the case of *C. diaphanus*, but that the size of the individuals depends on the conditions of existence, the larger form being generally found in muddy places rich in food and the smaller in clear water.

In France, where *C. diaphanus* is common, it appears first in March, and commonly disappears in summer owing to the drying up of the pools. In this country it has been recorded in almost every month in the year, but Mr. H. J. Waddington's observations* show that, near Christchurch, it appears between January and March, disappears in summer, and reappears again for a time in autumn. The notes which Mr. Lucas has kindly sent me of its occurrences at Claygate seem to prove the same kind of cycle, but I do not think that the history of any colony has ever been completely followed throughout the year. The eggs of *C. diaphanus*, unlike those of most other Phyllopod, do not require to be dried before developing, though they can, of course, resist desiccation. Brauer states that, when they remain in water after being laid, they have a resting period of some months; and the individuals appearing in autumn would, therefore, be derived from the eggs laid in spring. On the other hand, Shaw, who gave an interesting account of his observations†, states that eggs laid by a female isolated in an aquarium hatch in about a fortnight; and it seems that further

* Journ. R. Mic. Soc. 1913, pp. 250-254.

† Trans. Linn. Soc. i. 1791, pp. 103-110.

investigation of the life-history of this, our only remaining British Phyllopod, are required.

CLADOCERA.

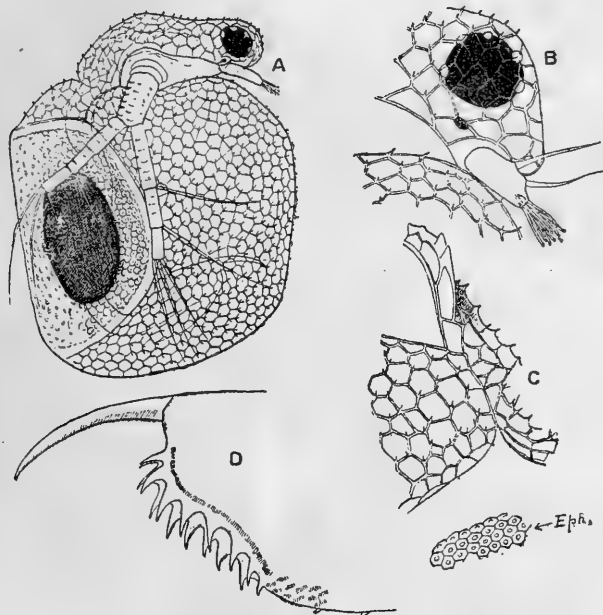
The two species mentioned below were both found during August and September 1919 on East Ruston Common, three miles north-west of Stalham, in East Norfolk. At the spot where I have made my collections the marsh is crossed by a road at its narrowest part, and on the south of the road is a bog which is always under water. There is a rich vegetation of the usual fen type, with a dense growth of Hypnum below the water, with which is mingled *Utricularia minor* and *intermedia*. The presence of Chara in a pool in the marsh indicates a calcareous water. The Entomostracan fauna is of remarkable richness, and differs in several respects from that of any waters with which I am acquainted. Twenty-four species of Cladocera and twenty of Copepoda have been found in a small space of a few square yards, besides several Ostracoda; while some of the species are extremely rare in other parts of the district, but occur here in considerable numbers—for example, *Metacypris cordata*, *Cypris fasciata*, *Candona euplectella*, *Cyclops nanus*, and *Canthocamptus northumbicus*. The two species, *Ceriodaphnia setosa* and *Kurzia latissima*, were found only in this one small spot and not elsewhere in the marsh.

2. *Ceriodaphnia setosa*, Matile. (Fig. 1.)

A few specimens of this peculiar *Ceriodaphnia* were found in a collection made on Aug. 26 in moss under a depth of about six inches of water. I returned to the spot two days later with the intention of obtaining more material, but was again rewarded only by a very few individuals in spite of exhaustive search, and was not able to ascertain in what kind of situation it was living. Its almost entire absence from collections made in the clear open water seems to show that it lives actually among the moss, whereas *C. laticaudata*, which was also present at the same time, was commoner in the open water. *C. setosa* is a sluggish swimmer, and is easily distinguishable from the usual red form of *C. laticaudata* by its whitish colour faintly tinged with rose; but this character is not altogether distinctive, since I have found *C. laticaudata* in abundance in a similar situation at Sutton Broad, every individual being of exactly the same colour as *C. setosa*. In fact, I supposed at the time that I had found a new habitat for the latter.

C. setosa is characterized by the presence of small spines all over the body, these spines springing from every node of the conspicuous reticulations of the shell and head. Lilljeborg states that, in the male, they do not arise from the nodes only, but I have not found any difference between the sexes in this respect. Similar spines are described in *C. echinata*, Moniez, and in *C. acanthina*, Ross, but in the former the postabdomen is even broader than that of

Fig. 1.

*Ceriodaphnia setosa.*

- A. Ephippial female.
- B. Head of male.
- C. Fornix and margin of ephippium of female.
- D. Postabdomen of female.

C. laticaudata, and in the latter the front of the head is said to be smooth, while the postabdominal claws are denticulate.

The ephippium is marked off from the valves by a broad, clear space which is free from reticulations, and the ephippium itself is covered with small reticulations, each with a small knob or boss in the centre, but with no spines.

The first pair of antennæ of the female are longer and more slender than in *C. laticaudata*, and the postabdomen is not so broad. The male is readily distinguished by the protuberance of the rostral region of the head.

So far as I am aware, *C. setosa*, which was first described in 1890 from specimens taken in the neighbourhood of Moscow, has since that time only been recorded from Sweden and from Plön, in Holstein. Prof. Lilljeborg states that it is very rare in Sweden, though widely distributed, being found in places with rich vegetation, particularly Lemna, in company with *C. laticaudata* and *C. rotunda*. The latter has never been found in this country since 1850, when Baird described it in his 'Natural History of British Entomostraca,' and it is very probable that his description refers to *C. laticaudata*.

3. *Kurzia latissima*, Kurz.

This species was found for the first time on Aug. 26, and was common on that day in a small patch of Hypnum, which reached to the surface of the water. This patch was little more than a yard in diameter, and the *Kurzia* were almost confined to it, since none were found in the surrounding marsh. On subsequent days occasional specimens were taken in the neighbourhood of this spot, but the species rapidly decreased in numbers, and only two individuals were found on Oct. 7 in spite of assiduous search.

Kurzia latissima is a rare species, but has an extremely wide range, being recorded from Sweden, Bohemia, Russia, Switzerland, Brandenburg, Central Asia, United States, Paraguay, Brazil, and Argentina. It is readily distinguishable by its broad outline and its very narrow postabdomen. The ephippial area is not marked off from the rest of the shell by a "line of weakness," but is dark brown in colour and marked with fine brown dots. The male differs little from the female either in shape of shell or of postabdomen.

COPEPODA.

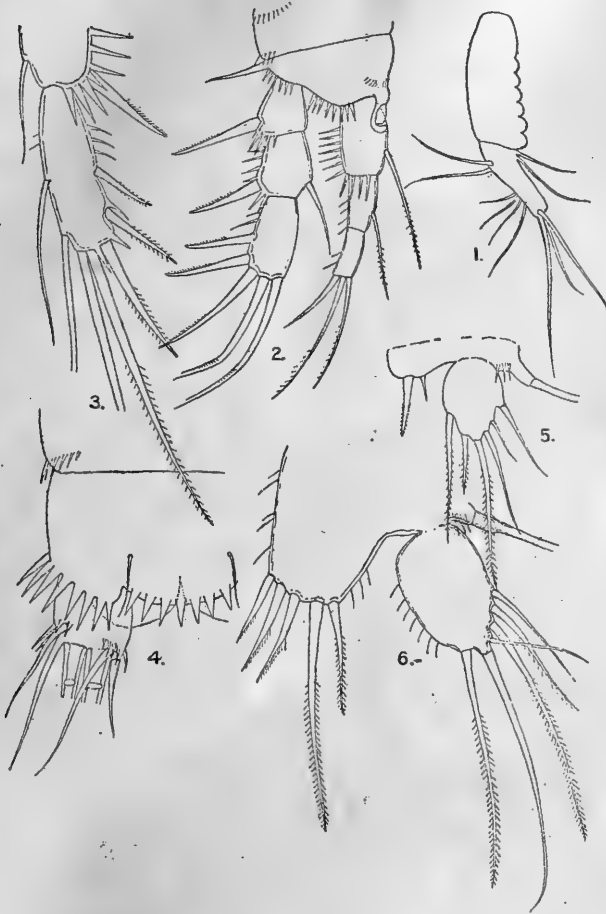
4. *Nitocra simplex*, Schmeil. (Fig. 2.)

Syn. *N. mulleri*, Van Douwe, Zool. Anz. xxviii. 1905, p. 434.

Nitocra hibernica (Brady) is widely distributed in the Norfolk Broads, both in those which are quite fresh and also in the rather brackish waters of the Hickling region; and *N. spinipes*, Boeck, is also found, though rarely, in the

estuarine region of the rivers and near the coast. This year I have found *N. simplex*, Schmeil, also in Horsey Mere and

Fig. 2.



Nitocra simplex.

1. First antenna of male, last two joints.
2. First leg of male.
3. Third leg of female, last joint of external branch.
4. Furca and operculum of male.
5. Fifth foot of male.
6. Fifth foot of female.

Hickling Broad, but I have only met with it in decayed stems of *Typha angustifolia* when searching for *Horsiella*

brevicornis (Van Douwe). It occurs in these stems in fair numbers, and can generally be distinguished from *N. hibernica*, with which it is associated, by its smaller size and absence of brown markings. This distinction in colour does not always hold good, since, on the one hand, Van Douwe notes strong pigmentation in his examples, and, on the other hand, *N. hibernica* may sometimes be quite colourless. Structurally *N. simplex* is most closely allied to *N. spinipes*, Boeck *, but differs from it in the structure of the first and fifth feet and of the prehensile antenna of the male. The penultimate joint of the latter in *N. simplex* has a series of small knobs along its inner edge, which are not found in any other species of the genus. In some males of *N. hibernica* this joint has a few cuticular ridges, which indicate an approach to the condition found in *N. simplex*.

Nitocra simplex appears to be confined to waters in which there is an appreciable quantity of salt present. Schmeil found it in Holstein, in water having a salinity of $\cdot 5\%$, while Thienemann † records its occurrence in water with a salt content of about 2.5 grm. per litre. In Hickling and in Horsey Mere the salinity varies between 40 and 70 grains per gallon. I have found specimens in a collection made in 1899 at Cley, in Norfolk, in a ditch close to the sea in which the water was probably slightly brackish, though it contained otherwise only freshwater Entomostraca.

The genus *Nitocra* seems to be characteristically marine, and *N. simplex* holds an intermediate position between such species as *N. spinipes* which is found only in water of high salinity and *N. hibernica* which is a genuine freshwater species.

5. *Mesochra rapiens* (Schmeil).

Apsteinia rapiens, Schmeil, Zeits. Naturw. lxxvii. 1894, p. 348.

Canthocamptus hirticornis, Scott, 13th Ann. Rep. Scottish F. B. 1895, p. 251.

Canthocamptus megalops, Lilljeborg, K. Sv.-Ak. Handl. xxxvi. 1902, p. 30.

Apsteinia rapiens, Van Douwe, Deutsch. Susswasserfauna, 1909, p. 61.

Mesochra hirticornis, Sars, Crust. of Norway, v. 1911, p. 210.

The identity of *C. megalops*, Lillj., with *Mesochra hirticornis* has already been pointed out by Dr. Scott and accepted by Prof. Sars, but a comparison of the description of Schmeil and the figures given by Van Douwe of *Apsteinia rapiens*

* I refer to *N. spinipes*, as described by Sars (Crust. of Norway, v. p. 213). With this species *N. palustris* (Brady) is synonymous.

† Verh. Deutsch. Zool. Ges. Vers. xxiii. 1913.

with Dr. Scott's description and figures of *C. hirticornis* leaves no doubt that both were dealing with the same species. As Schmeil's name has priority, it is unfortunate that the specific name of *hirticornis* must give way to that of *rapiens*. Prof. Sars is undoubtedly right in including the species in the genus *Mesochra*.

Mesochra rapiens is fairly common in the Norfolk Broads, where the salinity is high (e. g., Hickling and Horsey), and I have also found it at Flordon Common, near Norwich. The water there is perfectly "fresh," but is highly calcareous, and my specimens were found in greyish calcareous mud, covered only by a mere film of water. It occurs also in Oulton Broad, in Suffolk, since a slide in Dr. Brady's collection, labelled "*Canthocamptus palustris*, Oulton Broad," contains, besides several *C. palustris*, also two specimens of *Mesochra rapiens* and one of *Tachidius littoralis*, Poppe. This slide was probably made before the year 1880.

M. rapiens has been found by Dr. Scott in various parts of Scotland (Outer Hebrides, Loch Tarbert, Forth District, Loch Lomond, and R. Ythan, Aberdeenshire), often in brackish water and always not far from the sea. In the Baltic it has been recorded from Colberg by Schmeil in water of a salinity of $\cdot 5\%$, and by Lilljeborg from the Baltic coast and from the Ekoln branch of Lake Mälaren in fresh water. Prof. Lilljeborg suggests that it may be regarded as a relict in Lake Mälaren of a former extension of the Baltic. The Ekoln is known to contain other Crustacea which are supposed to be relicts of such former extensions*. In Norway the species has only been taken in a brackish pool in the South.

6. *Tachidius brevicornis*, Lillj., in fresh water.

Mr. Scourfield † has drawn attention to the small pools of water which collect at the roots and in holes in trees as the habitat of Entomostraca, and has described a new species, *Moraria arboricola*, which inhabits such pools in Epping Forest. In Epping Forest the pollarding of the oaks has provided innumerable water-holes, but I found, during a visit to the New Forest in August 1919, that the only collections of water there were in beech-trees, either at the roots or in the hollow in the fork between two main branches, though there were other holes which had at one time contained water, but were then dry. *Moraria arboricola* proved to be common, occurring in the majority of the pools,

* Ekman, Zool. Stud. tillägn. T. Tullberg, 1907.

† Journ. Quekett Mic. Club, (2) xii, 1915, p. 431.

but my experience was that Entomostraca seldom occurred in those pools in which the water was foul from decaying leaves. Generally, however, the water is very pure, and a kind of fine peat is deposited by slow decay of the leaves, as has been described by Picado*. Contrary to Mr. Scourfield's experience, I found other species, both of Cladocera and of Copepoda, in these holes, though *M. arboricola* was the only species met with as a rule. For instance, in one hole the following species were found, in addition to *M. arboricola*:—*Alona affinis*, *Chydorus ovalis*, *Chydorus sphaericus*, and *Canthocamptus pygmæus*, while another large hole contained only *C. pygmæus* in abundance. On one occasion a few specimens of *Candona pratensis*, Hartw., were met with in a hole near Burley †.

The most remarkable discovery, however, was made in a pool at the root of a beech-tree at Burley. In this pool were a number of *M. arboricola*, and among them were three specimens of *Tachidius brevicornis*, Lillj.—two young and an egg-bearing female. The occurrence of this littoral and brackish-water species in such a situation is extraordinary and unaccountable, since the water in these holes must be pure rain water, and Burley is over six miles from the sea. In the East Norfolk rivers, where there is a mingling of marine forms with those from fresh water, *T. brevicornis* has never been found beyond the reach of salt water, though *T. littoralis*, Poppe, penetrates sometimes into quite fresh water. No chemical analysis of the water in these tree-holes has been made, but it is possible that it may become rather highly concentrated by evaporation without drainage. That is a question which might be worth investigation.

XLIX.—On Neotropical Bats of the Genus *Eptesicus*.

By OLDFIELD THOMAS.

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THE Neotropical species of the widely-spread genus *Eptesicus* are almost all members of the group of which "*E. hilairei*" (using for the moment the name best known for it) is typical—small delicately built bats quite different from the large heavily built *E. fuscus* of North America. The group represented by the latter, however, not only goes into Central

* Bull. Sci. France Belgique, (7) xlvii. 1913, pp. 215–360.

† E. Simon, Ann. Soc. Entom. France, (6) vi. 1886, p. 415, alludes to the occurrence of *Tanytastix stagnalis*, Linn., in hollows in tree-roots.

America in the form known as *E. f. miradorensis*, but I am now able to record its presence as far into S. America as Merida, Venezuela, whence comes a bat which I may commence by describing.

Eptesicus fuscus pelliceus, subsp. n.

General characters very much as in *E. f. miradorensis*, All., of Mexico and Central America, but fur decidedly longer. Colour quite as in Guatemalan *miradorensis*, the dorsal hairs blackish for four-fifths their length, their ends glossy cinnamon; underneath paler, the ends dull buffy whitish. Hairs of back about 9 mm. in length.

Skull about as in *miradorensis*.

Dimensions of the type (measured on skin):—

Forearm 54 mm.

Third finger, metacarpus 50, first phalanx 19.5.

Skull: palato-sinual length 8.6; interorbital breadth 4.3; front of canine to back of m^3 7.5; front of p^4 to back of m^2 5.2.

Hab. Heights near Merida, Venezuela. Type from La Culata. Alt. 4000 m.

Type. Old female. B.M. no. 98. 7. 1. 28. Collected 20th June, 1897, by S. Briceño. One specimen only.

Turning now to the true lightly built S.-American species, there is a considerably larger number of names to be reckoned with than has hitherto appeared, as I find no less than fourteen described from different parts of the continent, some of these having been wholly neglected by modern writers. Indeed, the earliest one of all, *brasiliensis*, Desm., 1819, seems never to have been used, but should evidently supersede *hilarii*, I. Geoffr., 1824, for the comparatively large dark-coloured Brazilian species, with which it is probable that *derasus*, Burm., 1854, *arctoides* and *nitens*, Wagn., 1855, and *arge*, Cope, 1889, are all synonymous. Then it seems evident that *dorianus*, Dobs., 1885 (Misiones), is synonymous with *furinalis*, D'Orb., 1847 (Corrientes), with forearm 37–38 mm., while for the pale Ecuadorean and N. Peruvian coast-species I fear that *innocuius*, Gerv., 1841 (Amotape, Piura), will have to supersede *espadæ*, Cabrera, 1901 (Babahoyo). *E. melanopterus*, Jent., 1904, would be the name for the Guianan species (forearm 37–40 mm.), to which *chapmani*, Allen, 1915, is likely to be nearly related. Then *andinus*, Allen, 1915, would be the highly suitable name for a dark-coloured species which ranges down the Andean chain from N. Colombia to Peru, our most southern examples coming from Chanchamayo.

To this the following new Central-American form would seem to be most nearly related:—

Eptesicus chiriquinus, sp. n.

Allied to *E. andinus*, but with longer forearm and legs and fluffier fur.

Size, as gauged by skull, not exceeding that of *E. andinus*, but the forearm and legs are materially longer and the length of the trunk, as given by collector, is greater. Fur long, soft, fine and rather woolly, more so than in the rather straight-haired *andinus*; hairs of back about 8 mm. in length. General colour blackish brown, the lighter ends to the hairs of the posterior back short and little conspicuous. Under surface practically as dark as upper, therefore darker than in *andinus*. Membranes black throughout.

Skull about as in *andinus*, though the supraorbital edges are more sharply angular. Canines of normal slenderness, while in *andinus* they seem to be always comparatively short and broadly conical; but how far the difference may be an effect of wear I cannot be sure.

Dimensions of the type (the italicized measurements taken in flesh by collector):—

Forearm 46·5 mm.

Head and body 70; tail 50; ear 14. Third finger, metacarpus 43; first phalanx 16·5; lower leg and hind foot (c. u.) 28.

Skull, greatest length 16·2; zygomatic breadth 11·1; intertemporal breadth 4; breadth of brain-case 7·8; palatosinual length 7; front of canine to back of m^3 6·3; front of p^4 to back of m^2 4·2.

Hab. Chiriqui. Type from Boquete. Alt. 4000'.

Type. Adult male. B.M. no. 3. 3. 3. 1. Original number 90. Collected 6th April, 1902, by H. J. Watson. Presented by Oldfield Thomas.

This species is recognizable by its long forearm and legs as compared with *E. andinus* of Colombia. *E. propinquus*, Peters, with which Mr. Osgood has shown *E. gaumeri*, Allen, to be synonymous, is also characterized by its much paler under surface and smaller teeth. The only other Central-American *Eptesicus* is *E. fuscus miradorensis*, a member of the quite different *serotinus* group.

Next we may take two closely allied species characterized by their large rounded and swollen skulls, very different from the rather low flattened skulls of the S.-American species hitherto known:—

Eptesicus montosus, sp. n.

A small *Eptesicus* with swollen and rounded skull.

Size about as in *E. brasiliensis*. Fur very long and fine, hairs of back about 9 mm. in length. General colour blackish brown, lightened on the posterior back by the Prout's brown of the tips of the hairs. Under surface also brown, the tips of the hairs paler brown. Ears and tragus apparently as in *brasiliensis*.

Skull, as compared with that of *brasiliensis*, conspicuously more swollen, higher in the brain-case, with much broader and quite unridged interorbital region, the whole skull less flattened and less ridged.

Molars apparently rather narrower transversely than in *brasiliensis*, their longitudinal diameter about the same.

Dimensions of the type:—

Forearm 43 mm.

Head and body 55; tail 43; third finger, metacarpus 40; first phalanx 13; lower leg and hind foot (c. u.) 26.

Skull: greatest length 15.6; condylo-basal length 15.2; basi-sinual length 12; zygomatic breadth 10.3; interorbital breadth 4.2; breadth of brain-case 8; vertical height, including bullæ, 7.6; palato-sinual length 6.2; front of canine to back of m^3 6; front of p^3 to back of m^2 4.

Hab. (of type). Choro, north of Cochabamba, Highlands of Bolivia, on the upper waters of the R. Mamoré. Alt. 3600 m.

Type. Adult male skin and skull. B.M. no. 2.1.1.1. Original number 1433. Collected 8th May, 1901, by P. O. Simons. Presented by Oldfield Thomas.

"Native name Chiñi."—P. O. S.

All the hitherto described South-American species of *Eptesicus* have a characteristically flattened skull with widely spread zygomata and narrow interorbital region, while this highland form differs by its much higher and more rounded skull. Attention is especially drawn to the great interorbital breadth and the vertical height of the brain-case.

This is the "*Vespertilio* sp.—*hilairei* group" of my paper on Mr. Simons's Bolivian collection*.

An allied species is

Eptesicus inca, sp. n.

Near *E. montosus*, but larger. Skull more heavily ridged. General characters of *montosus*, with similarly large inflated

* Ann. & Mag. Nat. Hist. (7) ix. p. 126 (1902).

skull and long soft fur. Colour, so far as can be judged on a spirit-specimen, much as in that species. Sides of muzzle much swollen, tumid, the edges of the nostrils not projecting. Ears rather large, their outer margin with a rounded basal lobule. Tragus large, straight, not bowed inwards, with low basal lobule. Wings to base of fifth toe. Last vertebra of tail exerted.

Skull larger than that of *montosus* and rather more normal in general shape, less rounded and swollen. Brain-case with well-defined sagittal ridge. Intertemporal breadth equally exceeding that of the ordinary species of the genus. Teeth rather larger throughout.

Dimensions of the type (measured on the spirit-specimen):—

Forearm 46 mm.

Head and body 55; tail 44; ear 16; tragus on inner edge 6; third finger, metacarpus 39, first phalanx 16.

Skull: greatest length 16·2; condylo-basal length 15·9; basi-sinual length 13; zygomatic breadth 10·8; intertemporal breadth 4·5; breadth of brain-case 8; palato-sinual length 6·8; front of canine to back of m^3 6·3; front of p^4 to back of m^2 4·2.

Hab. Chanchamayo, Cuzco, Peru.

Type. Adult male in alcohol. B.M. no. 94. 8. 6. 1. Collected by J. Kalinowski. One specimen.

Along the coastal regions of Ecuador and N. Peru the members of this genus are brownish, approximating to Prout's brown, cinnamon-brown, &c.—in marked contrast to the more or less blackish *E. andinus* of Colombia and the higher grounds of the Andes. Specimens from Piura, Peru, are topotypical of *innoxius*, Gerv., while quite similar forms are in the collection from Eten, Peru, to the south, and Santa Rosa, Ecuador, further north, the Museum containing thirteen specimens in all. In these the forearm is about 37–38 mm. in length, and the skull 14·9 to 15·5 mm. *E. espadæ*, Cabrera, from Babahoyo, with forearm 38 and skull 15·4 mm. in length, must no doubt be considered the same form, as it is expressly stated to be very pale in colour.

But among our specimens are two from the island of Puna so much smaller than the others as to demand distinction:—

Eptesicus punicus, sp. n.

Colour as in *E. innoxius*, but size, and especially skull, markedly smaller.

Upper surface Prout's brown, the bases of the hairs darker brown but not blackish. Hairs of under surface brown basally, broadly light drab terminally.

Skull in shape like that of *E. innoxius*, but much smaller.

Dimensions of the type (the italicized measurements taken in the flesh):—

Forearm 35 mm.

Head and body 42; *tail* 35; *ear* 13. Third finger, metacarpus 32·5, first phalanx 12·7; lower leg and hind foot 21·2.

Skull: greatest length 14·1; condylo-basal length 13·8; zygomatic breadth 9; intertemporal breadth 3·8; breadth of brain-case 7·1; mastoid breadth 7·6; palato-sinual length 11; front of canine to back of m^3 4·9; front of p^4 to back of m^2 3·7.

In the paratype the forearm is longer—37 mm.,—but the skull is of quite the same small size.

Hab. Puna Island, Gulf of Guayaquil. Type from Puna. Alt. 10 m.

Type. Adult male. B.M. no. 99. 8. 1. 1. Original number 1. Collected 1st November, 1899, by Perry O. Simons. Two specimens.

The type was the first mammal obtained by Mr. Simons on his historic collecting-trip down the Andean region of S. America.

Although in other respects quite similar to the neighbouring *E. innoxius*, the Puna bat is distinguishable by the small size of its skull and teeth.

Passing now further to the south, we have *E. furinalis* as the smaller species of Paraguay and the Argentine (Corrientes, Misiones, &c.), but the larger would seem to need a name:—

Eptesicus argentinus, sp. n.

The pale open-country representative of *E. brasiliensis*.

Size large, even larger on the average than in *brasiliensis*. Fur rather short, hairs of back about 5 mm. in length; the narrow naked area often running along the edges of the back and rump unusually wide and well marked. General colour above quite pale, the light ends to the dorsal hairs near buffy brown, therefore much paler than in the dark Brazilian forms. Under surface dull whitish, the hairs slaty with whitish tips, inguinal region white. Ears and membranes brown, not black.

Skull robust, flattened, well-ridged, the zygomata broadly expanded. Teeth large and heavy.

Dimensions of the type (the italicized measurements taken in the flesh) :—

Forearm 45·5 mm. (range in adults from about 43).

Head and body 67; tail 44; ear 18. Third finger, metacarpal 42, first phalanx 15; lower leg and hind foot (c. u.) 25.

Skull: greatest length 17·3; basi-sinual length 13·6; zygomatic breadth 12·5; intertemporal breadth 3·9; breadth of brain-case 8; palato-sinual length of front of canine to back of m^3 6·7; front of p^4 to back of m^2 4·5.

Hab. Corrientes. Type from Goya, on the Parana. Alt. 600'.

Type. Adult female. B.M. no. 98. 3. 4. 6. Original number 18. Collected 16th December, 1895, by R. Perrens. Presented by Oldfield Thomas. Eight specimens.

The combination of large size and comparatively pale colour will at once distinguish this species from any other in S. America.

Also in the Argentine, just to the south of Goya, there is another species which in size is at the opposite pole from *E. argentinus*, being about the smallest species in S. America:—

Eptesicus fidelis, sp. n.

Size very small, slightly smaller even than *E. diminutus* and *punicus*. Fur fairly long, hairs of back about 7 mm. in length; edges of wing-membranes hairy for about half a centimetre out from the body, in contrast to *E. argentinus*, where there is even a naked edging on the body itself; inter-femoral membrane and base of tail also hairy for about a quarter its length. Tail very short, even relatively to the small size of the animal; its extreme tip only exerted. Ears and tragus small, the inner edge of the latter slightly concave. General colour, so far as can be seen in a spirit-specimen, brown, not black, the ends of the hairs a little paler; under surface brown, with whitish tips to the hairs; membranes brown throughout.

Skull low, smooth, unridged, with comparatively broad intertemporal region and scarcely perceptible sagittal and lambdoid crests. Canines proportionally rather short.

Dimensions of the type (measured on the spirit-specimen) :—

Forearm 34 mm.

Head and body 50; tail 32; ear 12·5; tragus on inner edge 4·2; third finger, metatragus 29, first phalanx 11; lower leg and hind foot (c. u.) 19·5.

Skull: greatest length 13·9; basi-sinual length 10·7; zygomatic breadth 9·8; intertemporal breadth 4; breadth of brain-case 7·3; mastoid breadth 8·1; palato-sinual length 5·5; maxillary tooth-row 5; front of p^4 to back of m^3 3·2.

Hab. Santa Fé Province, Argentine. Type from Esperanza.

Type. Adult male in alcohol. B.M. no. 1. 2. 4. 1. Collected by E. Lindner. One specimen.

Just a shade smaller than the two smallest species known—*E. diminutus*, Osg., of Bahia, and *E. punicus*, of Puna,—and distinguishable from both, apart from geographical considerations, by its comparatively broad intertemporal region, which forms a much less well-marked waist to the skull. All other described species are decidedly larger.

Lastly, in Brazil we have the large dark *E. brasiliensis*, Desm., found from the Amazon to Rio Grande do Sul, while the little *E. diminutus*, Osg., is as yet only known from the Rio Preto, Bahia.

L.—On the Group of African Zorils represented by *Ictonyx libyca*. By OLDFIELD THOMAS and MARTIN A. C. HINTON.

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IN connection with the determination of a Western specimen of this group we have noticed not only that the group itself contains a larger number of species than has been recognized, but also that its characters—as contrasted with the *capensis* group—are so much weightier than has been previously observed that it clearly ought to be separated as a distinct genus from the ordinary Zorils, to which all the previously existing names are referable. Consequently a new name is needed for the *libyca* group.

PÆCILICTIS, gen. nov.

Genotype, *P. libyca* (*Ictonyx libyca*, Hempr. & Ehr.).

Skull shortened; greatly expanded across the mastoid region. Bullæ hypertrophied.

Palms and soles hairy except on the actual pads, the region between the pads naked in *Ictonyx*; pads themselves smaller, more sharply defined and separate than in that genus.

Pattern of coloration about as in *Ictonyx*, except that the

median black dorsal stripe is broadly split on the posterior back, with a white area within it, this having generally again a truly median black line, so that at this point there are five longitudinal bands instead of three. Ears with but little white on them.

Range. North Africa, from Algeria to the Egyptian Soudan; partly overlapping the range of *Ictonyx*.

The species of *Pœcilictis* appear to be as follows:—

1. *P. vaillanti*, Loche.

Size largest. A male skull 59·2 * mm. long by 36·2 mm. in mastoid breadth.

Colour-pattern of medium distinctness. Ends of terminal tail-hairs black.

Hab. Algeria and Tunis.

2. *P. libyca*, Hempr. & Ehr.

Size smaller. A male skull 49·3 × 26·9 mm.

Colour-pattern very irregular and indistinct. Tip of tail black.

Hab. Lower Egypt.

3. *P. multivittata*, Wagn.

Schreb. Säug. Supp. ii. p. 221, pl. cxxxiii. B (1840).

Syn. *Ictonyx frenata*, Sund., 1842.

Size smallest. Male skull 47·2 × 24·6 mm.

Colour-pattern rather more defined than in *libyca*. Tail-tip white.

Hab. Egyptian Soudan.

There cannot be the slightest doubt that Wagner's *multivittata* is the same as Sundevall's *frenata*, although the former's artist has erroneously given the animal a broadly white-ended ear, such as is found in true *Ictonyx*.

4. *P. oralis*, sp. n.

Size rather smaller than in *vaillanti*, larger than in *libyca*, an adult male skull 55 × 32·6 mm. Colour-pattern very ill-defined, about as in *libyca*. White frontal band narrow; chin-band scarcely developed. Upper lips and a small bit of the edge of the ear white as usual. Long hairs of tail white, those at the end with black tips for the terminal 3 inches below; wool-hairs of tail white basally, blackish terminally.

* Condyllo-basal length.

Skull and teeth intermediate in size between those of the large *P. vaillanti* and the smaller *P. libyca*.

Dimensions of the type (measured on the spirit-specimen) :—

Head and body 245 mm.; tail 168; hind foot 38; ear 19.

Skull: condylo-basal length 55; zygomatic breadth 35; interorbital breadth 14·8; intertemporal breadth 12·5; mastoid breadth 32·6; palatal length 26·4; length of p^4 on outer edge 6·7; transverse diameter of m^1 6·9.

Hab. Suakin.

Type. Adult male. B.M. no. 3. 12. 8. 35. From the late Dr. John Anderson's Collection. Presented by Mrs. Anderson. One specimen and a separate skull.

No doubt most nearly allied to the Egyptian *P. libyca*, but larger.

LI.—Some undescribed Ethiopian Cicadidæ.

By W. L. DISTANT.

THE following descriptions refer to genera and species recently received from various sections of the Ethiopian region, and the types of which are contained in the British Museum :—

MAROBODUUS, gen. nov.

♀. Head with the front subconically produced and centrally longitudinally depressed, about as long as space between eyes, which are large and prominent; pronotum narrowed anteriorly, the lateral margins concavely excavate; mesonotum (including cruciform elevation) a little shorter than head and pronotum together; abdomen in ♀ longer than the space between the apex of head and base of cruciform elevation; tegmina and wings hyaline; tegmina with eight apical areas, of which the uppermost is smallest, the fourth broadly convex at base, thus narrowing the apical half of the second upper ulnar area; radial area with the lower vein strongly angulated and produced beneath, the ulnar area immediately beneath it being very wide and apically upwardly recurved; wings with six apical areas, the uppermost of which is subglobose.

The peculiar venation of the tegmina, especially of the radial area, and the upwardly turned apex of the ulnar area

immediately behind it are the principal characteristics of this genus, which (in the absence of the ♂) I place in the division *Psithyristriaria* in the subfam. *Gæaninæ*.

Maroboduus fractus, sp. n.

♀. Body and legs virescent, the tibiæ and tarsi more ochraceous; eyes castaneous; ocelli pale shining sanguineous; narrow posterior abdominal margins above black; tegmina and wings hyaline, the venation of both dull virescent; head with the front longitudinally linearly depressed, the lateral areas obliquely transversely striate, the basal antenniferous tubercles very robust and prominent; pronotum centrally broadly longitudinally striate, two oblique striations on each lateral area, the lateral margins broadly concavely sinuate, the basal lateral angles convexly subprominent; rostrum reaching the intermediate coxæ; other structural characters as in generic diagnosis.

♀. Long., excl. tegm., 20; exp. tegm. 60 mm.

Hab. W. Africa; Sierra Leone (*Jas. J. Simpson*).

Lemuriana consobrina, sp. n.

♂. Body above, abdomen beneath, and face pale castaneous; sternum and legs paler and more ochraceous; tegmina and wings pale hyaline, costal membrane to the first, and the whole of the venation to both ochraceous; pronotum with two oblique incisures on both sides of disk; eyes black; rostrum ochraceous, its apex black and about reaching the posterior coxæ; face globose, strongly laterally striate; opercula short, laterally rounded, transverse, their apices roundly angulate, not extending beyond the base of the first abdominal segment.

♀. Abdomen beneath with a central longitudinal piceous fascia.

Long., excl. tegm., ♂ 15, ♀ 16; exp. tegm., ♂ 46, ♀ 56 mm.

Hab. Uganda (*R. Dummer*); Nile Prov. (*Dr. R. E. McConnell*).

Allied to *L. flavocostata*, Dist., but differing by the shorter and more anteriorly rounded head, less prominent eyes, &c.

Panka umbrosa, sp. n.

Body and legs ochraceous or brownish ochraceous; basal area of head (more or less), pronotal incisures, two short obconical central spots to anterior margin, a long sublateral

spot on each side subacutely narrowed posteriorly, and two small basal spots before cruciform elevation to mesonotum, black; anterior basal segmental margins to abdomen above more or less black; apex of rostrum more or less black; tegmina and wings hyaline, venation black or blackish, tegmina with the costal membrane ochraceous; apical margin of the claval area to wings black; segmental margins to abdomen beneath sometimes black; front of head centrally longitudinally excavate; opercula in ♂ short, broad, roundly oblique; anterior femora with three blackish spines beneath; rostrum just passing the intermediate coxæ; basal cell to tegmina long and somewhat narrow.

Long., excl. tegm., 10-11; exp. tegm. 30-31 mm.

Hab. N.E. Rhodesia; W. of Medona (*D. MacDonald*). Nyassaland; Mt. Mlanje (*S. A. Neave*). Kindu (*Burgeon*). S. Leone, Gbonkopillar (*A. Pearse*).

Psilotympana varicolor, sp. n.

♀. Head and pronotum ochraceous; head between eyes, a large subcruciform central fascia, and lateral margins to pronotum black; mesonotum black, with two central, sinuate, longitudinal fasciæ, and narrow lateral margins ochraceous; basal cruciform elevation ochraceous; abdomen above black, the segmental margins narrowly ochraceous; body beneath greyishly pilose; legs ochraceous; disk of sternum maculately black; face ochraceous, more or less transversely blackly striate; tegmina and wings pale talc-like, venation and costal membrane to tegmina ochraceous, the latter with the transverse veins at bases of second and third apical areas narrowly, palely infuscate; rostrum ochraceous, about reaching the intermediate coxæ.

Long., excl. tegm., ♀, 14; exp. tegm. 36 mm.

Hab. South Africa (no precise locality).

Taipinga rhodesi, sp. n.

♀. Head and pronotum black; a marginal spot on each side near base of face and posterior margin and lateral angles of pronotum, pale ochraceous; mesonotum greyish white, with a large central cruciform spot and a large sublateral obconical spot on each side black; abdomen above dark ochraceous, posterior segmental margins pale ochraceous, and a central longitudinal more or less continuous fascia black; body beneath pale ochraceous; rostrum and legs dark ochraceous, the former reaching the intermediate coxæ; anterior femora strongly spined beneath; tegmina and wings

hyaline, venation and costal membrane to the former ochraceous, upper apical area, and the inner margins of the second, third, and fourth apical areas pale shining purplish.

Long., excl. tegm., ♀, 12; exp. tegm. 26 mm.

Hab. South Africa; Kimberley.

Stagira ruficostata, sp. n.

♀. Body above virescent; eyes dull ochraceous; body beneath and legs virescent, tibiæ and tarsi and posterior margins of the abdominal segments testaceous; tegmina and wings hyaline, extreme bases of both, costal membrane and costal area of tegmina sanguineous, venation of both tegmina and wings pale testaceous, darker on basal areas; pronotum with a central, discal, longitudinal sulcation, the oblique incisions very distinct; mesonotum with two short obconical spots at base, only denoted by their darker margins; abdomen narrowly elevated on basal half; rostrum reaching the posterior coxæ; anterior femora prominently thickened and compressed with a few strong spines beneath.

Long., excl. tegm., ♀, 13; exp. tegm. 37 mm.

Hab. S. Africa; Grahamstown.

Stagira consobrina, sp. n.

♂. Allied to the preceding species, *S. ruficostata*, Dist., but with the head (including eyes) distinctly narrower; the coloration of the body paler, and the abdominal segmental margins above broader, paler, and very narrowly darkly margined; the upper apical area to the tegmina much longer and more sinuate, the basal cell longer and narrower; the face strongly centrally carinate; the tegmina and wings not prominently testaceous at bases, &c.

Long., excl. tegm., ♂, 14; exp. tegm. 37 mm.

Hab. S. Africa; Transvaal (*Junod*).

Stagira sanguinea, sp. n.

♂. Body above and beneath sanguineous, the abdominal segmental margins distinctly darker in hue; basal abdominal segment beneath with a central foveate black spot on its anterior margin; antennæ black; oblique furrows to pronotum dull ochraceous; mesonotum with two somewhat obscure, blackly margined, obconical spots on anterior margin; tegmina and wings hyaline, costal area and membrane and the venation sanguineous; rostrum reaching the posterior coxæ; femora and trochanters ochraceous,

anterior femora with three prominent spines beneath; opercula short and rounded; face distinctly transversely striate.

Long., excl. tegm., ♂, 19; exp. tegm. 45 mm.

Hab. "Caffraria."

DECEBALUS, gen. nov.

♂. Head short, depressed anteriorly, eyes large and prominent; pronotum scarcely longer than total length of head, the moderately dilated lateral margins not quite reaching apices; mesonotum about as long as pronotum; opercula prominent and exposed; abdomen somewhat short, about as long as head and thorax together; rostrum about reaching the posterior coxæ; face somewhat elongate, centrally longitudinally sulcate; tegmina elongate, more than twice as long as broad, basal cell longer than broad, ulnar areas short and broad, especially the discal ones, apical areas eight, much longer than broad, wings with the apical areas narrow and elongate.

Allied to *Akamba*, Dist., but differing by the shorter and broader discal ulnar areas to the tegmina.

Decebalus ugandanus, sp. n.

Body above pale virescent with pale ochraceous suffusions; head above with prominent dark fuscous spots—two at inner margins of eyes and another at bases of antennæ; pronotum with the anterior and posterior margins and a central narrow longitudinal fascia virescent, each lateral area with about five prominent but irregular black spots; mesonotum with two obconical spots on anterior margin, followed by two strongly curved and irregularly shaped spots and a large submarginal fascia on each side, more or less castaneous brown; abdomen above with the segmental margin castaneous brown, becoming broader and more confluent on apical half; body beneath paler than above; anterior femora with three prominent dark spines beneath; tegmina and wings hyaline, the venation dull virescent, the costal area to the first distinctly paler and more virescent.

Long., excl. tegm., ♂, 12; exp. tegm. 38 mm.

Hab. Uganda Protect., Southern Toro, Mbarara (*S. A. Neave*).

Zouga festiva, sp. n.

Body above black, more or less longly pilose; eyes, ocelli, basal margin of pronotum, tympanal coverings, lateral

margins and posterior segmental margins to abdomen, rostrum, and abdomen beneath ochraceous; legs brownish ochraceous, base of abdomen beneath narrowly black; tegmina and wings hyaline, the venation to both and costal membrane to tegmina ochraceous; head, pronotum, sternum, and legs longly pilose; rostrum reaching the intermediate coxæ; opercula short, oblique, somewhat widely separated internally; posterior tibiæ centrally and on apical area longly spinose.

Long., excl. tegm., ♂, 22; exp. tegm. 48 mm.

Hab. S. Africa (no precise locality).

The largest and most distinctly coloured species of this genus as yet described.

NEOMUDA, gen. nov.

Body moderately short and robust; head about as long as breadth between eyes, the apex somewhat broadly rounded, ocelli about as wide apart from eyes as from each other; pronotum with the lateral margins irregularly convex, the posterior angles broadly prominent; face prominently globose, transversely striate, and centrally longitudinally sulcate; anterior femora very strongly incrassate and strongly spined; abdomen beneath longly subovate, the lateral margins laminately recurved; tympanal coverings absent; tegmina about three times as long as greatest breadth, apical areas eight in number; wings with six apical areas.

Type, *N. peringueyi*, Dist.

Neomuda peringueyi, sp. n.

Head and thorax above dull ochraceous, with a more or less greenish tint, especially on the pronotum; head above with the basal area castaneous, surrounding the ocelli, which are pale sanguineous; pronotum with two central longitudinal fasciæ (not extending beyond the anterior confines of the basal marginal area) and two curved fasciæ on the lateral areas, castaneous; mesonotum with two central obconical spots at middle of anterior margin and a somewhat larger, more indistinct, elongate spot (denoted by their margins only) on each lateral area castaneous; abdomen above ochraceous, with four longitudinal segmental series of transverse castaneous spots, the apical segment more completely castaneous; abdomen beneath more uniformly ochraceous; legs greenish ochraceous, more or less annulated with castaneous; apices of tarsi castaneous; face pale greenish, with the striations

castaneous; tegmina and wings hyaline; tegmina with the costal membrane greenish ochraceous, the venation more ochraceous, linearly and distinctly spotted with black, especially the apices of the ulnar areas; wings with the veins blackish, a few pale greenish; structural characters as in generic diagnosis.

Long., excl. tegm., 21; exp. tegm. 56 mm.

Hab. South Africa (no precise locality).

Neomuda abdominalis, sp. n.

Allied to the preceding species, *N. peringueyi*, but differing in the following characters:—The abdomen above has only three longitudinal segmental series of transverse castaneous spots, the central series being longest; tegmina and wings distinctly ochraceous, the venation uniformly of the same hue. Structurally distinct in the abdomen beneath, in which the lateral margins are considerably more broadly and roundly recurved.

Long., excl. tegm., 21; exp. tegm. 57 mm.

Hab. Cape Colony.

Neomuda trimeni, sp. n.

♀. Allied to the two preceding species, but with the tegmina practically unspotted, the costal membrane and the bases of both tegmina and wings sanguineous; body beneath and legs dull sanguineous or dark ochraceous; venation to tegmina and wings brownish ochraceous, the bases and apices of the apical areas to tegmina sometimes lightly or faintly palely infusate; pronotum with two central, longitudinal, moderate carinations continued on basal area of head, ocelli in distinct depressions; lateral areas of the pronotum with distinct dark vittæ; mesonotum with four distinct darker obconical spots, the outermost longest and subacute; rostrum with its apex black and reaching the intermediate coxæ; face centrally broadly excavate, the lateral areas transversely striate; anterior femora with two robust spines beneath.

Long., excl. tegm., ♀, 19–22; exp. tegm. 43–55 mm.

Hab. S. Africa; Wynberg, Oudebosch (Brit. and S. Afr. Mus.).

OUDEBOSCHIA, gen. nov.

Allied to the preceding genus, *Neomuda*, but wings with seven apical areas.

Lateral margins of pronotum a little convexly sinuate, posterior angles more or less strongly ampliate; head with front roundly triangularly produced, about as long as breadth between eyes; abdomen beneath with the lateral margins strongly inwardly roundly recurved.

By the venation of the wings and the recurved margins of the abdomen beneath, this genus is also allied to *Nablistes*, Karsch, but from which the venation of the tegmina is altogether dissimilar.

Oudeboschia festiva, sp. n.

♀. Head virescent, blackly pilose, inner margins of eyes and two central longitudinal lines black, ocelli ochraceous; pronotum ochraceous, a large central anterior and a central subbasal spot and the posterior marginal area virescent, the lateral areas with black suffusions; mesonotum greenish ochraceous, with four longitudinal black fasciæ, of which the two central are sinuate and the outer ones shorter and posteriorly acute; abdomen above ochraceous, the posterior segmental margins paler in hue; head beneath, sternum, and legs virescent, irregularly marked with black; abdomen beneath ochraceous, the base and two small central spots on posterior segmental margins black, the roundly incurved lateral margins virescent, with their segmental margins dark ochraceous, apical segment centrally black; tegmina dark ochraceous, the costal membrane virescent, the venation fuscous, the longitudinal veins defining the ulnar areas broken, the radial area and basal cell paler in hue; wings pale ochraceous; structural characters as in generic diagnosis.

Long., excl. tegm., 25; exp. tegm. 65 mm.

Hab. S. Africa; Oudebosch, Calydon.

STELLENBOSCHIA, gen. nov.

Differs from *Pauropsalta* by the dilated tegmina.

Type, *S. rotundata*, Dist.

Melampsalta rotundata, Dist. Ann. & Mag. Nat. Hist. (6) ix. p. 324 (1892).

Differs from *Pauropsalta* by the shorter and broader tegmina, which at their greatest breadth are half as broad as their greatest length; they are also strongly roundly arcuated from near base. As in *Pauropsalta*, the wing possesses only five apical areas, and in the tegmina the radial area is at its greatest breadth about half as broad as long.

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[NINTH SERIES.]

No. 29. MAY 1920.

LII.—*Notes on the Asilidæ: Sub-division Asilinæ.*
By GERTRUDE RICARDO.

[Continued from p. 241.]

Dysmachus tibialis, Macq.

Dipt. Exot. i. (2) p. 245 (1838).

This species was described by Macquart from the Cape as follows:—

“Yellow-haired. Moustache yellow. Legs black; tibiæ red. Wings with the fourth posterior cell oblique. Face and forehead with yellow tomentum. Beard yellow. Antennæ wanting. Thorax and abdomen black with green reflections, tomentum and pubescence greyish yellow. Legs with yellow and black bristles, apices of tibiæ black. Wings yellowish, the longitudinal veins bordered with light brown. 9 l. ♀.”

The specimens noted below seem to answer to this description, but till the type can be examined the question must remain doubtful. The following description will serve, at any rate, to identify my specimens:—

Males and females from Stellenbosch, in Cape Museum Coll.

Distinguished by the wholly yellow beard and by the yellowish-red tibiæ and yellow pubescence on scutellum.

Length, ♂ 22-23, ♀ 24 mm.

Ann. & Mag. N. Hist. Ser. 9. Vol. v.

26



Male.—*Face* with fairly thick yellow or orange *moustache* reaching the antennæ. *Palpi* blackish with chiefly black hairs. *Antennæ* blackish brown, the first two joints with black hairs and at least one yellow one on underside, the arista long and stout. Forehead covered with hairs a little lighter in colour than those of moustache. The curled bristles yellow, not stout, difficult to distinguish from the many yellow hairs round them, continued round head. *Thorax* bronze-coloured with greyish tomentum and short black pubescence, a few yellow hairs interspersed; the mane consists of black hairs, some longer than others, but outstanding bristles are absent, the four præsutural bristles are yellow with shorter ones round them, the supra-alar and postalar are black and yellow and more numerous than usual. *Scutellum* covered with thick long yellow or orange hairs, and the same-coloured bristles on posterior margin. *Abdomen* appears blackish brown with soft reddish-yellow pubescence and the same below; there are traces of yellowish tomentum on dorsum. *Genitalia* black, shining, stout, the upper pincers large with two points widely separated, the upper one club-shaped, obtuse, and short; the lower one slender and much longer, with yellow and black hairs, also below, but a tuft of orange hairs appears on the black under-plate in the centre. *Legs* blackish, the femora with fairly long yellowish pubescence and stout black bristles on the middle and hind pair; tibiæ almost honey-yellow, the apices of middle and hind pair black, the fore tibiæ with long yellow hairs and many long yellow bristles, the middle pair with black bristles but many weak yellow ones, the hind pair with black bristles and two or more yellow ones, the yellow hairs present but not so thick on the two hind pairs; tarsi with black bristles. Wings clear, the middle transverse vein very oblique, situated on about two-thirds of the length of the discal cell.

Female identical. *Abdomen* covered with greyish-yellow tomentum and yellowish pubescence, the ovipositor short, black.

Dysmachus leoninus, Schiner.

Verh. zool.-bot. Ges. Wien, xvii. p. 402, 106 [*Lophonotus*] (1867).

The type was described from the Cape, measuring 12–13 mm.

One ♀ from Caledon, Cape Colony (*K. H. Barnard*), 1916, in Cape collection. It measures 21 mm.

Easily distinguished by the short fox-red pubescence on

the thorax, becoming longer posteriorly, also present on the scutellum with bristles of the same colour, and on the first five abdominal segments where it is fairly long, especially at the sides, but not very thick. *Legs* with the same-coloured pubescence, the tibiæ bright yellow-red with many bristles of the same colour. *Moustache* reddish yellow, with black hairs at sides in this specimen.

Dysmachus porcellus, Speiser.

Schwed. Zool. Exp. Ost-Afrik. p. 102 (1910).

A series of males and females from S. and E. slopes of Kenya, 6000–7000 ft., and on edge of Forest, Brit. E. Africa.

This species belongs to the group represented by *D. chalcogaster*, Wied., also containing *D. suillus*, to which Speiser suggests it is related. It is distinguished from *D. chalcogaster* by the genitalia of the male, which are short and stout. *Wings* largely brown at the apex.

Length, ♂ 18–22, ♀ 18–21 mm.

Speiser gives the length as 17 mm., and gives the localities as Kibonoto, near Kilimandjaro, at 2000–3000 m., and Meru, 3000 m. high.

He gives the yellow colour of the hairs or bristles in the middle of the hind border of head, and the middle of the thorax with not very long bristles, as distinguishing it from *D. suillus*. The *moustache* is yellowish, but surrounded above and at sides by black bristles; in these specimens the black predominate over the yellow bristly hairs, and the long curved over bristles of head are black, but yellow bristly hairs are present between them. *Scutellum* with bristly black hairs and on outer border with long yellow bristles, in the female these latter are often black. For further particulars, see Speiser's description.

Dysmachus orientalis, sp. n.

One male (type) from Mombasa, E. Africa (A. J. Cholmeley), 1906, 225.

One male from Narok, Masai Reserve, E. Africa, 27. iii. 1914 (Captain A. O. Luckman), in I. E. E. Coll.

A small pubescent species allied to *Dysmachus tarsalis*, sp. n., but distinguished from it by the tibiæ which are reddish yellow for two-thirds of their length, the hind pair only reddish yellow at the base and the tarsi are black. Abdomen more pubescent. Genitalia shorter.

Length 15 and 16 mm.

Face covered with silky yellowish tomentum. *Moustache* reaching to the antennæ, composed of snow-white soft hairs, surrounded by black bristly hairs. *Palpi* with black hairs. Beard snowy-white. *Antennæ* black, the first two joints with very long black bristly hairs below and shorter ones on their upper sides. *Forehead* with usually long black hairs. Hind head with weak white hairs at vertex curling over and black stout bristles also curling over, beyond these the hairs round head are soft and pale-coloured. *Thorax* bronze-coloured with whitish tomentum and short whitish pubescence, the mane thick and composed of long black hairs with which are intermingled short white hairs, becoming longer posteriorly but still leaving the centre with black hairs, the usual stout bristles on sides of dorsum are weak, chiefly whitish, some very long. *Scutellum* covered with long white hairs becoming more bristly on the border, these hairs are not disposed as white tufts. *Abdomen* bronze-coloured, with thick rather bushy white hairs on the first three segments, less bushy beyond, but still present as short white pubescence, and hairs at sides are pale-coloured; the usual dark spots are present on each segment, with greyish tomentum at sides; under side with soft whitish hairs. *Genitalia* black, shining, with white hairs, below disposed as snowy-white tufts; forceps short but stout and wide, two-pronged with obtuse teeth. *Legs* bronze-coloured with white hairs; the fore and middle tibiæ honey-yellow above for two-thirds of their length, and black underneath, the hind pair chiefly yellow at their base only; the two anterior pairs of femora and tibiæ with long white hairs on each side, the hind legs with fewer but with stouter longer black bristles; the fore tibiæ with three white bristles at their apices and the middle pair with three on their outer side, fore and middle tarsi with some white bristles, the hind pair with only black ones. *Wings* greyish, with yellow veins, the small transverse vein beyond the middle of the discal cell.

Dysmachus tarsalis, sp. n.

Type (male) and other males from Willow Grange, Natal (R. C. Wroughton), in I. E. E. Coll.

A small species, to be recognized by the dull reddish or in some specimens reddish-yellow tibiæ, which have a black stripe on the inside, and by the wholly light-coloured tarsi. Abdomen with a dark large spot on each segment. Scutellum with yellow hairs only.

Length 12-15 mm.

Male.—*Face* with yellowish tomentum. *Moustache* black above and bright yellow below, composed of long rather weak hairs, reaching the antennæ. Beard white. *Antennæ* blackish brown, the first two joints with black and yellow hairs; the arista long and stout, not quite so long as the third joint. *Forehead* with straggling long black hairs. The curled bristles at back of head are chiefly yellow, about two black ones are to be seen below on each side, all rather weak and not very long. *Thorax* metallic, greenish brown, shining, with well-marked brown stripes; the mane not very thick, composed of long weak black hairs, some longer than others, those on the posterior half are largely yellow, as are also the two præsutural bristles; pubescence on dorsum not thick, all short black hairs, and some grey tomentum is visible. *Scutellum* same colour as thorax, with weak yellow hairs not very numerous; on the posterior border are two very long weak bristly hairs on each side, yellow or white. *Abdomen* bronze-coloured, but covered with grey tomentum; the large blackish spots form an irregular median stripe; pubescence on dorsum consists of some short black hairs and longer yellowish hairs at sides, also present on the underside, but no bristles appear on the abdomen. *Genitalia* long, black, and shining, with yellowish pubescence, the pincers club-shaped, the upper tooth very small; underside with a thick tuft of yellow hairs. *Legs* bronze-coloured; the tibiæ and tarsi vary in colour somewhat, the hind pair rather darker; the pubescence on femora long and yellow but not thick, yellow and black bristles are present on the hind pairs; the tibiæ with long yellow hairs and black bristles, the anterior pair with some black hairs; all the tarsi armed with long and short black bristles. *Wings* clear, the small transverse vein just beyond the middle of discal cell.

Dysmachus rhodesii, sp. n.

Type (male), type (female), and other males and females from Salisbury, Rhodesia (*R. W. Tucker*), in the Cape Museum Coll.

A small bronze-coloured species. *Moustache* black with a few yellow hairs below. Mane chiefly black. Legs bronze-black, the tibiæ at extreme base red, bristles black, but long yellowish-white hairs on fore and middle legs.

Length, ♂ 11-12, ♀ 10-11 mm.

Male.—*Face* greyish. *Moustache* very large with long

black hairs, a few yellow ones near the oral opening. Beard yellowish. *Antennæ* blackish with long black hairs and a very few white ones on upper side, the third joint is wanting. *Forehead* with black hairs. The bristles on hind part of head are black and white, not so stout as usual, but long. *Mane* black with a few white bristly hairs at sides, becoming more reddish yellow posteriorly; the large bristles at sides are reddish yellow; pubescence on dorsum black, sparse; tomentum greyish on the bronze ground-colour. *Scutellum* with long weak yellowish bristles and usually a few black ones on the posterior edge. *Abdomen* covered with yellowish-grey tomentum and a black spot on each segment; pubescence appears chiefly whitish, with no bristles present; underside with pale reddish-yellow hairs. *Genitalia* long, covered with greyish tomentum, weak yellow hairs, and short black bristly hairs; a reddish curled filament is present between the upper pair of oblong forceps and also between the lower pair. *Legs* blackish, all tibiæ reddish at base only, the fore femora with long white hairs below, present in a less degree on the others; tibiæ with the same; bristles chiefly black, some reddish-yellow ones on the fore tibiæ and on the hind femora. *Wings* clear, the small transverse vein before the middle of wing.

Female identical, the white hairs in the mane not discernible. *Ovipositor* black, nearly as long as the last two segments.

Dysmachus hirtipes, sp. n.

Type (male) from Ceres Div., Matroosberg, 3500 ft., type (female) from same locality and another male from same locality at 4000 ft.

This rather striking-looking species has apparently not been described before. Bronze-coloured with thick pubescence, though not very long, on thorax and abdomen and on legs. Scutellum entirely covered with yellowish soft hairs.

Length, ♂ $14\frac{1}{2}$ –15, ♀ 14 mm.

Male.—*Face* with glittering yellowish tomentum. *Moustache* white bordered with black hairs, all soft and fine, extending to the antennæ. Beard white. *Antennæ* blackish, the first two joints with a few black hairs, the third joint with a stout fairly long arista. *Forehead* with white hairs in the middle and at the sides, intermixed with black hairs at sides. The curled bristles at back of head all yellow, intermixed with yellowish-white hairs. *Thorax* bronze-coloured, shining with fairly thick yellow pubescence, the

side-bristles also yellow; mane composed of black hairs bordered with shorter yellowish hairs; there are no long outstanding bristles; all the bristles are yellow on posterior part of thorax. *Scutellum* covered entirely with thick yellowish-orange and whitish-yellow long hairs. *Abdomen* bronze-coloured with grey tomentum at sides and at apex, covered with whitish and yellowish hairs; on the underside they appear chiefly white. *Genitalia* elongated, the upper forceps deeply indented, the lower fork being the longest, the upper one short, obtuse, same colour as abdomen with yellow and white pubescence, below with chiefly black hairs. *Legs* bronze-coloured, shining with thick yellow pubescence on both sides of the two anterior pairs of tibiæ; femora with long whitish pubescence, the hind pair armed below with a row of short, stout, black bristles, the hind tibiæ with long fine yellowish hairs and five or more very stout red bristles above and shorter black ones below near apices; fore tarsi with long yellow bristly hairs and a few black bristles below, the middle ones the same, the hind tarsi with fewer yellowish-red bristles. *Wings* clear, small transverse vein very oblique and situated about two-thirds of length of discoidal cell from the base.

Female identical. *Moustache* darker. *Abdomen* with grey tomentum at sides of segments, more noticeable towards the apex; pubescence does not appear so thick as in the male. *Ovipositor* black, shining, short, not much longer than the last segment.

Loew's Division II.

Abdomen with bristles before the segments.

II¹.

No bristles on the underside of abdomen.

Dysmachus congoensis, sp. n.

Type (male) from Lualaba River, Congo, 15. 5. 07, 2500-4000 ft., type (female) from same locality (*Neave Coll.*), 1907, 230. Other males and one female from same locality.

A species with no apparent bristles on the underside of abdomen, and the strong white ones above are not numerous. Moustache black above and yellowish white below. Legs blackish, metallic with rather long pale yellow pubescence and black and yellow bristles. Scutellum with yellow hairs

and bristles only; the posterior border of thorax also with weak yellowish bristles each side of the median stripe. Mane of not very long black hairs with few outstanding bristles.

Length, ♂ 15-17, ♀ 15 mm.

Male.—*Face* covered with glistening yellowish tomentum. *Moustache* composed of long yellowish hairs, bordered with black ones, reaching the antennæ. Beard white. *Antennæ* with the first two joints blackish, the third wanting. *Fore-head* with long stout black bristly hairs, the curled bristles behind long and black; below them in the centre are numerous yellowish hairs. *Thorax* blackish covered with yellowish-brown tomentum and a well-marked median stripe and short side-stripes; pubescence very scanty, blackish, the three supra-alar bristles are yellow. *Scutellum* with long weak yellow bristles and shorter hairs. *Abdomen* blackish with a large dark brownish spot on each segment, sides with grey tomentum; pubescence on dorsum is short but rather thick, yellow in colour; underside with straggling long whitish hairs. *Genitalia* large, stout, black, and shining, the under pair of pincers proceeding immediately from the under black plate are short, obtuse, testaceous, these and the upper pair with long yellow pubescence, a few black hairs intermixed. *Legs* with the posterior femora thickly covered with short whitish-yellow pubescence, and longer hairs below, strong yellow bristles on underside, and a few black ones above; middle and anterior pair with less pubescence; tibiæ with long and short yellow hairs and black bristles, those on the fore pair chiefly long, yellow, and weak; fore tarsi with some yellow bristles. *Wings* clear, shaded at apex and on posterior border, the small transverse vein below the middle of the discal cell.

Female identical. Hind tibiæ with some yellow bristles.

Dysmachus flavopilosus, sp. n.

Type (male), type (female) from Willow Grange, Natal (*W. C. Wroughton*), in I. E. E. Coll.

Other males and females from Howick, Natal (*J. P. Cregoe*), 1904, 46, in Brit. Mus. Coll.

One male and one female from Mfongosi, Zululand (*W. E. Jones*), and Krantzkopf, Natal, in the Cape Coll.

Males and female from Pretoria, 28.12.1912 (*H. K. Munroe*), 1914, 263.

There are bristles on the abdomen, but none below; in

general characters this species is allied to the group represented by *D. auribarbis*; it differs very much in size, but I can find no character to distinguish the small specimens from the larger ones.

A species distinguished by the yellow beard in the males, with some black hairs above in the females, by the usually honey-yellow basal half of the tibiæ, which in the two fore pairs have long yellow pubescence, by the yellow bristles and hairs on the posterior part of the thorax, and by yellow hairs and bristles on the scutellum. Ovipositor in male long, black, with some bright yellow pubescence.

Length, ♂ type $15\frac{1}{2}$, ♀ type $15\frac{1}{2}$ mm.; other males 12–22, other females 12–20 mm.

Male.—*Face* bronze-green with some white tomentum, convex, carrying a fairly thick *moustache* composed of long weak yellow hairs with three or four black ones below the antennæ. Beard yellow. *Antennæ* bronze-green, the third joint dark brown, the first two joints with chiefly black bristly pubescence; the arista nearly half as long as the third joint. *Forehead* with black bristly pubescence. The curved bristles at back of head not very long, all yellowish, as are the hairs round head. *Thorax* bronze-black with brownish-grey tomentum and very well-marked double median stripe and side-stripes. Mane not very thick, composed of short black hairs on the anterior half with three or four very long stout outstanding bristles; beyond these the few hairs are yellow surrounded by many stout yellow bristles; all the bristles at sides and at base of wings are yellow; pubescence on dorsum sparse, of short black hairs. *Scutellum* with long weak yellowish-white bristles on the posterior border and weak yellow hairs on the dorsum. *Abdomen* blackish, covered with grey tomentum and with short yellow pubescence, the bristles at sides yellow, weak, the tomentum often thicker at sides and on posterior borders of segments; underside with weak fairly long whitish hairs. *Legs* black, shining, the tibiæ honey-yellow on the basal half, on the fore pair extending almost two-thirds of the length; the femora with a little short yellow pubescence and with longer yellowish hairs above and below, the hind pair with white bristles below; the fore tibiæ with long yellow hairs and yellow pubescence, the mid-pair the same; the hind pair with shorter yellow hairs, the bristles on this latter chiefly yellow, on the others mostly black; the tarsi with long yellow bristles and shorter black ones. *Wings* clear, veins yellowish, the small

transverse vein below the middle of the discal cell. *Genitalia* of male black, long, the upper forceps simple, large, with short white pubescence on the upper sides and long bristly yellow hairs below; the basal plate below with a fringe of hairs, usually yellowish white or orange-yellow, the lower forceps short, with yellow hairs. The male from Zululand has rather darker pubescence on the genitalia and on thorax.

Female identical. *Moustache* with more black hairs above. *Ovipositor* black, shining, about as long as the last two segments.

Loew's Division II^{2a}.

Bristles on underside of abdomen. Mane extending the whole length of thorax.

Dysmachus molitor, Wied.

Ausszweifel. Ins. i. p. 450 [*Asilus*], 1828, etc.

One male from S. Africa (*Dr. Smith*), 446, in Brit. Mus. Coll.

One specimen from Dunbrody (*Rev. O'Neil*), 1900, in Cape Museum Coll.

An easily distinguished small species, the abdomen being thickly covered with whitish hairs. Mane white posteriorly. Moustache thick, white. Legs covered with white pubescence and with white bristles. Scutellum with three thick tufts of white hairs and two or more black bristles on the posterior border.

Length 12-14 mm.

Dysmachus parvus, sp. n.

Type (male) and type (female) from Mababe, 100 miles N.E. of Lake Ngami, 3000 ft., Bechuanaland Protectorate, 9. viii. 1909 (*R. B. Woosnam*), 1910, and another ? female.

A small pretty little species allied to *D. molitor*, Wied., but distinguished from it by the black and white moustache and black bristles on the legs. *D. incisuralis*, Macq., is said to be allied to *D. molitor*, but Macquart says the genitalia are short, whereas in this species they are very long and slender; the white bristles on the abdomen are very noticeable.

Length 10 mm.

Male.—*Face* covered with glistening white tomentum. *Moustache* large and thick, composed of black and white hairs intermixed. Beard white. *Antennæ* black, the first two joints with stout black bristly hairs; the arista long. *Forehead* with white hairs. The curved bristles are weak, black, but fairly long. *Thorax* bronze-coloured with lighter tomentum and some short white pubescence; the mane is large, composed of fairly thick short black hairs and many long outstanding bristles; a few longer white hairs are visible on the posterior part of thorax at the sides and also intermixed with the mane, but not forming a noticeable white stripe. *Scutellum* with a double row of black bristles, about four in each, and with long white hairs each side and in centre; hardly tuft-like. *Abdomen* black covered with brownish-grey tomentum and with fairly thick short white pubescence; the bristles chiefly white in a double row, one on the top of the other; underside with longer thick white pubescence and weaker white bristles. *Genitalia* almost equal in length to the last two segments, stout at base, tapering to a point, covered with white pubescence; the lower pair of forceps very short. *Legs* bronze-coloured, with white pubescence and longer white hairs on femora and tibiæ; middle and hind femora with white bristles, otherwise all bristles are black. *Wings* clear, the small transverse vein on the last third of the discal cell towards apex.

Female identical. *Abdomen* better preserved, shows a large brownish-black spot on each segment, the white bristles longer and three-deep. *Ovipositor* short.

Dysmachus transvaalensis, ♂, sp. n.

Type (male) and another male from Bloksberg, Johannesburg (*C. H. Peard*), 1907, 250, in Brit. Mus. Coll.

A small species with short white pubescence on the body and legs and many white bristles on the abdomen both above and below; distinguished from *D. spiniventris*, Loew, by the reddish colour of the tibiæ and tarsi. Scutellum with white hairs and bristles. Mane white posteriorly. Moustache whitish.

Length 9 mm.

Face with silvery-white tomentum at sides. *Moustache* large, extending the whole length of face, yellowish white with only a very few black hairs intermixed. *Antennæ* black, with thick black bristly pubescence on lower side of the first two joints. *Forehead* with yellowish tomentum, a bunch of

white hairs on each side and long black hairs beyond, the curled-over bristles black and long, a bunch of white hairs at vertex between them, and hairs round head white. *Thorax* bronze-coloured with sparse white pubescence; the mane of long outstanding bristles and thick black hairs inside, posteriorly these hairs are white; bristles at sides whitish, long, the dorsal bristles on posterior part of thorax chiefly black, and longer white hairs are present here. *Scutellum* with tufts of white hairs on its black dorsum and long yellowish-white bristles on the posterior border. *Abdomen* with grey tomentum and thick whitish pubescence, the yellowish-white bristles on dorsum are about four deep on each segment; underside bristles with them and has short white pubescence. *Genitalia* short, stout, chestnut-brown, club-shaped with square ends, deeply notched below, lower surface with thick whitish hairs and above with shorter white pubescence; under lamellæ short with long whitish hairs. *Legs* blackish with the bristles largely white, the anterior and middle tibiæ and tarsi of an obscure reddish colour, the hind pair only so at their extreme base; the fore femora with stout black bristles below and some whitish hairs and one or more white bristles on their upper surface, the middle pair with chiefly white bristles above and black ones below, the hind pair with white and black bristles; the tibiæ with long yellowish hairs below and long stout yellow bristles, the fore pair with some black bristles on their upper surface; tarsi all reddish, armed with chiefly white bristles; pubescence on legs thick, white. *Wings* clear, veins yellow.

Dysmachus albofasciatus, Ricardo.

Ann. & Mag. Nat. Hist. (7) vi. p. 178 (1900).

Type (male) and another male from Pretoria (*W. L. Distant*), and males and females from Estcourt, Natal, Sept. and Oct. 1896 (*G. A. K. Marshall*), 1906-17, and one female from Ulundi, Natal, 5000-6500 feet, by the same collector.

A species measuring $15\frac{1}{2}$ mm.

Dysmachus leucotania, Bezzi.

Bull. Soc. Ent. Ital. xxxvii. p. 286 (1906) [*Lophonotus*].

Two males from Victoria Falls, Zambesi, July 1914 (*Miss J. Brincker*), 1915, 125, and one female; one male from Mfongosi, Zululand (*W. E. James*), in Cape Coll.

Museum; one female from Salisbury, S. Rhodesia (*R. W. Tucker*), in Cape Coll. Museum; one female from Pretoria (*Miss J. Brincker*), 1915, 125; and females from Estcourt, Natal, Sept. and Oct. 1896 (*G. A. K. Marshall*), 1903, 17; all in Brit. Mus. Coll., except where otherwise specified.

These specimens from a rather wide range of localities appear to be all identical, and agree with the description of *Bezzi's* species. He gives the size as 15–18 mm., describing one or more males from Somaliland. These range in size from 14 to 20 mm. in the males and in the females from 15 to 17 mm.

A species distinguished by the white short pubescence on *abdomen* and *legs*, and by the median black stripe and white bristles on the *abdomen*. The *moustache* white with black hairs intermixed varies somewhat—in the females chiefly white, in the males the black hairs preponderate. The *forehead* with black and white bristly hairs, and the curled-over bristles black and white. *Mane* with long outstanding bristles and shorter black hairs, posteriorly forming a white mane continued on to the *scutellum*, which is armed with six black bristles. The fore and middle tibiæ are black with a red stripe, occasionally present on the hind pair, bristles on legs are chiefly white. *Genitalia* of male stout, long, club-shaped, with a fine yellow process produced below, reaching the under lamellæ which are stout and short; all a chestnut colour covered with white pubescence. *Ovipositor* of females short, black.

Bezzi speaks of it as a fine distinct species, distinct from the three *Loew* species, viz., *spiniventris*, *ustulatus*, and *pulcher*, and from my species *albofasciatus*. From this latter it is distinguished by the much longer genitalia and by the white bristles on the legs.

Dysmachus natalensis, sp. n.

Type (male), type (female), and one other male, all from Willow Grange, Natal (*W. C. Wroughton*).

One male from S. Africa (Distant Coll.).

A small greyish species in the same group as *Dysmachus wroughtoni*, sp. n. The black mane has a few long white bristly hairs on each side on the posterior half of thorax. Moustache black above, yellow below. Legs blackish, only the extreme base of tibiæ red. Genitalia of male large, stout.

Length, ♂ 12-13, ♀ 12 mm.

Male.—*Face* yellowish, the moustache reaching the antennæ, black above, yellow or white below. Beard yellowish white. *Antennæ* blackish, the first and second joints with long black hairs on each side. *Forehead* with black hairs, those on hind part of head long, black, bristly, with yellowish-white hairs round head. *Thorax* bronze, with greyish-brown tomentum, the mane thick with outstanding long black bristles and the white ones each side; pubescence on dorsum appears to be absent, bristles at sides are all yellow. *Scutellum* with a double row of white bristles and with a few white hairs. *Abdomen* greyish, with a large black spot on each segment and short white pubescence, the bristles on upper side are not very numerous, yellow in colour, the underside appears devoid of any, but has pale weak hairs. *Genitalia* black, shining, with white pubescence, the underplate is black, the forceps short, simple at apex but not produced to a point, being club-shaped, broad at the base with an obtuse tooth. *Legs* black with white tomentum, and all bristles white, except those on the underside of tarsi; the fore femora and tibiæ with long white hairs also present on the middle ones, but less apparent on the hind pairs. *Wings* clear, the small transverse vein about the middle of the discal cell.

Female identical, the *ovipositor* black, shining, almost as long as the two preceding segments.

Dysmachus rapax, sp. n.

Type (male) and type (female) and a long series of each sex from Nyasaland (*S. A. Neave*), in I. E. E. Coll., evidently a rapacious species; all caught with some victim, usually of the same family.

A species dark in colouring, with wholly bronze-coloured legs, with a black and yellow moustache, some yellow hairs on legs, and scutellum with wholly yellowish hairs and bristles. *Genitalia* short and small. It bears resemblance to *D. albopilosus* and *D. nigripes*, sp. n., as regards its mane, which is scanty, but distinctly begins from the anterior border of thorax, hence its place in the above-division.

Length, ♂ 19-20, ♀ 19-21 mm.

Male.—*Face* brownish, with grey tomentum. Moustache composed of yellow bristly hairs, bordered by black ones. Palpi with numerous strong black bristles. *Antennæ* blackish, the first two joints covered with grey tomentum, and

with strong black bristles on their underside and black hairs above, the third joint nearly as long as the first two joints together, the arista barely half as long as the third joint. Forehead with black bristly hairs, rather numerous. The curved bristles black and strong, the hairs continued round head and the beard yellowish white. *Thorax* bronze-green covered with yellowish tomentum, the median stripe split in middle and the side ones distinct; pubescence on dorsum short and black. *Mane* thin, composed of scanty black hairs, becoming longer posteriorly, surrounded from just before the suture by powerful black bristles, those at the side of the same nature; some weak yellowish-white hairs are present below the two postalar bristles and also on sides. *Scutellum* with weak but long yellowish-white bristles on its posterior border and weak yellowish hairs on its dorsum, some black hairs in centre are present as continuation of the mane, which posteriorly has some weak yellow hairs beyond the black bristles. *Abdomen* covered with glistening yellow tomentum, thickest at sides and on the segmentations, leaving a large dark blackish spot visible on each segment, the pubescence black on these spots, yellow at sides and also in the centre of the first two segments, the bristles long yellow, two or three deep; underside with long soft yellow hairs and a few yellow bristles only. *Genitalia* short, black, the upper forceps swollen with short point, the under pair nearly as long; all with chiefly black hairs and a few shorter yellow ones. *Legs* bronze-coloured, with close whitish pubescence; the fore femora with long pale yellow hairs below, the middle pair the same, the hind pair with shorter black and white hairs; fore tibiæ with black hairs below, and appressed orange hairs and long yellowish hairs on their outer edges, the middle pair the same, the hind pair with the long hairs black and white; the tarsi with whitish hairs, the bristles on legs chiefly black, a few reddish-yellow ones present. *Wings* greyish, the small transverse vein beyond the middle of discal cell oblique, curved.

Female identical. *Ovipositor* short, about the length of the last segment, ending in a curved point, on which the pubescence is short, orange-red, elsewhere a few black hairs; on the underside on the posterior border of the last segment are four black weak bristles, not present in the male; in other females they are more than four and scattered on dorsum.

Dysmachus wroughtoni, sp. n.

Type (male), type (female), and other males and females from Willow Grange, Natal (*R. C. Wroughton*), in I. E. E. Coll.; and one male from Ulundi, Natal, 5000-6000 feet, Sept. 1896 (*G. A. K. Marshall*), 1903, 17.

A small greyish species. Abdomen with a black central stripe. Mane all black with the exception of an admixture of pale reddish hairs on the anterior half, but with a fine side-stripe of white tomentum on the posterior half and white tufts of hairs on the scutellum. Legs blackish; tibiæ partly reddish. Moustache black with a mixture of reddish-yellow and white hairs. Genitalia of male long.

Length, ♂ 15, ♀ 12-13 mm.

Male.—*Face* glistening white, the moustache very large, reaching to the antennæ; in the type the hairs are largely reddish yellow and white at their apices, with the black hairs in the centre. Beard white. *Antennæ* blackish, the arista short, the first and second joints with very long, stout, black, erect hairs on their under sides and shorter reddish hairs on their upper sides. *Forehead* darker than face, with many erect black hairs. The black curved bristles on hind part of head are long, with white hairs behind them and round head. *Thorax* armed with a very distinct mane, from which numerous long black bristles proceed in the whole length, the reddish hairs intermixed with the black are not very noticeable; dorsum with chiefly short, fine, dirty white or yellow pubescence, the sides with grey tomentum; the three præsutural bristles are yellow, the two supra-alar and two postalar bristles black, the narrow white stripes of tomentum are only visible in certain lights. *Scutellum* same colour as thorax, with reddish-yellow fine hairs and a double row of stout black bristles on its border, besides the white tuft of hairs on each side. *Abdomen* with greyish-yellow tomentum, with a well-marked narrow black central stripe and traces of dark spots on the sides, the first segment with thick white hairs, the dorsum with short yellowish sparse pubescence and stout yellow bristles on posterior borders and sides of segments, the undersides with long white hairs, only a few of the yellow bristles are visible here. *Genitalia* bronze, shining, with fairly long yellowish-white pubescence; the forceps are long, simple, their apices simple ending in an obtuse point with black hairs. *Legs* bronze, shining, with whitish short pubescence; the femora stout with some long yellowish hairs and with

black bristles; the tibiae obscurely reddish brown at their base, more widely so on the anterior and middle pair, which have long yellowish or white bristles and some long fine white hairs, the hind pair with black bristles only; the tarsi with black bristles. *Wings* hyaline, the small transverse vein beyond the discal cell.

Female identical, the ovipositor short, only a little longer than the preceding segment, black, shining.

The male from Ulundi only measures 10 mm.

[To be continued.]

LIII.—On some Eastern *Xylophilids* [Coleoptera].

By G. C. CHAMPION, F.Z.S.

MR. C. F. BAKER, of the Agricultural College, Los Baños, Philippines, has recently sent to the British Museum an interesting series of Eastern *Xylophilids*, mainly from the island of Basilan, to the west of Mindanao, and Sandakan in N.E. Borneo. These insects are enumerated or described in the present paper, which is a continuation of others on the same subject written by myself in 1915, 1916, and 1917 [cf. *Ann. & Mag. Nat. Hist.* (8) xvi.; *Trans. Ent. Soc. Lond.* 1916; and *Ent. Mo. Mag.* li., liii.]. A few additional Indian forms, given to the Museum by Mr. E. A. Butler, or sent by my son, H. G. C., from Almora during the past year, are included in the present contribution. Three *Xylophilids* have already been recorded from the Philippines by Pic (*Hylophilus baeri*, *bakeri*, and *sulcithorax*), but the Museum has not hitherto possessed any material from these islands, whence ten are now enumerated. On account of the humid climate, Mr. Baker's insects have been mounted with shellac, which is not easily removed without damage to the specimens, hence several of them must be left undetermined till further material is obtained.

HYLOBÆNUS, Pic.

Hylobænus fasciatus.

Hylobænus fasciatus, Pic, *Ann. Soc. Ent. Fr.* 1912, p. 272; *Champ. Ann. & Mag. Nat. Hist.* (8) xvi. p. 215 (1915); and *Trans. Ent. Soc. Lond.* 1916, p. 3, t. 1. fig. 1.

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Hab. CEYLON, Galle [type]; TENASSERIM; PENANG (*C. F. Baker*); BORNEO, Sandakan (*C. F. Baker*).

Four rather worn specimens sent by Mr. Baker agree with those recorded by me in 1916. The insect may be of littoral habits?

Hylobænus varicornis.

Hylobænus varicornis, Champ. Trans. Ent. Soc. Lond. 1916, p. 4.

Hab. SIAM; TENASSERIM; PHILIPPINES, Basilan Island (*C. F. Baker*).

One specimen from Basilan, not differing from the types.

PHYTOBÆNUS, Sahlb.

Phytobænus gibbiventris, sp. n.

♀. Elongate, narrow, robust, convex beneath, shining (when denuded); nigro-piceous, the front of the head reddish, the prothorax with the anterior margin, the elytra with a large oblique patch on the disc below the base (nearly reaching the suture), and a common, broad, arcuate, outwardly-narrowed subapical fascia, the palpi, and legs (the slightly infuscate posterior femora excepted) testaceous, the antennæ piceous; pruinose and very finely pubescent; closely, finely punctured. Head a little wider than the prothorax; eyes extremely large, almost contiguous, deeply emarginate; antennæ rather elongate, stout, joints 2-6 subcylindrical, 3 as long as 4, 8-10 transverse, 11 acuminate-ovate. Prothorax longer than broad, convex, rounded at the sides, unimpressed. Elytra moderately long, a little wider than the head, subparallel in their basal half, broadly depressed on the disc below the base. Posterior legs comparatively short, the femora moderately clavate towards the apex. The fused ventral segments 1 and 2 convex, together as long as 3-5 united.

Length $2\frac{1}{4}$ mm.

Hab. SINGAPORE (*C. F. Baker*).

One specimen. Narrower and more elongate than *P. amabilis*, Sahlb., a Palæarctic insect extending to Japan, the antennæ longer, the elytral markings different. The present species forms an intermediate link between *Phytobænus*, Sahlb., and *Hylobænus*, Pic.

XYLOPHILUS, Latr.

*Malayan forms.**Xylophilus glaucescens*, sp. n.

♂. Elongate, robust, convex, opaque (till denuded); piceous, the elytra with a common, broad, transverse, post-median blackish fascia, preceded laterally by an oblong, reddish, indeterminate patch extending downward from the shoulder, the antennæ black, with joints 1 and 2 and the tip of 11 rufescent, the palpi and legs testaceous, the posterior femora and tibiæ slightly infusate; pruinose and very finely pubescent, the vestiture fuscous on the elytral fascia and bluish grey or glaucous on the rest of their disc; the entire upper surface densely, very finely punctured. Head, with the eyes, broader than the prothorax, truncate at the base; eyes very large, occupying the whole of the sides of the head, feebly emarginate, separated by about one-half their own width as seen from in front; antennæ long, moderately stout, pilose, joint 3 slightly longer than 2, 11 stout, obliquely acuminate, much longer than 10. Prothorax longer than broad, rounded at the sides, unimpressed, about equal in width at the base and apex. Elytra long, wider than the prothorax, slightly rounded at the sides, flattened on the disc anteriorly. Legs long, rather stout; joint 1 of anterior tarsi broadly dilated, as long as 2-5 united; posterior femora simple, feebly incrassate, the tibiæ widened, the tarsi with joint 1 curved and about three times the length of 2-4 united. Aedeagus long, slender, acuminate.

Length $2\frac{1}{2}$ mm.

Hab. PHILIPPINES, Basilan Island (*C. F. Baker*).

One male, in perfect condition. In general facies this species approaches the Indian *X. armipes*, Fairm.; the basal joint of the anterior tarsi (♂) is greatly dilated, as in the Bornean *X. latimanus*, Champ., ♂ (1917); the pruinosity of the non-fasciate portions of the elytra is bluish.

Xylophilus complanatus, sp. n.

Elongate, depressed, shining; black, the apical joint of the antennæ rufescent, the palpi and tarsi, and in one specimen the anterior femora and tibiæ and the bases of the other femora, testaceous; pruinose and very finely pubescent; the elytra closely and very finely, the head and prothorax sparsely,

punctured. Head transverse, broader than the prothorax, convex, rapidly narrowed behind the eyes, the latter very large and separated by about half their own width; antennæ long in ♂, shorter in ♀, feebly serrate from joint 4 onward, 3 about as long as 4, 11 acuminate-ovate. Prothorax transversely quadrate, abruptly narrowed in front, grooved across the disc anteriorly and with a deep horseshoe-shaped impression before the base. Elytra much broader than the head, long, flattened and subparallel in their basal half, the disc with an oblique shallow depression extending downward from the humeri, the suture also depressed at the base. Legs long.

♂. Anterior tibiæ feebly curved, mucronate at tip; anterior tarsi dilated; posterior femora simple, slightly thickened. Aedeagus (so far as visible) rather broad, abruptly acuminate at tip.

Length $2\frac{3}{5}$ - $3\frac{1}{5}$ mm. (♂ ♀.)

Hab. BORNEO, Sandakan (C. F. Baker).

Three males and one female, the latter immature, the males varying in the colour of the anterior femora and tibiæ. Larger and more elongate than *X. planipennis*, Motsch., from Ceylon, the head simply convex posteriorly, the ♂ with the antennæ longer, stouter, and distinctly serrate (as in the Bornean *X. melanosoma*, Champ., 1915), the anterior tibiæ mucronate at the tip, the anterior tarsi stouter.

Xylophilus strangulatus, sp. n.

♂. Elongate, narrow, shining, pruinose; testaceous, the eyes black, the elytra (except at the base) and joints 3-10 of the antennæ more or less infuscate, the posterior femora and tibiæ a little darker than the tarsi; sparsely, minutely, the elytral depressions rather coarsely, punctured. Head broad, transverse, well developed behind the eyes, the latter large, distant; antennæ long, rather slender, joint 3 as long as 4, 11 stout, obliquely acuminate. Prothorax small, transversely quadrate, narrowed in front, with a deep arcuate excavation before the base and a strongly defined sulcus extending across the disc before the middle. Elytra long, slightly wider than the head, subparallel in their basal half, blunt at the tip, deeply excavate on the disc anteriorly. Anterior tibiæ feebly curved, unarmed; posterior legs not very elongate, the femora moderately thickened, simple. Aedeagus slender, curved upward at the tip.

Length $2\frac{1}{4}$ mm.

Hab. BORNEO, Sandakan (C. F. Baker).

One male, somewhat abraded, owing to the difficulty of

removing the shellac used in mounting it. A narrow elongate form, with the general facies of an *Anthicus*; the prothorax small, transversely sulcate anteriorly, and deeply excavate before the base; the elytra long, excavate and more coarsely punctured anteriorly. Near *X. claviger*, Champ. (1916), from Siam, the antennæ (σ) much longer and with differently shaped terminal joint, the prothorax not angulate at the sides. *X. malaccanus*, Pic, is also another allied form.

Xylophilus fimbriatus.

Xylophilus fimbriatus, Champ. Ent. Mo. Mag. li. p. 279 (Oct. 1915).

Hab. BORNEO, W. Sarawak [type, σ] (*G. E. Bryant*), Sandakan (*C. F. Baker*: ♀).

One example, differing from the type (σ) in having the elytra paler laterally, the antennæ shorter and not so stout, and the posterior femora simple. An allied unnamed form from Sandakan (now without antennæ) has a rougher head and prothorax, and the latter less angulate at the sides anteriorly.

Xylophilus castaneus, sp. n.

Oblong, robust, somewhat convex, shining, clothed with rather long pallid hairs; rufo-castaneous, the eyes, antennæ (the reddish joints 1 and 2 and tip of 11 excepted), posterior femora and tibiæ, the other femora at the tip and the corresponding tibiæ in great part, piceous or black, the rest of the legs (the infusate basal joint of the posterior tarsi excepted) and the palpi testaceous; closely, finely, the elytra rather coarsely, punctured. Head broad, truncate posteriorly, narrowly, subangularly extended on each side behind the eyes, the latter large, deeply emarginate, somewhat distant; antennæ long, stout, joints 3 and 4 subequal, 3 much longer than 2, 11 sharply, obliquely acuminate. Prothorax convex, transversely subquadrate, narrowed in front, unimpressed. Elytra oblong, much wider than the head, depressed on the disc below the base. Legs rather elongate; posterior femora stout, clavate, the tibiæ slightly bowed inward.

Length $2\frac{2}{3}$ mm. (♀ ?).

Hab. BORNEO, Sandakan (*C. F. Baker*).

One specimen. Very like *X. pulvinatus*, Champ. (1916), from Siam and Tenasserim, the posterior femora more strongly clavate and the puncturing of the elytra coarser. The σ of *X. pulvinatus* has longer antennæ, differently formed legs, &c., the ♀ of the latter resembling the present insect. From

X. cylindricornis, Champ., from Assam, the red head and less thickened antennæ, and the less excavate and stronger puncturing of the basal portion of the elytra will serve to distinguish *X. castaneus*.

Xylophilus holocinctus, sp. n.

Rather short, robust, shining, somewhat coarsely pubescent; the head, prothorax, a common very broad median fascia on the elytra (occupying more than one-third of their length), a space across the under surface in line with it, the intermediate and posterior femora broadly at the apex, and the posterior tibiæ to near the tip black or piceous, the rest of the elytra, legs, and under surface (that of the head excepted) testaceous or rufo-testaceous, the antennæ obscure ferruginous; closely, finely, the elytra a little more coarsely, punctured. Head very broad, short, truncate posteriorly, narrowly extended and subangulate on each side behind the eyes, the latter very large and somewhat distant; antennæ rather short and stout, joint 3 as long as 4, 5-10 transverse [11 missing]. Prothorax subquadrate, feebly canaliculate at the base. Elytra wider than the head, oblong, the post-basal depression deep, extending obliquely forward to within the humeri and along the suture to the base. Legs rather stout; posterior femora moderately clavate, the tibiæ almost straight and distinctly widened.

Length $2\frac{1}{10}$ mm. (♀?).

Hab. BORNEO, Sandakan (*C. F. Baker*).

One specimen. N ar *X. latericius*, (Champ. (1916), from Siam. The broad nigro-piceous elytral fascia is continued across the under surface in the present insect. *X. bryanti*, Pic, from Ceylon, is somewhat similarly coloured. *X. tavoyanus*, Champ., from Tenasserim, has a narrower prothorax and longer, less thickened antennæ.

Xylophilus basilanus, sp. n.

♂. Rather short, somewhat convex, shining, finely pubescent; testaceous, the eyes black, the head and posterior femora slightly infuscate, the elytra in one specimen with a small common transverse patch at the middle of the suture and a spot on the outer margin in line with it piceous; closely, finely, the elytra a little more coarsely, punctate. Head broad, truncate at the base, very narrowly extended and subangular on each side behind the eyes, the latter extremely large and subapproximate; antennæ about as long as the elytra, rather stout, joint 3 as long as 4, 11 stout,

obliquely acuminate. Prothorax transversely subquadrate, narrowed in front, unimpressed. Elytra wider than the head, comparatively short, narrowing from about the middle, without depressions on the disc. Anterior and intermediate tibiae feebly curved, sinuate within, the latter subangulate near the base; posterior femora curved, very stout, hollowed along their lower face, the lower edge shortly ciliate and also angulate at the apex as seen from above; posterior tibiae flattened, curved inward, slender at the base; basal joint of posterior tarsi almost straight, long.

Length 2 mm.

Hab. PHILIPPINES, Basilan Island (*C. F. Baker*).

Two males in good condition. Larger than *X. ephippiatus*, Champ. (1916), from Tenasserim, the elytra differently marked, the head testaceous, the ♂ characters different, the posterior femora, however, somewhat similarly formed in this sex. The Bornean *X. immaculipennis* is also not unlike the present species.

Xylophilus bakeri.

Xylophilus bakeri and var. *sericeopubens*, Pic, 'L'Echange,' xxxi. pp. 7, 8 (Feb. 1915).

♂. Moderately elongate, rather broad, shining (when denuded); rufo-testaceous above, the eyes black, the prothorax slightly infuscate along the sides and on the middle of the disc, the elytra with a large transverse scutellar patch, a broad, common, sharply angulate, submedian fascia, and a space along the sides, the under surface of the body, and the posterior femora and tibiae, nigro-piceous or black; pruinose and very finely pubescent, the vestiture fuscous on the elytral fascia and cinereous on the other parts of the surface; closely, finely, the elytra a little more distinctly, punctured. Head broad, narrowly extended behind the eyes, the latter large, somewhat distant; antennae moderately long, not very slender, serrate from joint 4 onward, 3 small, not longer than 2, 11 stout, acuminate. Prothorax subquadrate, narrowed in front, arcuately impressed on the disc before the base. Elytra oblong, much wider than the head, moderately elongate, depressed on the disc below the base. Anterior tibiae armed with a sharp triangular tooth towards the apex. Posterior femora moderately clavate, simple, the tibiae stout. Aedeagus (so far as visible in the dried specimen) very slender, pointed at tip.

Length $2\frac{1}{2}$ mm.

Hab. PHILIPPINES, Los Baños (*P. L. Baker*).

One male, in good condition. This insect seems to be a variety of *X. bakeri*, Pic (1915), from the same locality, with the elytral markings partly confluent, the type having two oblong nigro-piceous patches on the disc and the sutural region infuscate, and the var. *sericeopubens*, Pic, the elytra black, with a long humeral patch and about the apical third testaceous. The armature of the ♂ anterior tibiæ is similar to that of the Indian *X. armipes*, Fairm., except that the tooth is placed nearer the tip. Not unlike *X. furcatimanus*, Champ. (1916), from Tenasserim, but with the elytral markings more strongly angulate in front and behind and the ♂ characters very different. The sexual marks of distinction of *X. bakeri* were not noted by its describer.

Xylophilus cephalicus, sp. n.

Short, broad, convex, opaque (till denuded); piceous, the head, palpi, antennæ (the testaceous third joint excepted), and prothorax rufescent or ferruginous, the tarsi, and the anterior and intermediate femora and tibiæ in great part, testaceous; bluish-grey pruinose and also very finely pubescent; closely, minutely, the elytra more distinctly, punctured. Head large, subquadrate, greatly developed behind the eyes, rounded on each side at the base; eyes convex, moderately large, distant; antennæ short, stout, joint 3 very small, 5-10 strongly transverse, 11 thickened, acuminate. Prothorax narrow, subquadrate, rounded at the sides anteriorly. Elytra broad, short, rounded at the sides posteriorly, unimpressed. Legs rather short; posterior femora thickened, the tibiæ moderately stout.

Length $1\frac{3}{4}$, breadth nearly 1 mm. (♀?).

Hab. PHILIPPINES, Basilan Island (*C. F. Baker*).

One specimen, in perfect condition. Extremely like the Bornean *X. cæsius*, Champ. (1915), type probably ♀, but with the head larger, and the antennæ ferruginous and almost as stout as in *X. laticornis*, Pic, from Ceylon, &c., and shorter than in *X. annulicornis*, Champ. (1916), from Tenasserim. The post-ocular portion of the head is longer than in *X. laticornis* and the eyes are more prominent. The sexes of this latter insect have not been certainly identified by me, and further material of all of them is required.

Xylophilus sexguttatus, sp. n.

♂. Rather short, robust, shining, finely pubescent; testaceous, the head and prothorax reddish, the eyes black, the elytra

each with three small fuscous spots—one on the disc below the base and two placed transversely at about the apical third; closely, finely, the prothorax densely, the elytra rather coarsely, punctured. Head very broad, truncate at the base, narrowly extended on each side behind the eyes, the latter large, distant; antennæ comparatively short, rather stout, joint 3 about as long as 4, 11 stout, obliquely acuminate. Prothorax transverse, rounded at the sides anteriorly, canaliculate down the middle of the disc. Elytra rather short, wider than the head, with a shallow oblique post-humeral depression. Anterior tibiæ feebly curved; posterior legs comparatively short, the femora stout, clavate, the tibiæ slightly widened, the basal joint of the posterior tarsi curved, thickened.

Length 2 mm.

Hab. PHILIPPINES, Mt. Makiling in Luzon (*C. F. Baker*).

One specimen, assumed to be ♂ on account of the curved anterior tibiæ. More elongate than the Bornean *X. immaculipennis*, Champ. (1915), the antennæ and legs stouter, the elytra each with three small fuscous spots. Less elongate than *X. undulatus*, Champ. (1915), from Penang, the head rufescent, the elytra shorter and differently marked. *X. sulcithorax*, Pic (1914), also from the Philippines, is said to have a similarly canaliculate prothorax, but it differs in other respects.

Xylophilus philippinus, sp. n.

♂. Moderately elongate, shining (when denuded), pruinose; testaceous, the eyes black; closely, finely punctate. Head broad, transverse, much developed behind the eyes, the post-ocular portion (as seen from above) about equalling them in length; eyes moderately large, distant; antennæ slender, long, joint 3 small, not longer than 2, 11 obliquely acuminate. Prothorax transversely quadrate, narrowed in front. Elytra moderately long, about twice as wide as the prothorax, subparallel in their basal half, flattened on the disc anteriorly. Legs long; anterior tibiæ curved, angularly dilated at about their outer third (appearing strongly sinuate within); posterior femora thickened, hollowed along their lower face; basal joint of posterior tarsi very elongate, slender.

Length $2\frac{1}{4}$ mm.

Hab. PHILIPPINES, Basilan Island (*C. F. Baker*).

One male, perhaps slightly immature. The broad post-ocular portion of the head, rather small eyes, slender antennæ, with small third joint, long legs, peculiarly shaped ♂ anterior

tibiæ, and pallid coloration are the chief characters of this insect. *X. philippinus* can be placed near *X. parvicollis*, Champ. (1916), from Assam.

Xylophilus stratus, sp. n.

Oblong, rather convex, shining (when denuded); rufo-testaceous, the eyes and a sharply defined, outwardly-widened, post-median fascia on the elytra (the fascia narrowly interrupted at the suture) black; clothed with a very fine silky pubescence; closely, finely punctured, the puncturing of the prothorax dense. Head very broad, truncate at the base, narrowly extended and subangulate on each side behind the eyes, the latter large and somewhat distant; antennæ short, not very slender, joint 3 as long as 4, 9 and 10 transverse, 11 stout, acuminate. Prothorax transversely subquadrate, narrowed in front, obliquely bi-impressed before the base. Elytra oblong, wider than the head, obliquely depressed on the disc anteriorly. Posterior legs comparatively short, the femora moderately thickened, the tibiæ also rather stout.

Length $1\frac{1}{2}$ mm.

Hab. SINGAPORE.

One specimen, sex not ascertained. A small, oblong, rufo-testaceous insect, with the elytra sharply nigro-fasciate towards the apex, the antennæ short, the posterior legs comparatively short and moderately thickened, the surface appearing opaque till the vestiture is removed. The black elytral fascia is placed nearer the tip than in most of the similarly coloured *Xylophili* known to me.

Xylophilus biguttatus, sp. n.

Oblong-oval, convex, shining, sparsely pubescent; testaceous, the eyes black, the elytra each with a rather large oblique piceous spot at the middle of the disc not quite reaching the suture; closely, not very finely, the elytra more coarsely, punctured. Head short, broad, truncate posteriorly, narrowly extended on each side behind the eyes, the latter large, somewhat distant; antennæ rather long, not very slender, joint 3 longer than 2 or 4, 7-9 about as long as broad, 10 transverse, 11 acuminate-ovate. Prothorax as wide as the head, short, transversely subquadrate, the hind angles rectangular, the disc unimpressed. Elytra much wider than the head or prothorax, subparallel in their basal half, slightly depressed at the base within the humeri, for the rest convex. Legs rather elongate; posterior femora moderately clavate, the tibiæ a little widened.

Length $2\frac{1}{5}$ mm.

Hab. PHILIPPINES, Basilan Island (*C. F. Baker*).

One specimen, possibly ♂, the anterior tibiæ being perceptibly curved. A small, oblong, convex, shining, testaceous insect, the elytra piceo-biguttate and rather coarsely punctured, the puncturing of the prothorax also strong. The first ventral suture is just traceable across the middle. Not unlike *X. meranganus*, Champ. (1916), from Sumatra. The red head, broader prothorax, and differently coloured elytra separate *X. biguttatus* from *X. trinotatus*, Champ., from Tenasserim.

Xylophilus breviculus, sp. n.

Oval, rather convex, robust, shining, finely pubescent; testaceous, the eyes and a spot on the disc of the prothorax (possibly due to discoloration) black; closely, finely, the elytra more coarsely, punctured. Head broad, truncate posteriorly, narrowly extended on each side behind the eyes, the latter large, distant; antennæ short, rather stout, joint 3 a little longer than 2, 5-10 transverse, 11 oval. Prothorax convex, short, as broad as the head, rounded at the sides anteriorly. Elytra oval, short, wider than the prothorax, unimpressed. Legs short; posterior femora stout, clavate, the tibiæ widened.

Length $1\frac{1}{2}$ mm.

Hab. PHILIPPINES, Basilan Island (*C. F. Baker*).

One specimen. A very small, oval, convex, shining testaceous insect, much smaller than *X. biguttatus*, the antennæ short and rather stout, the legs short, the posterior femora relatively thicker.

Xylophilus sandakanæ, sp. n.

Oblong-oval, shining, finely cinereo-pubescent; nigropiceous, the palpi, joints 4-11 of the antennæ, the coxæ, bases of the femora, knees, tibiæ (the median third of the posterior pair excepted), and tarsi testaceous; densely, finely, the elytra a little more coarsely, punctured. Head broad, truncate behind; eyes very large, occupying nearly the whole of the sides of the head, somewhat distant; antennæ rather long, slender, slightly thickened towards the tip, joint 3 as long as 4, 11 stout, acuminate-ovate. Prothorax transverse, rounded at the sides anteriorly, shallowly, obliquely bi-impressed before the base. Elytra much wider than the head, oblong, obsoletely depressed below the base.

Posterior legs comparatively short, the femora clavate, the basal joint of the tarsi rather stout, long, almost straight.

Length $1\frac{5}{8}$ mm. (♀?).

Hab. BORNEO, Sandakan (*C. F. Baker*).

One specimen, in perfect condition. A small oblong-oval insect, with the body uniformly piceous, the antennæ rather slender, testaceous, with joints 1-3 infuscate, and the legs partly testaceous, the posterior pair somewhat feebly developed. This species can be placed near *X. curtus*, Champ. (1916), from Assam, the latter having shorter and stouter antennæ.

Xylophilus microphthalmus, sp. n.

Oblong-oval, rather convex, shining (when denuded), very finely sericeo-pubescent; rufo-testaceous, the legs paler, the eyes black, the antennæ obscure ferruginous, paler at the base and tip; closely, finely, the elytra more distinctly, punctured. Head a little wider than the prothorax, truncate posteriorly, rather broadly extended on each side behind the eyes, the latter comparatively small, convex; antennæ thickened, joint 3 as long as 4, 5-10 transverse, 11 acuminate-ovate. Prothorax transversely subquadrate, depressed on the disc before the base. Elytra oval, almost unimpressed. Posterior femora moderately clavate.

Length $1\frac{3}{4}$ mm.

Hab. PHILIPPINES, Los Baños (*P. L. Baker*).

One example only of this convex rufo-testaceous form has been sent. The small, prominent eyes, oval, unimpressed elytra, rather stout antennæ, and silky pubescence are its chief characters. Smaller than *X. sandakane*, the antennæ stouter, the head broadly extended behind the eyes, the body differently coloured.

Indian forms.

Xylophilus albolineatus, sp. n.

Moderately elongate, rather broad, shining; black, the palpi, tarsi (except the basal joint of the intermediate and posterior pairs), and the coxæ and bases of the femora to a variable extent, testaceous; clothed with rather long, adpressed, fuscous and whitish hairs, the latter condensed on the elytra into a posteriorly-abbreviated sutural streak, an oblique line on the disc exterior to it, and a common, arcuate subapical fascia, the hairs along the sides of the elytra, and on the under surface, antennæ, and legs, also whitish;

densely, finely, the elytra more coarsely, punctured. Head a little wider than the prothorax, truncate at the base, extended on each side behind the eyes, the latter large, distant; antennæ moderately long, somewhat thickened, joint 3 about as long as 4, 11 obliquely acuminate. Prothorax transversely subquadrate, narrowed anteriorly, depressed laterally towards the apex. Elytra oblong, broad, not very long, with a common, deep, arcuate excavation below the base extending forward to the humeri. Tarsi slender. Posterior femora stout, clavate.

Length $2\frac{1}{2}$ mm.

Hab. S. INDIA, Kodaikanal (*T. V. Campbell*).

Two specimens, ? ♂ and ♀, one of them in good condition, the other imperfect, both presented to the Museum by Mr. E. A. Butler. An isolated form, with a shining black body, the tarsi in part and the palpi flavescent, the long elytral pubescence partly whitish, and arranged into irregular lines and a subapical fascia, the post-basal depressions deep and oblique. *X. melanotus*, Champ. (1916), from Assam, is perhaps the nearest ally known to me.

Xylophilus brunneomaculatus.

? *Xylophilus brunneomaculatus*, Pic, 'L'Echange,' xxiii. p. 182 (1907).

Xylophilus brunneomaculatus, Champ. Trans. Ent. Soc. Lond. 1916, p. 20.

Hab. INDIA, Himalaya.

Two imperfect specimens recently received from my son (*H. G. C.*) from W. Almora differ from the two recorded by me from Kasauli and Simla in their much darker coloration: the head and a common, broad, indeterminate median fascia on the elytra are black, and the legs, prothorax, and posterior portion of the elytra infuscate or piceous. The antennæ are entirely testaceous and formed as in the examples described by me in 1916. The angularly dilated sides of the prothorax separate the present species from *X. rosti*, Pic, from Kulu, an insect compared with *X. neglectus*, Duval, and at present unknown to me.

Xylophilus himalaicus, sp. n.

♀. Elongate, rather broad, robust, shining, finely, somewhat sparsely pubescent; black, the tarsi (the infuscate basal joint of the posterior pair excepted) and palpi testaceous, the elytra (a space along the sides extending from a little below the humeri to near the tip and the apical margin excepted) reddish brown; closely, strongly, the elytra more

coarsely, punctured. Head broad, truncate at the base, narrowly, subangularly extended on each side behind the eyes, the latter large, distant; antennæ stout, moderately long, joint 3 as long as 4, 8-10 transverse, 11 obliquely acuminate. Prothorax transversely subquadrate, narrowed in front, distinctly canaliculate towards the base. Elytra rather long, much wider than the head, narrowed from about the middle, obliquely depressed on the disc anteriorly. Posterior femora moderately clavate.

Length $2\frac{1}{2}$ - $2\frac{3}{4}$ mm.

Hab. INDIA, W. Almora in Kumaon (*H. G. Champion*: v. 1919).

Two specimens. Very like *X. crassipes*, Champ., from Ceylon (1915, type ♂), but larger, broader, and more robust; the antennæ stouter and wholly black (except at the extreme tip); the puncturing of the head stronger; the elytra bordered with black at the apex, the post-basal depressions shallow.

Xylophilus varus, sp. n.

♂. Moderately elongate, rather broad, shining, finely pubescent; testaceous, the head nigro-piceous; closely, finely, the elytra a little more coarsely, punctate. Head broader than the prothorax, narrowly extended and subangular behind the eyes, the latter large and separated by a rather narrow space; antennæ very long, about the length of the elytra, not very slender, the joints subcylindrical, 3 about as long as 4 [11 wanting]. Prothorax convex, transverse, narrowed anteriorly, without definite impressions. Elytra moderately long, comparatively broad, subparallel in their basal half, slightly depressed within the humeri. Legs long [posterior pair wanting]; intermediate tibiæ abruptly bowed inward from a little beyond the middle.

Length $2\frac{1}{2}$ mm.

Hab. S. INDIA, Kodaikanal (*T. V. Campbell*).

One male, presented to the Museum by Mr. E. A. Butler. Larger than the Cingalese *X. cribricollis*, Pic (= *mucronatus*, Pic), the antennæ and legs much elongated, the intermediate (instead of the anterior) tibiæ abruptly bowed in ♂. Judging from the structure of its allies, the posterior femora in the present species should be clavate and more or less infusate in the same sex. A smaller ♂, from the Nilgiri Hills (*H. L. Andrewes*), now wanting the antennæ and the anterior and posterior legs, may belong to the same species: the elytra, however, have the suture in part and a spot at the sides beyond the middle infusate. *X. nigropictus*, Champ. (1915), from Kandy, has similar intermediate tibiæ in ♂.

LIV.—A Key for the Ready Identification of the Species of *Cephalodiscus*. By W. G. RIDEWOOD, D.Sc.

IN the Report on the specimens of *Cephalodiscus* obtained by the 'Terra Nova' on the British Antarctic Expedition of 1910-1913, published in 1918 by the British Museum (Nat. Hist.), there is given a synopsis of the species at present known, and a list of all recorded specimens (pp. 66-77). The particulars therein set forth were derived mainly from an examination of actual specimens, but in the case of five species that were not available for personal study they were taken from the published descriptions. The list records the latitude and longitude of the locality from which each specimen was obtained, and is supplemented by two maps showing the geographical distribution of the various species.

It has been pointed out that the synopsis and list would have been of greater service if there had been appended a key or table such as would enable those who have not made a special study of the genus to identify readily the species of any material that might come into their hands. It is with a view to supplying this deficiency that the present key has been drawn up. Seeing that it is only intended as a supplement to the Report, to be used in conjunction with the synopsis, only a few explanatory notes need be given here.

Three subgenera of *Cephalodiscus* are at present recognized, the first two—*Demiothecia* and *Idiothecia*—being introduced in 1907 in the Report on the Pterobranchia of the National Antarctic Expedition ('Discovery'), and the third—*Orthoecus*—added by Andersson later in the same year in his report on the Pterobranchia obtained on the Swedish South-Polar Expedition of 1901-1903. The differences between *Orthoecus* and *Idiothecia* are much less pronounced than are those between *Idiothecia* and *Demiothecia*, and on p. 19 of the 'Terra Nova' report are given the reasons for transferring Schepotieff's species, *indicus*, from the subgenus *Idiothecia*, in which he placed it, into the subgenus *Orthoecus*.

The reasons for regarding Andersson's *inæquatus* as synonymous with *hodgsoni* are published in the report on the Pterobranchia of the Scottish National Antarctic Expedition (1902-1904, 'Scotia'), 1913, pp. 559-563. *Cephalodiscus æquatus* is not easily separated from *C. hodgsoni*, but the evidence is not sufficiently strong for regarding the two as synonymous—see 'Terra Nova' Report, pp. 59 and 69. Since the characters that distinguish the species *hodgsoni*, *æquatus*, and *dodecalophus* cannot be expressed in a few

words, the synopsis itself should be consulted by those wishing to discriminate between these species. As regards the two diminutive species of the subgenus *Demiothecia*, Harmer writes ('Pterobranchia of the "Siboga" Expedition of 1899-1900,' Leiden, 1905, p. 4):—"The possibility is not excluded that *C. siboga* is the male form of *C. gracilis*."

A study of the large and varied collection of *C. densus* obtained by the 'Terra Nova' leads to the conclusion that what Andersson described as *C. rarus* is but an early colony of *C. densus*, with the tubes of the cœnœcium lax, straggling, and irregular, instead of closely set and more or less parallel—see 'Terra Nova' Report, pp. 39-40.

Gravier's species—*C. anderssoni*—is with difficulty distinguishable from *C. densus*; his description of the zooids is incomplete, and the principal feature that distinguishes the cœnœcium of his species is the aggregation of the tubes into clumps or clusters which stand out more or less distinctly from the other clumps—see 'Terra Nova' Report, pp. 40 and 76.

The present key is so drawn up as to bring the species *nigrescens* and *solidus* together. Although belonging to different subgenera, they have many points in common, and I was for some time uncertain whether the cone-shaped colonies obtained on the Australasian Antarctic Expedition of 1911-1914 were small, short-tubed colonies of *C. solidus* or unbranched colonies of *C. nigrescens*—see report on the Pterobranchia of the expedition, Sydney, 1918, pp. 19-20. The arms of well-preserved zooids of *C. nigrescens* show a characteristic double black band on the axis, but the bands are lost in badly preserved material. On the other hand, it is not definitely known that the zooids of *C. solidus* do not possess such bands; Andersson does not mention them, and the zooids of one of his specimens that I had an opportunity of studying do not show them; the material, however, is not well preserved, and there are evident signs of the colour of the zooids having become diffused and reduced in intensity.

The key is also arranged so as to bring together the two specially arenaceous species *agglutinans* and *evansi*; the former has black zooids and the latter white. Although *C. agglutinans* differs from the other species of *Idiothecia* in the tubes not ending blindly in the middle of the branch, the character is not readily determined, owing to the transparency and thinness of the tubes and the confusing effect of the numerous particles of shell embedded in the cœnœcial substance.

The only species outside the subgenus *Demiothecia* that has spines on the cœnoecium is *C. gilchristi*.

The length of the zooids given in the key is that from the free ends of the arms to the end of the trunk, not including the stalk.

- I. Cavities of the cœnoecium in the form of tubes.
 Each tubular space with a single orifice, and occupied by one zooid and its buds. Arms without end-swellings and refractive beads.
- A. Cœnoecium in the form of a branching system, with the newest tubes at the apices of the branches *Idiothecia*.
- a. Internal ends of the tubes communicating by a labyrinthic system.
1. Branches massive, fragile, with abundant fragments of shell embedded; each ostium with a short, blunt lip, but no peristomial tube. Zooids 4.5 mm., blackish; arms 8 or 9 pairs. *agglutinans*.
- b. Internal ends of the tubes blind.
2. Branches massive, fragile, with abundant fragments of shell embedded; each ostium with a short peristomial tube. Zooids 3.5 mm., white; arms usually 8 pairs. *evansi*.
3. Branches fairly long, slender, not fragile, with numerous long spines; brownish; ostia with or without peristomial tubes. Zooids 1.6 to 1.8 mm., blackish when alive, brown in preserved material, with blackish margin to anterior edge of shield; arms usually 6 pairs *gilchristi*.
4. Branches medium or slender, orange-coloured, no spines; each ostium with a single-lipped peristomial tube. Zooids 2.5 mm., whitish; arms 6 pairs *levinseni*.
5. Branches massive, rarely slender, greyish or brownish, no spines; each ostium with a short, single-lipped peristomial tube. Zooids 4.0 to 6.0 mm., blackish; arms usually 7 pairs, each with two black bands along the axis. *nigrescens*.
- B. Cœnoecium in the form of a hemisphere, cone, or cake, with the newest tubes at the edges; basal ends of the tubes blind *Orthoecus*.
6. Colony bulky and massive, tubes long, common cœnoecial substance firm; each ostium with a single thick lip,

- edge of ostium thick. Zooids 4.0 to 5.0 mm., blackish, fading to pale brown; arms usually 8 pairs *solidus*.
7. Colony bulky and massive, or small and lax if young (*rarus*), tubes long, common cœncecial substance soft and spongy; ostium without a definite lip, transverse or oblique, edge of ostium thin. Zooids 4.0 to 7.0 mm., brownish or greyish; arms usually 8 pairs *densus* (including *rarus* and (?) *anderssoni*).
8. Colony diminutive, orange when fresh, pale in alcohol; ostia without definite lip. Zooids 2.2 mm., pale; arms 3 pairs *indicus*.
- II. Cavity of the cœncecium continuous, and occupied in common by the zooids and their buds. Cœncecium branching, with numerous spines. Arms of zooids commonly with end-swellings beset with refractive beads *Demiothecia*.
- a. Colony up to 200 or 250 mm. in height, cœncecium amber-coloured or pale.
- 9, 10, 11. Colony much branched. Zooids 2.0 to 3.2 mm., crimson, brown, violet, or pale; arms 5 or 6 pairs. Species not easily distinguished, but *hodgsoni* is somewhat more robust, and with larger zooids, than *dodecalophus* *dodecalophus*, *hodgsoni*, (*inæquatus* = *hodgsoni*), *æquatus*.
- b. Colony diminutive and delicate, cœncecium orange-coloured.
12. Zooids 1.3 mm., orange-coloured, with a few tracts of black pigment; arms 5 pairs, with end-swellings in buds. No males known *gracilis*.
13. Zooids blackish; neuter zooids 1.3 mm., arms 4 pairs, no end-swellings; male zooids with one pair of arms only, without tentacles, numerous refractive beads. No females known *sibogæ*.

LV.—*Observations on the Genus Crassicauda.*

By H. A. BAYLIS, M.A.

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TWO sets of specimens from Deception Island, South Shetlands, kindly sent to the Museum recently by Mr. A. G. Bennett, throw interesting further light on this little-known genus of Nematodes. The host, in both these cases, was the

blue whale (*Balænoptera musculus*), and the worms were found with their caudal ends hanging freely into the urinary passage. In one case portions of the host's tissues (penis) were forwarded, and show the head-ends of the worms still deeply embedded. The tissue being very firm and muscular, and having been hardened in formalin, it has proved impossible, as is usually the case, to extract the worms intact. They pursue a very tortuous course in the tissues, and are easily broken in the attempt to remove them. The present account, therefore, will necessarily be confined to the characters of the posterior end.

In a former paper (1916) the writer described what was believed to be the head of an example of *Crassicauda crassicauda* (Crepl.). Up to that time there was no definite ground for believing that the genus included more than one species. In view, however, of certain considerations now to be set forth, there seems to be good reason for suspecting that two, and perhaps three, species of *Crassicauda* occur in whales.

The original worms described by Creplin (1829) as *Filaria crassicauda* were comparatively small, $6\frac{1}{2}$ inches being given as the length of a complete male, 12 to 13 inches as that of a complete female. Creplin describes and figures a single spicule in the male. The greatest thickness (and this in one exceptionally thick female) was about 1 line [=about 2 mm.].

Leiper and Atkinson (1915), reporting on material contained in the 'Terra Nova' collection, which they had previously (1914) referred to *C. crassicauda* (making this the type of the new genus), remark that they were unable to find any spicules in the males, and conclude that they are absent. They also state that the material (which consisted only of headless fragments) included portions of both males and females of a length of 16 inches.

A re-examination of the 'Terra Nova' material, now in the British Museum, and its comparison with the new material from the South Shetlands, lead me to believe that the latter represents the true *C. crassicauda*, while Leiper and Atkinson's determination of the former as belonging to Creplin's species was erroneous. It is proposed, therefore, to regard the 'Terra Nova' specimens as representing a new and larger species, which may be named *Crassicauda boopis*. It attains a thickness of between 3 and 4 mm. Leiper and Atkinson unfortunately gave no figures of the worm. Figures of both forms are therefore given here for comparison.

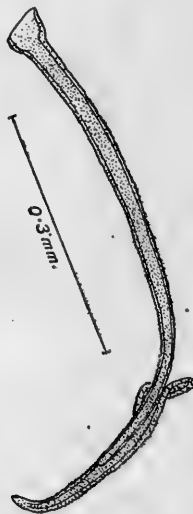
The material sent by Mr. Bennett includes fragments measuring up to about 16.5 cm. [=6½ inches] in length and not more than 2 mm. in thickness. The males have a

strongly coiled tail, and are provided with two spicules, which, though small, are easily seen in cleared specimens. These spicules (figs. 1 and 2 B) are unequal in length, measuring 0.62 mm. (left) and 0.3 mm. (right) respectively. They are completely covered externally with small rough granulations. Each spicule is considerably expanded at its proximal end and blunt distally.

The tails of both sexes show a very marked difference in size between the 'Terra Nova' and Mr. Bennett's specimens.

In the male (fig. 2) the distance from the cloacal aperture

Fig. 1.



Crassicauda crassicauda. The two spicules of the male, seen from the left side.

to the tip of the tail is about three times as great in the former as in the latter. In the female (figs. 3 and 4), in all cases and in both species, the curious constriction in the region of the vulva, described and figured by Creplin, is well-marked. The vulva (figs. 3 A and 4, v.) lies towards the anterior end of the constriction, and the caudal end assumes the shape of a rounded or oval knob. The anus (figs. 3 A and 4, a.) lies in a depression at the posterior end of the latter. According to Creplin's figures, the terminal knob would measure 5 mm. in length in an exceptionally large specimen. Leiper and

Atkinson place the constriction at 3 mm. from the extremity, but this is clearly an understatement, as in some of the 'Terra Nova' females it is over 5 mm. from the tip of the tail. In the South Shetlands specimens the terminal knob measures only 1 mm. to 2.5 mm. in length.

Fig. 2.

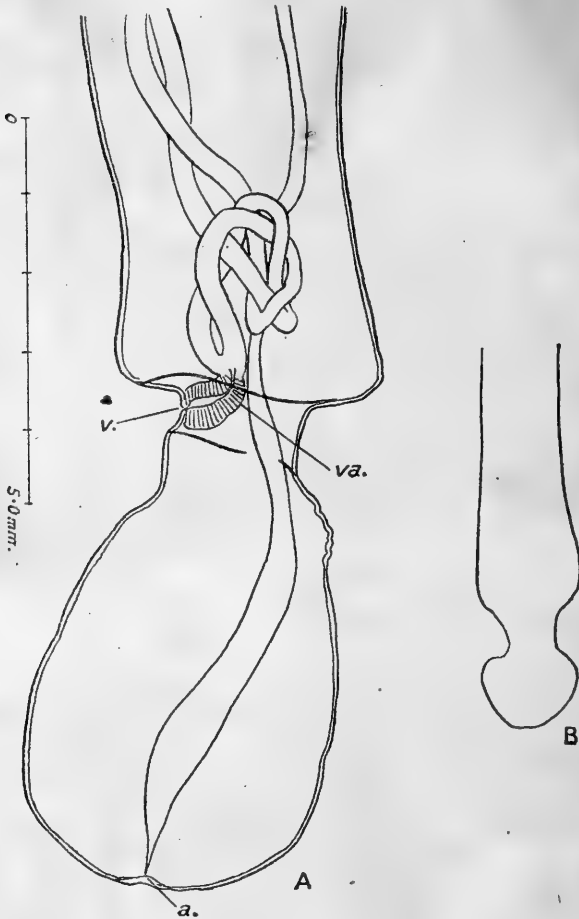


Nearly ventral views of the tail of the male, (A) of *C. boopis*, (B) of *C. crassicauda*, drawn to the same scale of magnification.

The writer has failed, as did Leiper and Atkinson, to discover any spicules in the 'Terra Nova' males. The remote possibility that they might have been left in the vagina of the females after copulation was thought of, but

examination of several females did not lead to the confirmation of this idea.

Fig. 3.

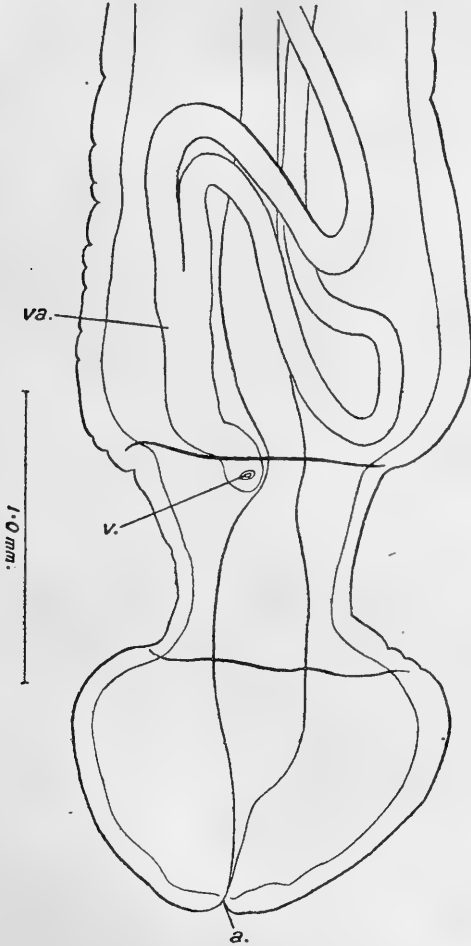


- (A). *C. boopis*; tail of female, seen from the left side. *a.*, anus; *v.*, vulva; *va.*, vagina.
 (B). *C. crassicauda*; outline of tail of female, drawn to the same scale of magnification as (A).

As regards the caudal papillæ of the male, Leiper and Atkinson state that there are on either side eight in the

'Terra Nova' material. On re-examination, however, the writer has not found less than nine on either side in any individual, while in one case (fig. 2 Å) there were as many as

Fig. 4.



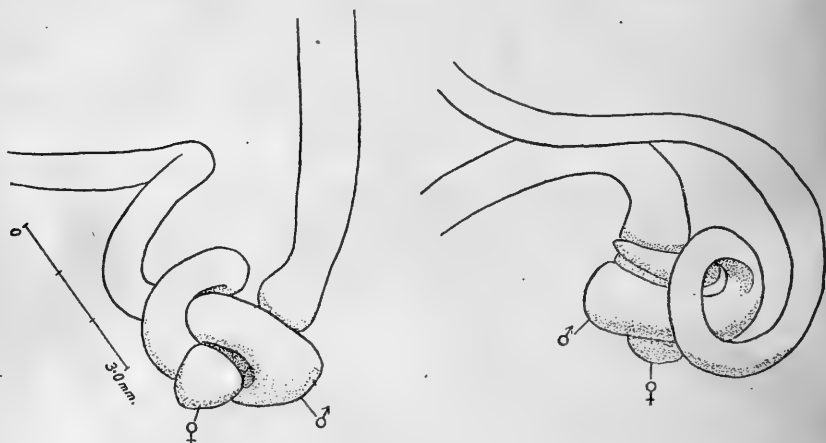
C. crassicauda; tail of female, nearly ventral view. *a.*, anus; *v.*, vulva; *va.*, vagina.

twelve on the left side and eleven on the right. It is not easy to count the papillæ accurately, owing to an infolding of the sides of the tail towards the mid-ventral line, so as to

form a groove extending from the cloaca to the tip of the tail. Some of the papillæ are not infrequently carried over so as to lie on the inside of this groove, and are thus only seen with some difficulty. In any case, however, the number on each side does not seem to be constant.

The same remarks apply, on the whole, to the material from the South Shetlands, the infolding of the sides of the tail (fig. 2 B) being often very marked. In this case the largest number of papillæ counted was eleven on the right side and eight on the left. The tail is laterally compressed in both forms, and slightly asymmetrical, the right side tending to be a little longer than the left. This is probably

Fig. 5.



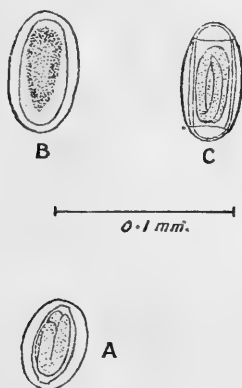
C. crassicauda; views of the caudal ends of two pairs of individuals, to show the position during copulation.

a peculiarity connected with the mode of copulation, which is well seen in the material sent by Mr. Bennett. Several pairs of individuals have remained, on fixation, in the position indicated in fig. 5. The manner in which the tail of the male is coiled round the constricted portion of the female is apparently constant. The tail makes two or three turns in the direction of a right-handed screw, but the last turn is reversed, so that the tip of the tail comes to lie in front of, instead of behind, the previous coil. This seems to offer an explanation of the slight asymmetry of the tail. Though Creplin noted the constriction in the region of the vulva, and speculated as to the probability of its being a natural

structure or artificially produced by the pressure of the male, he does not appear to have seen specimens in the position of copulation, nor did the 'Terra Nova' material throw any light on this point. From the constancy with which the constriction appears in females of all sizes, it seems probable that it is a preformed structure, and not merely due to the act of copulation itself.

The vagina (figs. 3 A and 4, *va.*), in both species, is very short and muscular, and gives off, almost immediately in front of the caudal constriction, two uteri, which are thick-walled and have a narrow lumen. These, after forming one or two coils, run, parallel to each other and nearly straight, in the

Fig. 6.



Ova, (A) of *C. boopis*, (B) and (C) of *Crassicauda* sp. (?) from *Hyperoodon*. (C) represents a later stage than (B), and shows the thickened belt of chitin.

direction of the head. The ova (fig. 6, A) have a very thick shell, and in both forms measure about $50 \mu \times 35 \mu$. They contain a coiled embryo when laid.

As regards the anterior end previously described by the writer (1916) as that of *C. crassicauda*, it is not at present possible to decide to which of the two species here distinguished it belongs. From its size alone it appears more probable that it is *C. boopis* than *C. crassicauda*. The various records of the occurrence of the supposed *C. crassicauda* were collected in the same paper, and a list of hosts was given. This, in view of the fact that the species of *Crassicauda* cannot now be regarded as one, will require some revision ;

but it is impossible to settle definitely at present which records refer to which species, except as regards those dealt with in the present paper.

There seems to be reason for believing that yet a third species of *Crassicauda* may exist, differing from the two already considered in the size and structure of its eggs, and probably in other particulars. In 1916 Mr. Bennett sent to the Museum some fragments, in poor condition, of what appeared to be a species of this genus, from the kidney of a *Hyperoodon*, from the South Orkneys. The fragments contain immense numbers of ova (fig. 6, B, C) of a larger size ($66 \mu \times 33 \mu$) than those of *C. crassicauda* and *C. boopis*, and of characteristic structure, in that the shell, in the fully-formed condition, has a thickened belt of chitin round the middle region, the ends being comparatively thin-shelled.

The following brief generic diagnosis may now be given (it being borne in mind that no complete account yet exists of any species):—

CRASSICAUDA, Leiper and Atkinson, 1914.

Filariidæ (?): Mouth without lips, but with one small papilla and three larger, more lateral papillæ on either side*; cuticle thick, transversely striated, sometimes raised into a swelling which appears to act as a "holdfast." *Male* with laterally compressed and spirally coiled tail, with a ventral groove behind the cloaca; at either side of the groove a somewhat irregular row of genital papillæ; two small unequal spicules present, or spicules absent. *Female* with vulva near the posterior end of the body, in a constriction just in front of the knob-like caudal extremity; vagina very short; uteri two, parallel; anus terminal; ova with thick shell, containing a coiled embryo at the time of laying.

Hab. Various parts of the urinogenital system (or, exceptionally, other parts of the body) of Cetacea.

Genotype: *C. crassicauda* (Creplin, 1829) [nec *C. crassicauda* (Crepl.) of Leiper and Atkinson, 1914 & 1915].

Two species may at present be distinguished with some certainty, though their characters are as yet incompletely worked out, and the determination must depend upon measurements when male tails are absent:—

1. *Crassicauda crassicauda* (Crepl.).

Two unequal spicules present in the male. Thickness of

* See Baylis, 1916.

either sex not exceeding 2 mm. Distance of cloacal aperture of male from tip of tail about 0.5 mm. Distance of vulva from tip of tail about 1.5–3 mm.

Hosts: *Balænoptera physalus*, *B. musculus*, and (?) other whales.

2. *Crassicauda boopis*, sp. n.

[= *C. crassicauda* (Crepl.) of Leiper and Atkinson, 1914 & 1915.]

Spicules absent. Thickness of either sex may reach 3 mm. or more. Distance of cloacal aperture of male from tip of tail about 1.5 mm. Distance of vulva from tip of tail about 5–7 mm.

Only certain host: *Megaptera nodosa*.

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LVI.—*Freshwater Fishes from Madagascar.*

By C. TATE REGAN, F.R.S.

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I. A COLLECTION MADE BY THE HON. P. A. METHUEN.

A COLLECTION of fishes made in Madagascar in 1911 by the Hon. P. A. Methuen has been sent to me for determination by the Director of the Transvaal Museum, Pretoria. The list is as follows:—

Anguillidæ.

Anguilla mossambica, Peters.

Lake Alaotra and Ambatoharanana, E. Madagascar.

Syngnathidæ.*Doryichthys millepunctatus*, Kaup.

Folohy, E. Madagascar.

Centropomidæ.*Ambassis commersonii*, Cuv. & Val.

Folohy and Ambilo, E. Madagascar.

Liognathidæ.*Gerres filamentosus*, Cuv. & Val.

Ambilo (lagoons).

Gerres methueni, sp. n.

Depth of body $2\frac{1}{4}$ in the length, length of head 3 to $3\frac{1}{4}$. Snout as long as or a little shorter than diameter of eye, which is 3 to $3\frac{1}{2}$ in the length of head and nearly equal to the interorbital width. Maxillary extending to below anterior $\frac{1}{4}$ of eye; 3 or 4 series of scales on cheek; 7 or 8 gill-rakers on lower part of anterior arch. 44 scales in a longitudinal series, 5 between lateral line and scaly sheath at base of spinous dorsal, 12 or 13 below lateral line, 7 or 8 from base of pectoral to middle of chest. Dorsal X 9; third spine nearly as long as or a little longer than second, $\frac{1}{2}$ to $\frac{2}{3}$ length of head. Anal III 7; second spine a little longer than third, $\frac{2}{3}$ to $\frac{1}{2}$ length of head. Pectoral longer than head, nearly or quite reaching origin of anal. Caudal widely forked. Caudal peduncle as long as or a little longer than deep. Dark longitudinal stripes along the series of scales.

Three specimens, 100 to 140 mm. in total length, from Folohy and lagoons at Ambilo, E. Madagascar.

This species is distinguished from *Gerres lineolatus*, Günth., by the deeper form and the shorter second dorsal spine.

Liognathus dussumieri, Cuv. & Val.

Ambilo (lagoons) and Folohy.

Monodactylidæ.*Monodactylus argenteus*, Linn.

Ambilo (lagoons).

Cichlidæ.

Paratilapia polleni, Bleek.

Lakes Alaotra and Rasoabé, E. Madagascar; Andranolaho, S.W. Madagascar.

In seventeen specimens I count X-XII 9-12 dorsal and III 8-11 anal rays, 28 to 30 scales in a longitudinal series and 8 or 9 gill-rakers on the lower part of the anterior arch.

Ptychochromis oligacanthus, Steind.

Ambilo (brackish lagoons); Folohy; Lake Rasoabé.

In nine specimens I count XIII-XIV 11-13 dorsal and III 7-8 anal rays.

Paretroplus polyactis, Bleek.

Ambilo (brackish lagoons); Folohy; Lake Rasoabé.

In nine specimens I count XVI-XVII 16-19 dorsal and VII-VIII 14-16 anal rays.

Carangidæ.

Caranx melampygus, Cuv. & Val.

Ambilo.

Mugilidæ.

Mugil robustus, Günth.

Folohy.

Atherinidæ.

Atherina alaotrensis, Pellegr.

Lake Alaotra, Lake Rasoabé, and Ambatoharanana, E. Madagascar.

Bedotia madagascariensis, Regan.

Lake Rasoabé.

Eleotridæ.*Eleotris fusca*, Bloch.

Ambilo and Lake Rasoabé, E. Madagascar; Andranolaho, S.W. Madagascar.

Eleotris legendrei, Pellegr.

Ambilo, Lake Alaotra, Ambohidratrimo and Ambatoharanana, E. Madagascar.

Eleotris tohizonæ, Steind.

Lake Alaotra.

Gobiidæ.*Gobius æneofuscus*, Peters.

Ambatoharanana, E. Madagascar; Maroamalona, S.W. Madagascar.

Gobius giuris, Ham. Buchan.

Ambilo, E. Madagascar; Andranolaho and Maroamalona, S.W. Madagascar.

II. THE MADAGASCAR CICHLIDÆ.

The Cichlid fishes of Madagascar belong to three endemic genera, which are defined below.

1. PARATILAPIA, Bleek., 1868 (type *P. polleni*, Bleek.).

Dorsal X-XIII 9-12. Anal III 8-11. Scales cycloid or feebly denticulate, large (28-30); two lateral lines. Mouth terminal; end of maxillary exposed; teeth in jaws conical, in 3 to 5 series, outermost enlarged. Lower pharyngeals united by a straight suture to form a triangular plate; anterior teeth conical, posterior somewhat compressed and indistinctly bicuspid, hooked. Occipital and parietal crests ending above middle of orbits; a broad median depression in anterior part of frontals. Posterior part of parasphenoid forming a strong apophysis, compressed antero-posteriorly, ending in a pair of transverse oval facets for articulation of the upper pharyngeals. Vertebrae 27 (13+14); third with paired inferior apophyses; præcaudals with parapophyses from the fourth; ribs sessile.

Madagascar; a single species.

This genus is closely related to *Pelmatochromis*, Steind., from the Congo and West Africa; as now restricted, *Pelmatochromis* includes only species with few vertebræ (25 to 27), short lower lateral line, and cycloid scales (species 4 to 21 of Boulenger's synopsis, with the addition of 5 placed in *Paratilapia*, viz., *P. cerasogaster*, *P. dorsalis*, *P. luebberti*, *P. corbali* and *P. thomasi*). In *Pelmatochromis* the pharyngeal apophysis of the parasphenoid is not so strong as in *Paratilapia* and the inferior apophyses of the third vertebra unite to form a median spine, but other differences from *Paratilapia* are unimportant.

2. **PTYCHOCHROMIS**, Steind., 1880 (type *Tilapia oligacanthus*, Bleek.).

Dorsal XIII–XV 10–14. Anal III 7–12. Scales finely denticulate, large (32–36); two lateral lines. Mouth terminal; end of maxillary exposed; teeth in jaws compressed, bicuspid, in 3 to 5 series, outermost enlarged, inner small. Lower pharyngeals united by a sinuous suture to form a triangular plate, with large rounded blunt teeth in the middle posteriorly and slender bicuspid teeth elsewhere. Occipital and parietal crests extending forwards to above middle of orbits; former high, ending behind a median depression on frontals. Posterior part of parasphenoid forming a strong apophysis with flattish heart-shaped articular surface for upper pharyngeals. Vertebræ 28 (14+14); third with inferior apophyses which unite below to form a median spine; præcaudals with parapophyses from the fourth; ribs, except the first, on parapophyses.

Madagascar; two species.

Related to *Tylochromis*, Regan, differing especially in having the teeth bicuspid instead of conical. *Tylochromis* occurs in West Africa, the Congo, and Tanganyika.

3. **PARETROPLUS**, Bleek., 1868 (type *P. damii*, Bleek.).

Dorsal XVI–XX 11–18. Anal VII–X 9–14. A scaly sheath at base of dorsal and anal fins. Scales cycloid, large (32–37); two lateral lines. Mouth terminal; end of maxillary exposed; teeth in jaws uniserial, compressed and somewhat spatulate; one or two median pairs enlarged. Lower pharyngeals united by a sinuous suture to form a strong triangular plate; most of the teeth stout, rounded, with flat surfaces. Occipital crest strong, extending forward to anterior end of frontals; parietal crests weak, ending above middle of orbits. Pharyngeal apophysis strong, formed by

parasphenoid only; articular surface broadly ovate, almost heart-shaped. Vertebrae 34 (17 + 17); fourth with a pair of very small inferior apophyses; præcaudals with parapophyses from the fourth; ribs subsessile.

Madagascar; two species.

This genus is quite distinct from any of the African genera, but is closely related to the Indian *Etroplus*, which differs from *Paretroplus* in its more generalized dentition, the jaws with 2 or 3 series of tricuspid teeth, those of the outermost series enlarged, in the adult truncate, often without lateral cusps, and the lower pharyngeal with most of the teeth slender, uni- or bicuspid, only the two middle rows being formed of large blunt teeth.

The Madagascar Cichlidæ belong to three endemic genera, two of which appear to be related to West-African genera, whilst the third is closely related to, but more specialized than, the only Indian genus of the family. Except the Cichlidæ, none of the families of fishes characteristic of the fresh waters of Africa occurs in Madagascar, which is populated chiefly by freshwater genera or species of marine families (Kuhliidæ, Atheinidæ, Eleotridæ). The Ostariophysii, which are dominant in the freshwater fauna of all other parts of the world except the Australian Region; are absent from Madagascar, except for two species of the endemic genus *Ancharius*, which belongs to the Ariidæ, one of the two families of Siluroids that form an exception to the rule that the Ostariophysii are strictly freshwater fishes.

The presence of Cichlidæ in Madagascar is probably due to the fact that some fishes of this family are found in waters of fairly high salinity. Species of each of the three Madagascar genera have been found in brackish lagoons on the coast, whilst *Etroplus suratensis* of India and Ceylon is characteristically an estuarine fish, and, according to Day, "extends its range into brackish or even saline water." It is evident that Madagascar has not been connected during the Tertiary with either Africa or India to an extent that sufficed for the passage of true freshwater fishes, but it may have received its Cichlidæ from Africa at a time when it was only narrowly separated from or even temporarily connected with that continent, and perhaps from India when the islands of the Indian Ocean were more extensive and a brackish-water fish might pass from one to another; this time can hardly have been later than the beginning of the Miocene.

LVII.—On the Anatomy of *Paludestrina jenkinsi*.

By G. C. ROBSON, B.A.

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[Plate XV.]

THE Gastropod *Paludestrina jenkinsi*, first described by E. A. Smith (13) in 1889, has been for the last thirty years an object of interest for British malacologists on account of its rapid spread through the inland waterways of England, Wales, and Ireland. It has recently attracted fresh attention owing to the discovery made by Boycott (2), and confirmed by Quick (10) and Gatenby and Robson (MS.), that it is parthenogenetic. The precise nature of this parthenogenesis, whether absolute or periodic, has yet to be determined; but since the animal has been under close observation no trace of a male has been discovered.

The following account of part of the anatomy of this mollusc is based upon material obligingly presented to the British Museum by numerous collectors. It is hoped to publish in the present year an account of the reproduction of this form.

Great difficulty was encountered in the preparation of material for study owing to the animal's contractility, small size, and power of resistance to anæsthetics. It was hence practically impossible to get satisfactory expansion of the anterior part of the body. Small shreds of tobacco and alcohol gave the most satisfactory results for this purpose; but it usually happened that after slow and careful narcotization extending over four or five days the animals would suddenly contract, or, when at last properly expanded and insensitive to touch, they were found to be dead and already showing signs of maceration. The best results for general purposes were obtained by eliminating narcotization, and, after very carefully cracking away the shell, placing the animals directly in Bouin's solution (picro-formalin with a small quantity of glacial acetic acid), in which they were left for not less than ten hours, after which they were washed in 70 % alcohol and proceeded with as usual.

EXTERNAL FEATURES AND BEHAVIOUR.

The shell and external features have been described by Smith (13) and others; but the following additions and corrections may be made.

The animal when in captivity crawls about fairly actively with a continuous movement of the foot like a Planarian, waving its long slender tentacles and moving the head from side to side in an inquisitive manner. As Smith points out,

the head is usually not very much protruded beyond the shell, though one can generally see the eyes. The buccal mass can be seen working backwards and forwards if the animal is browsing. The coloration is variable. Specimens have been found almost colourless, with two narrow bands of black pigment running backwards from the base of the tentacles. More usually this pigment is very dense on the head, muzzle, and upper and anterior parts of the foot, while on the sides and back of the foot it is less well developed. The foot-sole is invariably colourless except for the stripes referred to by Smith.

Contrary to Smith's statement, the animal is frequently seen floating on the surface-film (*v. anon* under "Pedal Glands"), and on one occasion it was observed to make use of this faculty in a peculiar fashion. If it is turned over on to the back of its shell it usually rights itself by rolling the front of its foot backwards over its head, getting a foothold, and pulling itself over by a leverage of the foot on the right-hand side of the shell-aperture. One was being prevented from doing this* when it suddenly stretched its foot upwards to the surface of the water and drew itself away from the detaining needle by this method.

INTERNAL ANATOMY.

The only substantial account of the anatomy of this genus of which the author is aware is by Henking (5) upon *Hydrobia* [= *Paludestrina*] *ulvæ*, Pennant. Henking's paper and the present account do not cover the same ground, but, where possible, full comparison is made between the two forms.

The Alimentary Canal.

The *mouth*, when viewed transversely, presents the same general features as *H. ulvæ*. The oral cuticle is not developed to the same thickness, however, while the vertical depth is greater in *P. jenkinsi*. The oral musculature does not correspond with that figured by Henking, the small dilators (m_3) shown by him being absent in *P. jenkinsi*. Separate elements corresponding with Henking's lip-protractors are found.

The *jaws* are situated much as in *P. ulvæ*. Henking does not describe them in detail. In *P. jenkinsi* they consist of about ten to twelve rather irregular columnar pieces of specialized cuticle, of which the median are the largest (Pl. XV. fig. 1).

Behind these the mouth expands laterally and is flattened dorso-ventrally over the *lingual cartilages*. Owing to the thick investment of muscle and the consequent difficulty in

* In a watch-glass full of water.

dissecting out the two cartilages it is rather difficult to be certain as to the exact position the latter occupy. They are rather irregular, thick, flattish plates, the ventral edges of which are flanged outwards both anteriorly and laterally. They are loosely united in the median line anteriorly and dorsally, and diverge ventrally and posteriorly. When separated out they appear to be rather asymmetrical. The finer structure is as described by Henking, except that it is doubtful whether the dark pigment referred to for *ulvæ* is present in *jenkinsi*.

The *radula* has been figured and described by Woodward (14), and that of *P. ulvæ* by Lehmann (6) and Meyer and Möbius (7).

The anterior part of the œsophagus is very much folded dorsally. This folded condition is found in *ulvæ*, but it is very much more marked in the present species, the roof of the œsophagus being divided into three main divisions, each of which again exhibits lateral diverticula (Pl. XV. fig. 2).

The *stomach* is a fairly large organ of irregular size, situated mainly in the body-whorl. For the most part it is thin-walled. It is lined with a relatively thick cuticle, which is apparently confined to the stomach and does not extend down the intestine as it does in some other forms.

On the average, the cells giving rise to this cuticle approximate in size to those figured for *Valvata piscinalis* by Bernard (1), though they do not appear to be so regular (Pl. XV. fig. 4). It is interesting to compare the stomach-epithelia of these two forms with that figured by Randles (11) for *Trochus*. It may be pointed out, however, that in certain areas just below the cuticle a layer of (*sc.*) pigment-granules was found (*cf.* Randles, *l. c.*).

Anteriorly the stomach gives off a large sac for the reception of the crystalline style, and parallel to this and opening into the stomach in the same plane is a well-marked pylorus, from the anterior extremity of which the intestine is given off. The pylorus and style-sac are in communication with each other by a narrow slit extending down nearly the whole of their length. This arrangement appears to be rather uncommon, and the author has not succeeded in finding any cases exactly analogous among other *Tænioglossa*. The internal (right-hand) wall of the posterior chamber of the stomach shows a well-marked ridge such as is found in other *Tænioglossa*, and the aperture of the style-sac and pylorus is marked by a strong annular development of cuticle. A localized patch of ridges is found in the neighbourhood of the entrance of the hepatic duct. Possibly these may be compared to the "bosselures et sillons" described by Garnault

for *Cyclostoma* (4). These ridges are sometimes of considerable length.

The crystalline style (Pl. XV. fig. 3) fits closely into its sac and is a relatively large cylindrical body of hyaline appearance, usually with rounded ends. No attachment to the cuticular lining of the sac could be found. After extraction it invariably disperses in the fluid into which it is placed.

The *hepatopancreas*, which extends from the apex down to the penultimate whorl, opens into the posterior chamber of the stomach by a single broad and short duct near to and on the same side as the opening of the œsophagus.

The *intestine* leaves the pylorus and curls round the end of the style-sac to its anterior face, runs backwards alongside the sac till it reaches the face of the posterior chamber of the stomach, when it turns vertically and then runs forwards to the anus. The intestinal wall is folded into a well-defined typhlosole, which extends almost up to the pylorus.

Pedal Gland.

A well-developed pedal gland is present. It is possible that it is by the aid of the secretion from this gland that the animal adheres to surface-films. Among other freshwater *Tænioglossa* such a gland has been described for *Valvata* (12).

The Respiratory and Circulatory System.

There is a single monopectinate gill (Pl. XV. fig. 5) lying somewhat diagonally in the mantle-cavity, with its anterior extremity between the tentacles and its posterior extremity rather to the left; it therefore lies roughly parallel to the rectum. Its filaments* diminish gradually in size anteriorly and posteriorly, those of about the median third being much larger than the rest.

It is almost impossible in sections of a whole animal to make certain that the gill-filaments are cut exactly transversely; but from examination of a large number of preparations it would seem that in *P. jenkinsi* they are more lanceolate in section than in *P. ulvæ*. The supporting membranes of the filaments are very long and thin.

There is evident no modification of the gill or mantle-cavity, although the animal is able to live out of water for at least several hours. No positive trace of a hypobranchial gland could be found.

The *heart* lies in a capacious pericardium, which is situated in the usual position. The auricle lies in front of the ventricle and is smaller than the latter; its walls, as usual,

* Twenty-seven to thirty in number.

are thinner than those of the ventricle, and there is a capacious efferent branchial vessel. No very satisfactory sections of the auriculo-ventricular orifice were obtained. In the best, however, distinct traces of modifications of a valvular nature were found (Pl. XV. fig. 6), comparable in general to the condition figured by Moore (8) for *Typhobia*. At the posterior apex of the ventricle the anterior and posterior aortæ are given off quite close together. The first runs forward across the roof of the pericardium for a good distance, and then, following the œsophagus, passes into a large lacuna. The posterior aorta passes backwards into a similar lacuna situated between the stomach and intestine. Branches of an artery were found ramifying in the ovary and uniting to form a single trunk at about the same level as the commencement of the oviduct. The two run parallel for a long distance down the columellar region. This genital artery appears to run into the abdominal lacuna referred to above [*cf.* distribution of the posterior aorta in *Cyclostoma elegans* (Garnault, l. c.)].

The Excretory System.

A single kidney is found bounded by the posterior wall of the pallial cavity, the pericardium, and the body-wall; it opens into the first-named cavity by a short, narrow, ciliated canal. Making all due allowance for contraction, there is no trace of a ureter such as is found in *Paludina* and *Valvata*.

The kidney is rather triangular in section over most of its area, and its walls are slightly folded. Its distribution and relationships are as yet uncertain, but it appears to give off a posterior thin-walled prolongation which ramifies among the other organs.

The Reproductive System.

The animal is apparently parthenogenetic (*v. supra*). The *ovary* is situated as usual in the apical whorls, though it does not appear to extend to the actual summit. It is closely applied to the liver, and can usually be seen contrasting in colour with the dark hue of the latter. It lies on the right of the liver in each whorl, and extends downwards and inwards on the columellar (right-hand) side. It consists of a number of anastomosing tubules which finally unite in the oviduct. The contents of these tubules vary with age and condition, but, save in the very smallest specimens, one usually finds a certain number of developing oöcytes of various sizes. A quantity of yolk-globules is almost always seen in one or two of the largest tubules. This yolk is sometimes the *only* contents of the latter. It would seem that there is a special localization and concentration of yolk, though it is also found

in the same tubules as ripening oöcytes and also in the lining epithelia of such tubules (Pl. XV. figs. 7 A & B).

The *oviduct*, which passes down the columella area in company with the genital artery, is exceedingly slender and usually thin-walled. At its distal end it becomes rather convoluted and thicker. It opens into the vagina very close to and probably in association with the spermatheca. The latter is an organ corresponding in shape and position with the spermatheca of normal female gastropods, and there can be little doubt that it represents that organ. In the present instance, of course, it is functionless. The persistence of such an organ in a parthenogenetic female is very interesting, and not without importance in relation to the general question of parthenogenesis. A spermatheca is found in a few other *Tænioglossa*, e. g., *Cyclostoma* (4) and *Paludina* (3). In other genera usually considered close to *Paludestrina* there is no accessory organ in the female genital complex; but there appears to be some evidence for its presence in *P. ulvæ* (see below).

The *albumen-gland* is a large organ readily observable in the living animal lying at about the junction between the fifth and sixth whorls. It opens into the brood-pouch by a vertical slit-like aperture adjacent to the commencement of the vagina.

The *vagina* is very difficult to locate exactly, owing to contraction; it appears to be a tube passing forwards beneath the brood-pouch on the right-hand side, and opening into the mantle-cavity near the anus. The communication between the vagina and brood-pouch would appear to be a fairly wide aperture rather anterior to the openings of the albumen-gland and oviduct (Pl. XV. fig. 8).

The *brood-pouch* is a very capacious cavity when fully extended. It is excavated in the pallial integument of the right-hand side. On the left it is bounded by the rectum. When functional it occupies the whole right-hand side of the last whorl and almost reaches the penultimate whorl. In this condition it is capable of holding well over forty young.

Lehmann (6) has described the male and female genitalia of *H. balthica* (= *P. ulvæ*), but neither his description nor his illustrations are very satisfactory. If his account is to be followed, the brood-pouch leads on into the vagina, which is not the condition seen in *jenkinsi*. On the other hand, he says: "(die Scheide) . . . von welcher ein kurzer *Blasensiel mit rundlicher Blase ausgeht*," which seems to agree with the spermatheca described above for *jenkinsi*. He also figures and describes an apparently distinct and well-marked albumen-gland.

It should be pointed out that among other *Tænioglossa*

that have been described—*Paludina* (3), *Bithinia* (9), *Tanganyikia* and *Melania* (8)—the brood-pouch opens directly to the exterior by a terminal (vaginal) pore. On the other hand, in *Cyclostoma elegans* (4) the vaginal aperture is apparently not at the extremity of the brood-pouch, as the latter “est un organe tubulaire terminé inférieurement en cul-de-sac et présentant latéralement une large fente, la vulve.”

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EXPLANATION OF PLATE XV.

- Fig. 1.* *Paludestrina jenkinsi*. Transverse section of mouth, showing cuticle (*c.*) and mandibles (*m.*). [Cam. 4 oc. × 6 obj. Reich.]
- Fig. 2.* Ditto. Diagrammatic transverse section through cesophagus. [4 oc. × 6 obj. Reich.]
- Fig. 3.* Ditto. Crystalline style. [Cam. 4 oc. × 3 obj. Reich.]
- Fig. 4.* Ditto. Section through stomach-wall. *c.*=cuticle. [Cam. 4 oc. × 6 obj. Reich.]
- Fig. 5.* Ditto. Section through gill-filaments and supporting lamellæ. [Cam. comp. 6 oc. × 6 obj. Reich.]
- Fig. 6.* Ditto. Heart: section through auricle (*a.*) and ventricle (*v.*). [Cam. 4 oc. × 6 obj. Reich.]
- Fig. 7.* Ditto. Sections through (A) junction of oviduct with yolk-bearing ovarian tubule; (B) ovarian tubule, showing oöcytes and yolk in epithelium. *y.*=yolk; *od.*=oviduct.
- Fig. 8.* Ditto. Section through junction (*av.*) between spermatheca and vagina, and connection of albumen-gland (*ag.*) and vagina (*v.*) with brood-pouch (*bp.*). *od.*=oviduct. [Cam. 4 oc. × 6 obj.]

LVIII.—A new *Trichocera* from Siberia (*Diptera Polyneura*).

By F. W. EDWARDS.

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AMONG a collection of mosquitoes recently sent me for determination by Prof. Yngve Sjöstedt, of Stockholm, was a single male specimen of a *Trichocera* which, though differing little

in coloration from the common European species, is yet strikingly distinct in its genital characters. It may be named

Trichocera sibirica, sp. n.

Colour almost uniform dark brownish. Wings slightly infuscated, a very faint cloud over the *r-m* cross-vein. First flagellar joint of antennæ about six times as long as broad, somewhat thickened on its basal half; second and third each about half as long as the first, very slightly thickened in the middle. Venation: R_{2+3} slightly shorter than the basal section of R_2 ; otherwise as in *T. regelationis*. Genitalia: ventral junction of side-pieces forming a strong median



Trichocera sibirica; male genitalia, from beneath.

process; clasper on its inner side with two strong processes, the basal one thumb-like, the apical one conical, two rather long hairs close together at the tip. Adminiculum small, ending in two points; parameres not evident (the points on the body of the adminiculum may represent fused parameres).

SIBERIA: Verschininsk, Yenisei River, $69^{\circ} 5' N$. Type male (unique) in Stockholm Museum.

All the European species of the genus, as far as I know them, have the clasper almost cylindrical, with or without a minute process at the base, and most of them have also a pair of long curved parameres to the adminiculum. The venation of the new species is the same as in *T. fuscata*, Mg., as determined by Verrall.

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No. 30. JUNE 1920.

LIX.—Notes on the Asilidæ: Sub-division Asilinæ.

By GERTRUDE RICARDO.

[Concluded from p. 393.]

Lysmachus hirsutus, ♂, sp. n.

Type (male) and another male from Ulundi, Natal, 5000-6000 feet, Sept. 1896 (*G. A. K. Marshall*), 1903, 17.

A female from Willow Grange, Natal (*W. C. Wroughton*), in I. E. E. Coll., appears to be identical with these males.

A very hirsute black species with a large moustache and mane. Legs almost wholly black. Moustache black with a few white hairs only. Genitalia very long and slender. Scutellum with very long stout black bristles.

Length 17-18 mm.

Male.—Face with greyish tomentum, almost entirely covered by the thick black moustache which extends to the antennæ and is composed of black bristly hairs, the few white hairs are chiefly on the upper part. *Antennæ* blackish, the third joint wanting, the first two joints with black bristly hairs below. *Forehead* with long black hairs. The curled-over bristles long and black, a bunch of white hairs at vertex between them. Hairs round head black and then white. *Thorax* blackish with yellowish tomentum, the mane composed of some outstanding black bristles and thick black hairs between, the bristles on posterior part of thorax black

Ann. & Mag. N. Hist. Ser. 9. Vol. v.

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and long, a few weak whitish hairs appear among them and also at sides of mane. *Scutellum* black with a bunch of whitish hairs in the middle and long strong black bristles on dorsum and on posterior border. *Abdomen* with a large black spot on each segment and greyish tomentum at sides and on dorsum; bristles at the segmentations black and about three deep; the pubescence short, white; underneath with long weak whitish hairs and black bristles. *Genitalia* shining black, long; the upper forceps slender, drawn out to a long point, stout on their basal half, and with a curved lower edge thickly covered with white hairs; under lamellæ short, stout, with short black pubescence. *Legs* blackish or bronze-coloured, the tibiæ very obscurely reddish at their base, with long black and white hairs and short white pubescence and stout black bristles; the femora with long weak black and white hairs and black bristles, and some short white pubescence on their upper edges; tarsi blackish or obscurely reddish with white pubescence and black hairs and bristles. *Wings* clear, veins blackish, the small transverse vein beyond the middle of the discal cell.

Dysmachus montanus, sp. n.

Type (male), type (female), both from Mt. Mlanje, Nyassaland, 19. ix. 1913 (*S. A. Neave*), in I. E. E. Coll.

A small dark species with a well-marked black mane and black and white moustache. Pubescence on abdomen and legs chiefly white, and some white bristles on the legs.

Length, ♂ 13, ♀ 14 mm.

Male.—*Face* with glistening white tomentum. Moustache composed of stout black and white bristly hairs, the white hairs chiefly on upper part intermixed with black. *Antennæ* blackish brown with chiefly white hairs on the first two joints, the third with rather a long arista. Beard white. *Forehead* with white hairs near antennæ and black bristles beyond. The curled bristles at back of head black and very long and stout, round the head with white hairs. *Thorax* metallic brown with two well-marked dark stripes and with some grey tomentum; the mane consists of black hairs and numerous longer outstanding black bristles; the præsutural, supra- and postalar bristles all two in number and black; pubescence on dorsum short, white. *Scutellum* with a bunch of white hairs on each side and two in the centre, two stout black bristles on posterior margin, and another row of three or four in front of them. *Abdomen* blackish brown with white tomentose segmentations, most noticeable at the sides;

the posterior borders of the second and third appear reddish ; each segment is armed with very stout black bristles at the sides ; the pubescence on dorsum is chiefly white, longer and thicker on the first two segments ; short white bristles are present on the sides of abdomen and a few below on the underside, which is also covered with white pubescence. *Genitalia* blackish, stout, with chiefly white hairs, club-shaped. *Legs* blackish, only the knees and base of fore tibiæ dull testaceous, the white pubescence is long on the coxæ, short but fairly thick elsewhere, long on the underside of the femora and tibiæ ; white bristles are visible on the middle of hind femora, two or three in number, on the middle tibiæ, and especially on the anterior pair where they are long and stout, and are continued on to the tarsi in both pairs, elsewhere the bristles are black. *Wings* clear, uniformly greyish.

Female identical. Moustache is yellower on the upper part and largely predominates, not being bordered by black hairs. *Abdomen* not so strongly armed with bristles, the white ones predominate. Ovipositor black and shining, short with a few yellowish hairs at apex. *Legs* with many more white bristles on the hind femora and middle pair, but none on the tarsi. *Wings* with the small transverse vein beyond the middle of the discal cell as in the male.

Dysmachus similis, sp. n.

Type (male), type (female), from Bloksberg, Johannesburg (C. H. Pead), 1907, 250 ; and another female from Barberton, Transvaal (H. Edwards), April 1911, in Cape Coll.

Very similar to *D. wroughtoni*, sp. n., but distinguished from it by the shorter genitalia of male and by the bristles on the legs in the female being chiefly white.

Distinguished from *D. natalensis*, sp. n., likewise by the genitalia and by the long numerous black bristles on the scutellum.

It is very nearly allied to *D. montanus*, sp. n., from which it differs in the following particulars :—

Male.—Moustache is large, composed of black and white bristles intermingled, a few yellowish hairs are also visible. The front two joints of *antennæ* are armed with very strong black bristly hairs on the underside, with a few short white ones on the upperside. The curved bristles are very long, black and yellow. The *mane* has dull yellowish hairs bordering the thick black short ones, and there are many

outstanding long bristles, a few red ones appear on posterior part of thorax and all the side-bristles are reddish. *Scutellum* with many very stout, long, black bristles in the centre, a dozen or more, and tufts of white hairs on each side. *Abdomen* denuded, the bristles are white, pubescence whitish. Genitalia simple, the upper forceps long but tapering to a point, which is, however, rather obtuse, covered with short white pubescence, the under pair short black with some long white hairs. *Legs* with white pubescence, the hind femora with yellowish bristles, the fore and mid tibiæ with long yellowish hairs below, the hind ones with black hairs; the bristles chiefly black, but long yellowish ones are present on the fore and middle pairs; the tarsi with almost wholly black bristles.

Female identical, the white bristles on tibiæ rather more numerous, also present on the hind pair. *Ovipositor* short, not much longer than the last segment.

Length, ♂ 18, ♀ 17 mm.

Dysmachus nigricans, sp. n.

Type (male) from Piet Retief, 4100 feet, Transvaal, 23. viii. 1903 (*Capt. R. Crawshay*).

Type (female) and another from same locality and same collector; all in Brit. Mus. Coll., 1904, 43.

A small dark species with black mane, almost wholly dark legs and abdomen. Moustache black and white. Distinguished from *Dysmachus montanus* by the absence of white tomentum, white bristles on the abdomen, and of white bristles on the legs.

Length, ♂ 13½, ♀ 13 mm.

Male.—*Face* black (denuded). *Moustache* large, extending to the antennæ, composed of black bristly hairs with only a few stray white hairs. *Antennæ* wanting. *Forehead* with many long bristly hairs. The curled bristles at back of head very long and stout, extending as weaker black bristles a little way round head, and followed by white hairs. Beard white. *Thorax* blackish, covered with brownish tomentum; the median stripe is dark and distinct; the mane, wholly of black hairs and longer black outstanding bristles, is large for such a small fly and extends thickly to the scutellum, the pubescence on dorsum is scanty, of black and some white hairs. *Scutellum* armed with very long black bristles on its posterior margin and others inside, nine or ten in all, and some black hairs intermixed. *Abdomen*, somewhat denuded,

appears black with brownish tomentum, with some long black bristles and with rather thick black pubescence on the dorsum; underside thickly clothed with black bristles and hairs. *Genitalia* short and stout, testaceous at apex, otherwise black with some white hairs above and black hairs below arranged in tufts. *Legs* black, the knees and base of anterior tibiæ dull testaceous, all bristles black and the pubescence black, longer on undersides of femora and tibiæ. *Wings* clear, a little tinged with yellow along the veins.

Female identical. *Moustache* with more white hairs. *Abdomen* with traces of white hairs on the second segment and with long ones on the underside. *Legs* have some short white pubescence on underside of fore tibiæ and on underside of hind femora.

Note by collector as follows: "Taken on the bare wind-swept mountain-top, almost the only living insect.—R. C."

Loew's Division II^{2b}.

Mane not extending the whole length of thorax.

Dysmachus albopilosus, sp. n.

Type (male) from Howick, Natal (*J. P. Cregoe*), 1903, 212; and other males in Brit. Mus. Coll.

Type (female) from Willow Grange, Natal (*R. C. Wroughton*), in I. E. E. Coll., and other females from same locality; also from Howick and from Estcourt, Natal, Sept., Oct., 1896 (*G. A. K. Marshall*), 1903, 17, in B.M. Coll.

A species distinguished by the short genitalia of males and the short ovipositor of females. Mane white posteriorly, all hairs and bristles on scutellum white and most of the bristles on the legs white or yellow, and on the abdomen the same colour. Legs almost wholly metallic bronze-coloured. Distinguished from Loew's species, *D. setiventris*, by the absence of black bristles on the scutellum and the tibiæ are not brown.

Length, ♂ 13-16; ♀ 13-18 mm.

Male.—*Face* covered with pale yellowish tomentum. *Moustache* composed of chiefly yellow hairs, with black hairs at the sides, but none near the oral aperture, fairly thick, reaching the antennæ. *Beard* white. *Antennæ* with the first two joints blackish with black bristles, the third wanting. *Forehead* with some black hairs and bristles. The curled

bristles at back of head are black, on each side of the vertex. *Mane* apparently does not begin till the middle, although a row of very short hairs are visible in most of the specimens anteriorly on the median line, becoming longer below the collar; the mane proper begins at the suture in the form of long black bristles on each side, enclosing short black hairs which are replaced by long dirty yellow hairs reaching the posterior border; most of the bristles on each side of thorax are yellowish and long. *Scutellum* almost bare, with long yellow bristles on its posterior border, six or more in number, interspersed with a few weak yellow hairs. Thorax and scutellum bronze-green with greyish-yellow tomentum. *Abdomen* the same colour, the tomentum thickest at sides and on segmentations, having a large brownish spot on each segment; bristles on sides yellow, two deep; pubescence on dorsum very short, pale yellowish; underside identical. *Legs* wholly bronze-green with whitish pubescence and longer pale yellow hairs below femora and tibiæ, all the bristles yellow. *Wings* greyish, the small transverse vein at about the middle of the discal cell. *Female* identical, some black hairs present near the oral opening, third joint of antennæ with arista a little more than half its length. *Ovipositor* short, about the length of the last segment, black shining with some dirty yellow pubescence at tip.

Dysmachus nigripes, sp. n.

Type (male) from Willbrook, Natal, 17. ii. 1914.

Type (female) from Willow Grange, Natal (*R. C. Wroughton*), other males from same localities; two from Mfongosi, Zululand (*W. E. Jones*), and another female from Willbrook; all in I. E. E. Coll.

A species nearly allied to *Dysmachus albopilosus*, sp. n., but differing from it in the shape of the genitalia, which are here a fair length and slender, the moustache is also wholly yellow, and the legs entirely blackish.

Length, ♂ 16-18, ♀ 17-18 mm.

Male.—*Face* covered with glistening yellowish tomentum. *Beard* not very thick, composed of fairly long yellow bristly hairs, not reaching the antennæ, the space between being occupied by long black bristles, which in some specimens continue a short way alongside of yellow hairs. *Palpi* with long yellow hairs. *Antennæ* blackish, the first two joints with black bristly hairs below and a very few white ones on upperside, arista more than half the length of the third

joint. *Forehead* with chiefly black bristly hairs. The curled bristles are black and strong, with a few white bristles each side, the hairs continued round head are white. *Beard* white. *Thorax* bronze-green, covered with greyish-yellow tomentum and with well-marked median and side stripes. *Mane* very meagre, hardly typical of this genus, composed of scanty short yellow hairs beginning from the middle only, surrounded by very short black bristles; all the side-bristles are also stout but yellowish; the pubescence on dorsum black, short; a row of these hairs in place of a mane can be seen on the anterior part on the middle line. *Scutellum* with stout yellowish-white bristles on its posterior border and weak hairs of the same colour on its dorsum. *Abdomen* covered with yellowish tomentum, thickest at the sides and on the segmentations, leaving a large dark spot discernible on each segment; dorsum covered with short yellow pubescence, the bristles are whitish and long; underside with a few and also long yellowish hairs. *Genitalia* large, black, the upper forceps long, stout, and swollen at base, continued in a long curved point, the points meeting each other, leaving a large circular space between them; they are covered with rather thick yellowish-white pubescence; under-forceps short with long yellowish-white hairs. *Legs* wholly bronze-coloured, covered with thick short white pubescence and stout yellow bristles, the middle and posterior femora heavily armed with them; only a few black bristles are present, two at apices of fore femora, and a group of short ones on the dorsum of the fore tibiæ, or they are extended along the edge in some specimens, and a few black bristles are present on the tarsi. *Wings* clear, veins brown, the small transverse vein beyond the middle of the discal cell.

Female is identical; the black bristles above moustache are fewer in number. The curved bristles are all yellow. *Thorax* has some short yellow pubescence. *Ovipositor* short, the upper part covered with dense greyish tomentum on its basal half, the apical half narrower, black and shining, ending in a curved point, the lower part almost all black. *Wings* clear, greyish.

One of the specimens from Zululand is much larger, and has one black bristle on the scutellum.

DYSCLYTUS, Loew.

Öfvers. Kongl. Vet.-Akad. Förhandl. xiv. 1857, pp. 361 & 363 (1858).

This genus was formed by Loew for one species, *D. spurcus*,

from the Cape, evidently identical with Walker's species. The genus is distinguished from *Dysmachus* by the absence of a tubercle on the face, no curved bristles at back of head, and the moustache is thick with coarse bristles, but not wall-like as in *Dysmachus*, and it is much less pubescent on the body.

No other species has as yet been recorded.

Dysclytus firmatus, Walker.

Trans. Ent. Soc. London, n. ser. iv. p. 130 (1857) [*Asilus*].
[*Dysclytus spurcus*, Loew.]

Walker's type, a male, is from Port Natal.

A female from Stellenbosch, Durban, 21. xi. 1916 (C. N. Durham); in Cape Coll. Museum.

A large species, blackish, with greyish-yellow tomentum. *Moustache* black above, yellow below. *Legs* reddish, the femora largely black, chiefly below. *Scutellum* with two or more black bristles. *Ovipositor* in female black, very long, composed of the seventh and eighth segments. *Genitalia* of male long, black; under lamellæ very short. *Wings* large, clear, shaded grey at apex and on posterior border.

The male measures 24 mm., the female 25 mm. Loew gives 20-24 mm.

NEODASOPHRYS, gen. nov.

This genus is nearly allied to *Dasophrys*, but is distinguished from it primarily by the absence of the dilation of wing on fore-border in the male.

The three species placed here are all characterized by the long hairs on the legs, thickest on the fore femora and tibiæ. The tubercle on face is as in *Dasophrys*, with a fine-haired moustache. The hairs on thorax form a thin mane, but few bristles are present, and then only on the posterior part.

Neodasophrys natalensis, sp. n.

Type (male) from Karkloof, Natal, Feb. 1897.

Type (female) (G. A. K. Marshall), 1903, 17, and two other females from the same locality.

A large blackish species with brick-red tibiæ and long yellowish hairs on them, and long black hairs on the femora. *Moustache* black and yellow. *Genitalia* of male very long.

Length, ♂ 25, ♀ 24-28 mm.

Male. — *Face* covered with yellowish-white tomentum.

Moustache of fine long black hairs and yellow ones below, placed on an indistinct tubercle which extends to the antennæ. *Beard* of long yellow hairs. *Palpi* with black bristly hairs. *Antennæ* blackish, the third joint long with a long arista, the first two joints with black hairs. *Forehead* with long black hairs. Curved bristles all black and hairs round head; halfway round, yellow hairs take their place. *Thorax* blackish with narrow grey tomentum stripes; dorsum with black pubescence, which forms a very thin mane in the centre, anteriorly of short hairs and posteriorly of longer ones; præsutural bristles two, supra-alar two, postalar two very long ones, all black and interspersed with long, fine, black hairs; the posterior part of dorsum with thick, fine, black, long hairs, a few black bristles interspersed. *Scutellum* with some black hairs and a row of black bristles on the posterior borders. *Abdomen* blackish with yellowish tomentum, which predominates on the last two segments; pubescence whitish, yellower on the first segment at sides; underside with rather thick whitish pubescence, no bristles present. *Genitalia* very large and longer than the last three segments together, club-shaped but flattened at the ends; under lamellæ triangular, proceeding from beneath the last segment, ending in a blunt point, clothed with black hairs; a fringe of black hairs are very evident, proceeding from below the border of last segment; pubescence on the upper forceps black and fairly long above and below, a few yellowish hairs are visible above. *Legs* black, the fore and middle tibiæ brick-red, only black at their apices, the hind pair red for two-thirds of their length only, the fore and middle femora with long black and yellow hairs below and shorter black ones above, the hind pair with only black hairs and with black bristles; the fore tibiæ with long silky yellow hairs below and long black hairs above at sides, and shorter black pubescence on dorsum, one large black bristle at top, the middle pair the same, the hind pair with long not thick black hairs and very few yellow ones, also armed with very strong black bristles; all tarsi with black pubescence and strong black bristles; pulvilli large, orange-yellow, some yellow hairs present on the tarsi. *Wings* longer than the abdomen, with blackish veins, tinged brown; the second posterior cell bulges a little into the first one, the second submarginal cell nearly as long as the second posterior cell, the small transverse vein beyond the middle of the discal cell.

Female identical. *Abdomen* rather lighter in colour.

Ovipositor long, black, including the seventh and eighth segments; end-lamellæ free, the seventh segment forming the base with some black hairs, the rest of ovipositor compressed, bare.

Neodasophrys hirsutus, sp. n.

Type (male) from Bluff, Durban, 2. v. 1917 (*C. N. Barker*), No. 2074 in Durban Museum Coll., and two females; another female the same, 30. vi. 1918, No. 2262.

Type (female), Port Shepstone, Natal, May 1897 (*G. A. K. Marshall*), 1903, 17.

A species more pubescent than *Neodasophrys natalensis*, distinguished by the shaded transverse veins of wings and by the pale base of tibiæ, which are reddish with long reddish-brown hairs.

Length, ♂ 21, ♀ 18-21 mm.

Male.—*Face* bronze-coloured with yellowish tomentum. *Moustache* reaching the antennæ, composed of long fine black hairs and a few yellow ones below. *Palpi* with black hairs. *Antennæ* almost jet-black, the first two joints with short black hairs, the third long with an arista equal in length to it. *Forehead* with long black pubescence. Curved bristles black, the hairs round head yellowish, becoming very thick and noticeable on the lower half, as in *N. natalensis* species. *Thorax* with a broad median black stripe and short side-stripes, rest of dorsum covered with yellowish tomentum and with short black pubescence; the thin mane composed of black hairs becoming longer and thicker posteriorly and with a bunch of yellow hairs in the centre on posterior border. Præsutural bristles two, supra-alar one; postalar three, but all very long and not very stout, and interspersed with long black hairs. *Scutellum* covered with yellowish tomentum and with very thick yellow long hairs, the posterior border with black bristles. *Abdomen* with a deep black spot on each segment, bordered with yellowish tomentum, pubescence on dorsum short, black, on the first segment and at sides are long yellowish and reddish hairs, a few black ones above; underside with long, silky, yellowish-red hairs. *Genitalia* large, club-shaped, flattened at the ends, identical with those of *N. natalensis* but not so long; pubescence black. *Legs* with femora black, shining, extreme bases of tibiæ pale yellow, merging into a pale reddish colour, tarsi the same, the last joint blackish; the pubescence on femora

consists of long fine black hairs; fore coxæ with thick yellowish hairs, the others with black hairs; the tibiæ with long reddish hairs below and at sides, on the fore and hind pairs a good many black hairs appear; hind tibiæ with black bristles; tarsi with black hairs and bristles. *Wings* shaded brown on fore border, at apex, and in the centre of cells, transverse veins shaded brown, venation as in *N. natalensis*. *Female* identical, but the hairs on *legs* not so long or thick, and chiefly black, in the type those on the fore and middle tibiæ are yellowish, and the fore tibiæ have a fringe of appressed orange hairs below; the hind femora with some shorter white hairs above, in another female the hairs on fore tibiæ are wholly black. *Ovipositor* as in *N. natalensis*, but barely as long as the three preceding segments.

Neodasophrys androclea, Walker.

Type (male), in bad condition, from S. Africa (*Dr. Smith*), 44, 6. Male from Umbilo (*A. L. Bevis*), 1916. Female from Mgwavuma, Zululand, March 1917 (*E. W. Baxter*), both in Durban Museum Coll.

A species nearly allied to *Neodasophrys hirsutus*, but smaller and with clear wings.

Length, ♂ 17, ♀ 21 mm.

Male.—*Scutellum* with long yellowish-red bristles on its posterior border. In all other respects similar to *Neodasophrys hirsutus*.

Female.—Tibiæ with chiefly long yellowish hairs on each side on the middle pair, and black and yellow on the others. *Ovipositor* about as long as the three preceding segments.

MEGADRILLUS, Bigot.

Ann. Soc. Ent. France, ser. 3, v. p. 545 (1857).

This genus is only distinguished from *Dysmachus* by the first posterior cell of wing being closed.

Megadrillus brevipennis, ♂ ♀, Macq.

Dipt. Exot. i. p. 130 (1838). [*Lophonotus*].

Dysmachus elachipterus, Loew, Dipt. Süd-Afrik. i. p. 163 (1860); Schiner, Novara Reise, Diptera, p. 186 (1868).

One male from Ceres Div., Matroosberg, 2500 feet, in Cape Museum Coll.

This species was described by Macquart from an unknown locality. Loew's species from the Cape is evidently the same.

This specimen in the Cape Museum Coll. answers to Macquart's description, which is as follows:—

“Black, white-haired. Wings short, the first posterior cell closed. Length 7 lines, ♂.

“Face, moustache, and beard white. Abdomen cylindrical, with a black triangular spot on each segment. Legs with black bristles. Wing a little brownish.”

A pretty little species with a snow-white *moustache*, *mane* posteriorly white, with short black hairs anteriorly and outstanding black bristles along its whole length. *Scutellum* with the white mane continued in the centre and a tuft of white hairs on each side, the posterior border armed with four stout, long, black bristles. *Genitalia* small, black with white pubescence.

Length 13 mm.

Lophonotus heteroneurus, Macq., now in this genus, is described as having a large brown spot on wings with a black mane, and is from the Cape.

DASOPHRYS, Loew.

Öfvers. Kongl. Vet.-Akad. Förhandl. xiv. 1857, pp. 362 & 366, 29 (1858).

This genus was formed by Loew for his species *D. longibarbis* from Kaffraria. The genus is near *Dymachus*, but distinguished from it by the long *Itamus*-like ovipositor in the female, and by the widening of the wing on fore-border of the male. The face has an indistinct tubercle reaching the antennæ. Schiner described another species, *Dasophrys personatus*, from the Cape, and *Asilus nigricans*, Wied., has been placed in this genus, also from the Cape; neither of these species is known to me.

Dasophrys paron, Walker.

List Dipt. Brit. Mus. iii. p. 450 [*Asilus*], 1849, et vii. Suppl. 3, p. 714 [*Lophonotus*] (1855); Loew, Dipt. Süd-Afrik. i. p. 145 (1860) [*Lophonotus*].

Dasophrys longibarbus, Loew, Dipt. Süd-Afrik. i. p. 166 (1860).

Walker's type (male) from S. Africa (*Dr. A. Smith*), 44-6. Two males and five females from Junction Blaaw Krantz and Tugela River, Natal, Oct. 1896 (*G. A. K. Marshall*), 1903, 17.

A large species, characterized by the widening of the wings in the male and by the long *ovipositor* in the female, by the tubercle on face reaching the antennæ covered with the thick moustache, black above with some white hairs below. *Legs* are black, the *tibiæ* dull reddish or reddish yellow at their base, *femora* and *tibiæ* with long fine chiefly whitish hairs. *Scutellum* with white hairs and black bristles.

Loew gives 14–18 mm.

These measure, ♂ 18–22, ♀ 21 mm.

LX.—*Papers on Oriental Carabidæ*.—IV.

By H. E. ANDREWES.

DRIMOSTOMINI.

Genus COSMODISCUS, Sl.

This genus was described by Mr. T. G. Sloane in 1907 (*Proc. Linn. Soc. N.S.W.* xxxii. p. 371) for a unique specimen, *C. rubripictus*, Sl., taken by Mr. Dodd at Kuranda, Queensland. Mr. Sloane kindly sent me a second example of the genus from the Kei Is., which he thought was probably a small form of his own species: I quite concur, as, apart from its smaller size and the fact that the ferruginous pattern on the elytra is reduced, it agrees with the description.

In 1873 (*Trans. Ent. Soc. Lond.* p. 283) Bates described *Cælostomus* (*Stomonaxus*) *platynotus* for a single ♀ ex. taken by Mr. Geo. Lewis at Nagasaki, in Japan: he was struck at the time by the unusual form of this insect, but left it in the genus *Stomonaxus*. Mr. H. Stevens has lately sent me five examples of this species from Gopaldhara, British Sikkim, which I have compared with Bates's type; the localities are comparatively remote from each other, and I anticipate the discovery of further specimens in the intervening Southern Provinces of China. Two out of the five specimens are of the same size as the Japanese insect, but the other three, which I cannot separate from them, are a good deal smaller.

Yet another species, with testaceous markings, as in the genotype, has been found in different parts of Central India by Dr. Annandale and Mr. E. A. D'Abreu. Before describing this and giving a few further notes on Bates's species, I think it desirable to reproduce Mr. Sloane's description of the genus, with such modifications as are necessitated by the

inclusion of the two additional species. I also give a table differentiating the species.

Ligula short, wide, truncate at apex, bisetose: *paraglossæ* very narrow, adnate to near apex of ligula and projecting only a little beyond it. *Mentum* moderately excised, sinus oblique at sides, with a short wide triangular tooth: epilobes rather pointed at apex and extending a little in advance of lobes. *Palpi* stout: *labial* with penultimate joint bisetose; apical joint short, hardly longer than penultimate, compressed, truncate: *maxillary* with apical joint short, hardly longer than penultimate, obtuse at apex. *Labrum* shagreened, truncate, sex-setose. *Mandibles* short, without seta in scrobe, pointed at apex, serrate along lower half of internal margin, right one with a small median tooth. *Clypeus* bisetose. *Head* small; front deeply and shortly bi-impressed; *eyes* hemispherical, narrowly separated from buccal fissure beneath. *Antennæ* short, moniliform, lightly incrassate; joints 1-3 glabrous, 6-11 compressed, first large, about as long as second and third together, second shortest. *Prothorax* widely transverse, considerably wider at base than apex; basal angles obtuse; margins more or less bordered; two marginal setæ on each side, anterior just before middle, posterior at basal angle. *Elytra* with bordered base; apex sinuate and with margin interrupted on each side by an internal plica; no scutellary striole, interval 3 impunctate. *Prosternum* smooth; intercoxal process more or less bordered. *Metepisterna* much longer than wide, punctate. *Ventral surface* more or less punctate along sides. *Legs* short: anterior tibiæ with wide apex, rounded and spinose externally: tarsi short, glabrous on upper surface, joint 5 glabrous beneath, claws simple: anterior tarsi (♂) with joints 1-3 moderately dilated and biserially squamose beneath, 1-2 triangular, 3 rather more quadrate, 1 shorter than 2+3, 4 very small: anterior tarsi (♀) with joint 1=2+3+4, first two joints with apex produced internally into a spiniform process: posterior tarsi slender, joint 1=2+3+4: posterior trochanters with a setiferous pore near base.

The genus is allied to *Cælostomus* (*Stomonaxus*), but the antennæ are more slender, the thorax wider, nearly as wide as elytra, flatter, hardly contracted behind, median line and basal sulci much fainter, border less reflexed, elytra flatter, hardly contracted towards base, striæ impunctate.

Table of Species.

- 1 (4). Prothorax with front and side margins bordered throughout, basal margin unbordered, surface smooth.

- 2 (3). Black, unicolorous; shoulders of elytra dentate *platynotus*, Bates.
 3 (2). Black, with ferruginous pattern on elytra; shoulders of elytra not dentate *rubropictus*, Sloane.
 4 (1). Prothorax bordered throughout, except over middle third of front margin, and between the basal sulci; surface punctate at sides of base, elytra black, with testaceous pattern, shoulders not dentate *picturatus* n.

Cosmodiscus platynotus, Bates.

Length 6-8 mm.

Prothorax much more narrowed in front than the description indicates. There is a border along both front and side margins, but none along basal margin. As in the other species the surface is a little flattened out near hind angles. There are a few punctures in the basal foveæ, and the marginal channel at sides is also irregularly punctate, but the surface is otherwise quite smooth. The elytra are very short, hardly wider than the prothorax; the basal border is produced at the shoulder and forms a small but distinct tooth. On the underside, the prothoracic epipleuræ are very wide, and the intercoxal process is unbordered or bordered at extremity only; the mesepisterna, sides of metasternum, metepisterna, and sides of ventral surface are all coarsely punctate.

Cosmodiscus picturatus, sp. n.

Length 6.0-6.5 mm.; width 2.60-2.75 mm.

Black, shiny; border of prothorax and elytra, under surface of head, sterna, apex of ventral surface, tibiæ, tarsi, and joints 1-3 of antennæ ferruginous; rest of legs and an elytral pattern testaceous. The elytral pattern consists of: (1) a slightly oblique streak on the shoulder, covering approximately intervals 5-8 at base, and terminating on interval 6 about halfway towards apex; (2) a horseshoe-shaped mark, commencing at three-fifths from base and convex towards apex, interrupted on sutural intervals, the front part on intervals 4-5, the hind part on 2-3, the colour on these last extending a little towards apex; (3) a short oblique streak, close to apex, on intervals 7-8. (In the type and Oxford specimens the elytral pattern is light in colour and well developed; in all the others the markings, which are rather darker, are more or less evanescent, disappearing in some examples on the shoulder and in others near the apex.)

Head (about 1.30 mm. wide) convex, smooth, shiny,

with deep, short, divergent frontal foveæ. Prothorax transverse (about 2·0 mm. wide), shiny, moderately and uniformly convex, except that the sides are rather flattened, especially near hind angles; base slightly bisinuate at sides, wider than apex, front margin truncate, angles rounded, inconspicuous; sides moderately rounded, hind angles obtuse but not much rounded, all margins bordered, except that the border is obsolete over the middle third of front margin and between the basal sulci; median line faint, basal sulci narrow but well marked, punctate, as is the flattened area at sides.

Elytra ovate, shiny, about half as long again as wide, shoulders rounded (but the basal border is bent a little forward towards them), moderately striate, intervals nearly flat, a little more convex towards apex. Prosternal process bordered in front, but not at extremity; mesepisterna and metasternum smooth.

The species is a little more elongate than the genotype, the thoracic border interrupted in front, but extending over the sides of the base, basal sulci wider and deeper, sides punctate near hind angles, shoulders of elytra less rounded, intervals flatter, testaceous pattern evidently differing.

Central Provinces: Nagpur, 1000', 27. viii. 1917, "at light," 1 ex. (type) (*E. A. D'Abreu*). Orissa: Lake Chilka, Barkuda and Gopkuda Is., 7 ex., some "at light" (*Chilka Survey* and *N. Annandale*)—Indian Museum. "India," 1 ex.—Hope Dept., Oxford Univ. Museum.

Mr. D'Abreu has kindly allowed me to retain the type-specimen in my collection.

NEBRIINI.

Leistus championi, sp. n.

Length 8·75 mm; width 3·0 mm.

Piceous: margin of prothorax, mouth-parts, tibiæ, tarsi, and antennæ (joint 1 darker) testaceous-red.

Head wide (1·60 mm), elongate, smooth behind, a few fine punctures on vertex, rugose and punctate at sides; labrum porrect, only half as wide again as long, mandibles long, smooth, of same width (in front of lateral projections) to near apex, antennæ and palpi very long and slender; tooth of mentum bifid, each point and the acute apices of the lobes with a strong seta; setiferous appendages at sides of maxillary stipes long and more or less cylindrical, that on the squama palpigera very long, with two setæ, one terminal, the other a little below it, both directed inwards; at base of

mentum 4 setæ arising from small tubercles, process at base of submentum sex-setose.

Prothorax convex, just wider than head, widest a little before middle, equally contracted at extremities, base truncate, apex slightly emarginate; sides moderately explanate, strongly rounded in front, sinuate some little way before base, with which they form approximately a right angle, front angles quite rounded adjoining neck, a small flat tubercle on each side on the explanate margin, midway between base and apex, but no seta is visible either there (though there is an evident pore and the seta is probably abraded) or at hind angles; median line evident, but not deep, transverse impressions and basal foveæ deep, margins lightly and sparsely, base and apical area strongly punctate, the puncturation extending for some distance from both ends along the median line, disk very minutely and sparsely punctate.

Elytra (5.0 mm. long) ovate, convex, almost parallel, border very slightly sinuate both behind shoulders, which though rounded are well marked, and before apex; strongly punctate-striate, both striæ and punctures only a little less deeply impressed towards apex, intervals moderately convex, 3 with five punctures, marginal series on 9 consisting of some half-dozen punctures only. Sterna (except middle of metasternum), episterna, and sides of ventral surface at base coarsely and more or less confluent punctate; anal segment with two setiferous pores on each side.

The species differs from *L. indus*, Tchitch., the only other species described from India, in its pitch-black colour, without blue or green reflections; form more elongate, head, labrum, and mandibles all longer; prothorax narrower, contracted more abruptly behind, and sinuate at a greater distance from hind angles, surface more strongly punctate; striæ of elytra more coarsely punctate, the outer ones not obliterated towards apex, interval 3 with five punctures instead of three. The species appears to be allied to *L. gracilentus*, Tchitch.

United Provinces: W. Almora Division, Upper Gumti Valley, April 1919, 1 ex., ♀ (*H. G. Champion*). The type has been presented by Mr. Champion to the British Museum.

LOROCERINI.

Lorocera stevensi, sp. n.

Length 8.0 mm; width 2.50 mm.

Black with a faint greenish tinge; mouth-parts, joints 2-11 of antennæ, and tarsi reddish; tibiæ and front and mid-trochanters dark red; joint 1 of antennæ piceous.

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Head rather wide (about 1.5 mm.), impressions between eyes deep and confluent behind, with a few fine oblique striæ on sides of front, smooth behind. Antennæ long, reaching very nearly to middle of elytra; joint 1 long and thick, tapering at both ends, obliquely truncate at extremity, a single bristle on inner side at widest point, joints 2-4 tuberculate, a strong bristle arising from each tubercle, joints 5-7 with some bristles at apex; joint 2=5, 4 a little longer, 3 twice as long as 2, the remainder a little longer than 3.

Prothorax (about 2.0 mm. wide) convex, widest at middle, slightly emarginate at extremities, a little more contracted behind than in front; sides regularly rounded, with reflexed margin, front angles rounded, hind angles obtuse but not much rounded; median line and hind transverse impression well marked, the front one and the little pit on sides of disk in front only faintly indicated; surface smooth, base punctate.

Elytra elongate-oval, very nearly twice as long as wide, shoulders very oblique, moderately striate, the striæ finely but not very conspicuously punctate, intervals slightly convex; three large punctures on interval 4, at a fourth, a half, and three-fourths from base, two similar punctures on interval 7 at a third and two-thirds from base. Episterna of meso- and metasternum, and sides of the latter, also sides of the ventral surface at base coarsely but not very closely punctate; propisterna punctate at base and apex.

About the same size as *L. pilicornis*, F., but nearly black, tibiæ and tarsi darker, antennæ lighter. Antennæ much thicker and with longer bristles, first joint larger and longer; prothorax with the little pits near front angles much less evident; elytra with more sloping shoulders, less evidently punctured striæ, and with two large punctures on interval 7; propisterna punctate in front. The position of the punctures on intervals 4 and 7 is almost exactly as in *L. 10-punctatu* Eschsch.

Bri ish Sikkim: Tonglu, 10,000', 7 ex., ♂ ♀ (*H. Stevens*). Mr. Stevens has kindly allowed me to retain the type in my collection.

Lorocera aparupa, sp. n.

Length 9.0 mm.; width 3.0 mm.

As the above description applies in great measure to this species also, I give below the points in which it differs.

Size larger and form rather wider. Black without greenish tinge. Head with much smaller and shallower frontal foveæ. Prothorax more transverse, hind angles a little rounded, the

pits on sides of disk in front practically obsolete, base more closely punctate. Elytra less elongate, shoulders rather less cut away, intervals more convex, the front punctures on interval 7 wanting (but in the ♂ specimen it is present on the right elytron). Front of proepisterna impunctate.

United Provinces: W. Almora Division, Sunderdhunga Valley, 8000'–12,000', June 1919, 2 ex., ♂ ♀ (*H. G. Champion*). The type (♂) has been presented by Mr. Champion to the British Museum.

SCARITINI.

ZELMA, gen. nov.

Ligula very small, narrow, (apparently) glabrous, concealed behind the supports of the labial palpi: *paraglossæ* not visible. *Maxillæ* short, apex slender and glabrous, hooked, inner margin densely ciliate. *Palpi* very short and, when *in situ*, more or less concealed: *maxillaries* glabrous, apical joint three times as long as penultimate, tapering almost from base to extremity: *labials* with last joint a little longer than penultimate, inflated at base and tapering sharply to apex, which is finely truncate, penultimate with two setæ on inner margin near base. *Mentum* finely rugose, a little wider than long, moderately excised in front, base of excision straight, (apparently) without tooth, epilobes very wide, the ridge separating them from the lobes extending to base of mentum, two large pores near base of central part, which (viewed from below) is depressed; lobes pointed, more or less bordered, slightly rounded at sides, apex very obliquely truncate, surface pitted. *Mandibles* (apparently) without seta in scrobe, short, slightly curved, sharply pointed, with a rough inner edge. *Labrum* very short, front margin arcuate, sex-setose, but with some additional setæ at sides. *Antennæ* arising beneath a frontal plate, just before the eyes, moniliform, not quite reaching base of prothorax, joint 1 robust, a little longer than (each of) 2, 3, 4, and 11, which are about equal, remainder about two-thirds as long, pubescent from joint 2 (inclusive), more densely so after first third of joint 4. *Head* flat, semicircular, widest at base, which is emarginate in the middle to receive a projection of the prothorax, margin uneven, more or less serrate, bisinuate at sides, with deep frontal depressions, clypeal suture invisible; eyes invisible from above, coarsely faceted, sunk in sides of head, between them and buccal fissure (which is represented by a fine groove up to the insertion of antennæ) intervene first a deep groove, for the

reception of the first four joints of the antennæ, and then a pitted space of about equal width, corresponding with the paragenæ. *Prothorax* strongly transverse, quadrate, pedunculate, central part longitudinally raised, projecting in front into an indentation of head, with base emarginate and bituberculate above peduncle: sides explanate and hollowed out, three or four large, transverse, shallow pits arranged longitudinally along them, bounded inwardly by a fine ridge: scutellum very small, situated on the peduncle. *Elytra* tricarinate, base truncate, emarginate in middle, with small projections on each side of the emargination, resulting from extensions of the first carina, shoulders sharply rectangular, apex slightly truncate, the sutural angles just showing as a faint projection: outer carina forming the apparent margin, the real margin, inflexed, and invisible from above, separated from it by a shallow channel. *Underside* deeply pitted: epipleuræ of prosternum wide in front, narrowed behind, undulating in correspondence with the transverse pits on upper surface: intercoxal process bordered, narrowed between coxæ, and widened out horizontally behind, the border continued obliquely forward in front across the prosternum, which is finely carinate down the central line: a deep bordered channel between epipleuræ and prosternum for reception of antennæ, episterna shagreened and forming (as seen from beneath) the base of the antennal channel in front, but visible behind, where the channel widens out: mesepimera (apparently) reaching coxal cavities: metasternum channelled, the episterna long, narrow, and channelled behind: margins of ventral segments curving backwards at sides, penultimate and antepenultimate segments each with a deep, pitted transverse sulcus, apical segment with a setiferous pore at margin on each side. *Legs* short: front femora dilated, channelled beneath, tibiæ with two inconspicuous teeth below terminal one, tarsi minute, joint 1 as long as the rest together: mid-femora channelled beneath, with a tooth near base, tibiæ slender, finely spinose, without trace of spur: hind coxæ just meeting; claws minute. There are fully developed wings beneath the elytra.

The usual setæ to be seen on various parts of the body in the Carabidæ are almost entirely wanting, with the exception of those on the labrum, last segment of ventral surface, and legs, but the cleansing of the specimens must to some extent be responsible for this, and fresh material is required for examination.

The remarkable feature in this new genus is the presence of antennal grooves on the underside, not only of the head,

but also of the prothorax. In the *Cryptomorphinæ* there is a groove on the underside of the head for the reception of the antennæ, and in *Scarites* there is a shallow groove for the scape only. I know of no other instance in the Carabidæ of such a groove on the prothorax as well as the head. *Zelma* is evidently related to *Solenogenys*, described by Westwood in 1859 (Trans. Ent. Soc. Lond. p. 170) for *S. fœda*, a species taken by Bates on the Amazon. Apart from its larger size, this bears a strong superficial resemblance to *Z. miranda*, though in many of its characters it is strikingly different. In *Solenogenys* both the eyes and the margins of the elytra are visible from above, the antennal groove is confined to the underside of the head, and does not extend to the prothorax; joint 3 of the antennæ is much longer than 2 and 4, and the pubescence begins at joint 3; the mentum is toothed, the apical joints of the palpi are less inflated, the median part of the head is produced into a lobe beneath, the sides into two elongate processes, bounding the antennal channels; the under surface is not pitted, and the ventral segments are not transversely channelled.

With regard to the position of the two genera, I think that the (apparent) absence of a seta in the mandibular scrobe, the fossorial front tarsi, the pedunculate prothorax, and the insertion of the antennæ under frontal projections all point to their inclusion among the Scaritini. Putzeys, in his "Révision Générale des Clivinides" (Ann. Soc. Ent. Belg. x. 1867), includes the genus *Solenogenys*, but does not comment on its unusual characters. It is clear to me that neither genus will fit either into the *Scarites*-group or the *Clivina*-group, and I see nothing for it but to form a new *Solenogenys*-group. Whether this can be framed to include *Zelma* must remain an open question until further material is available for study.

Zelma miranda, sp. n.

Length 4.0 mm.; width 1.0 mm.

Upperside grey; underside dark pitchy-red, legs a little lighter. Upper surface covered with a minute, sparse, and almost invisible pubescence.

Head (1.20 mm. long) coarsely sculptured, surface uneven, two small tubercles on middle of front. Prothorax a little wider than head, sides almost parallel, with a row of small tubercles along the margin, front angles porrect, hind angles obliquely truncate, median line deep and widened out behind into the basal emargination: surface uneven and minutely

tuberculate. Elytra (2.40 mm. long) slightly convex, parallel, the carinæ minutely tuberculate (more finely so than the margin of the prothorax), between sutural interval and first carina, as also between first and second carinæ, approximately three irregular rows of shallow punctures, larger towards margin, between second and third carinæ the punctures are larger and quite irregular.

Burma: Tharrawaddy (*G. Q. Corbett*), 1 ex. (type) in my collection. Calcutta: Eden Gardens, "at light" (*F. H. Gravely*), 1 ex., Indian Museum. The Calcutta ex. is fragmentary, but shows a good many of the characters: it is a little smaller than the type.

GNAPHON, gen. nov.

Ligula short, truncate, rather hollowed out at apex and joined to tooth of mentum by a fine ridge: *paraglossæ* rather longer than ligula, projecting obliquely outwards, narrow at apex but meeting at base above ligula, densely fringed with hairs in front. *Maxillæ* straight, obtuse at apex, densely fringed with hairs on inner margin. *Palpi* thick: *maxillaries* glabrous, last joint obliquely truncate at apex, a little longer than preceding one: *labials* with last joint rounded at apex, slightly shorter than penultimate, which has half a dozen setæ on inner margin. *Mentum* moderately excised, with a wide, almost quadrate tooth, very obtusely angled at apex; finely carinate along median line, lobes rounded, slightly at sides, strongly at apex, extending beyond epilobes, rather concave beneath: *paragenæ* toothed and emarginate. *Mandibles* moderately curved, about as long as head, smooth, a ridge on upper surface from base to middle, each with an elongate irregular tooth occupying basal half of inner margin, left mandible with a smaller tooth near apex. *Labrum* very small, emarginate, with three setigerous pores. *Antennæ* moniliform, not reaching base of prothorax, joint 1 as long as next four joints together, 2 half as long again as 3, 4 a little shorter than the rest, which are approximately equal to 3. *Head* very large, nearly smooth, longer than prothorax, frontal impressions wide and shallow, sides deeply longitudinally impressed above eyes, genæ strongly dilated. *Prothorax* cyathiform, very wide and short, dentate at hind angles, and shortly produced in middle, so that the base appears to be bidentate on each side. *Elytra* short, flat on disk, shoulders carinate and dentate, interval 7 sharply carinate throughout, epipleuræ very wide at base. Prosternum not bordered; metepisterna very small, rather longer than wide;

ventral surface without transverse furrows. Front tibiæ with three teeth (including apical tooth) but without denticulations; mid-tibiæ with one spine. Type of genus: *Scaritoderus loyolæ*; Fairm.

Scaritoderus loyolæ, Fairm. Bull. Soc. Ent. Fr. 1883, p. 55.

Scaritoderus loyolæ, Andr. Ann. & Mag. N. H. (9) iii. 1919, p. 469.

Crepidopterus favrei, Maindr. Bull. Soc. Ent. Fr. 1904, p. 269, fig.

In his "Monographie des Scaritides" (Ann. Soc. Ent. Belg. xxii. 1879, p. 156) Chaudoir published the genus *Anomoderus* for *A. costato-granulatas*, a species from New Caledonia. Fauvel, finding the name of Chaudoir's genus was preoccupied, changed it to *Anomophænus* (Rev. d'Ent. i. 1882, p. 229); Atkinson in his Catalogue of Oriental Carabidæ (Journ. As. Soc. Beng. 1890, Suppl. i. p. 18) says that Fauvel's name is also preoccupied, but I cannot find that this is the case. When Fairmaire published his *Scaritoderus loyolæ*, he too had discovered that *Anomoderus* was a preoccupied name, and he suggested *Scaritoderus* to replace it; he pointed out some differences between the Indian and New Caledonian species, but left them in the same genus. As Fauvel's name is anterior to Fairmaire's, *Anomophænus* must stand for the New Caledonian species, and *Scaritoderus* becomes a synonym of it.

It is in these circumstances that I propose the new genus described above for the Indian species. It differs in some important points from *Anomophænus*: the tooth of the mentum is almost quadrate, a narrow slit on each side separating it from the lobes, the penultimate joint of the labial palpi is sex-setose, the first joint of the antennæ equal in length to the four succeeding ones, sides of prothorax dentate, base only slightly produced, &c.

LXI.—*Fossil Arthropods in the British Museum.*—II.

By T. D. A. COCKERELL, University of Colorado.

[Plate XVI.]

COLEOPTERA.

Carabidæ.

Carabites gardneri, sp. n. (Pl. XVI. fig. 10.)

Elytron 16.8 mm. long, 5.5 mm. wide; base truncate, apex narrowed, but obtuse at tip; the outer margin strongly concave just before the end. Outer margin with

a strong sharp sulcus, but no distinct row of punctures mesad of it; disc with eight strong striæ, beset with small round rather weak punctures throughout, about 7 punctures to a mm. On middle of elytron three striæ, with two intervals, go in 2 mm. transversely. The two outer discal striæ run to the apex, converging near it, as also do the two inner, but the four middle ones unite in two pairs, thus terminating, the outer pair 3 mm. and the inner pair 2 mm., before the apex. There is no basal incomplete stria, nor any sign of specialised discal punctures. The striæ, with their punctures, resemble those of *Morio*, but the fossil is easily separated from that genus by the absence of specialised submarginal and discal punctures.

Bartonian, Bagshot Beds; Bournemouth (*J. S. Gardner*). British Museum, 19010 with reverse (= type), 19009, 19012, 19011, 19019 with reverse, 19013.

The type of *Carabites*, Heer, is an elytron 3.5 mm. long, from the Lower Lias of Switzerland. Our insect is of course not congeneric, but Scudder used *Carabites* in a general sense for Carabidæ not referable to a known genus, and I follow him in this usage, to avoid giving a new generic name. I do not know a living genus to which *C. gardneri* may be referred, but I am not familiar with more than a small fraction of the numerous genera.

Elateridæ.

Elaterites purchisoni (Giebel).

Elytron as preserved 14 mm. long, the actual length was probably at least 15 mm.; width 4.5 mm.; nine longitudinal lines of small round punctures; near the apex 10 punctures in 2 mm. of length, and three rows in 1 mm. transversely; on middle of elytron two rows in 1 mm. The shape of the elytron is about as in *Agriotes*, the apex forming a large angle. The punctures are about as in *Pyrophorus*, but those in the apical field are stronger, although the insect is not so large.

Lower Bagshot Beds, Corfe Clay; Creech, between Corfe and Wareham, Dorset (*P. B. Brodie*). Brit. Museum, 18996. From W. R. Brodie (No. 17).

This is the type-specimen of *Elaterium purchisoni*, Giebel, 1856, based on Westwood, Proc. Geol. Soc. London, 1854, p. 395, plate 16. f. 34. It has quite typical Elaterid sculpture; but the type of *Elaterium* is *E. pronæus*, Westw., from the Purbeck, which has elongated punctures and, as Handlirsch remarks, is surely not congeneric. *Elaterites*, Heer

(type now designated *E. lavateri*, Heer, from Oeningen), seems applicable to the present insect. I include in *Elaterites*, however, various Elaterid elytra from the Tertiary, which cannot be definitely assigned to known genera. Those described below, if completely known, would very likely be found to include as many genera as species.

Elaterites perditulus, sp. n. (Pl. XVI. fig. 7.)

Elytron about 10·3 mm. long, width about 2 mm. ; eight rows of fine punctures, about the middle four rows in 1 mm. transversely ; punctures in the rows about 130–160 μ apart, and placed in delicate grooves. The general form is that of *Monocrepidius* ; the apex is too pointed for *Athous*.

Corfe, I. of Purbeck, Dorset (*Brodie*). Brit. Museum, 10418.

This is labelled "*Agrilus*, Buprestidæ (W.)." W. probably stands for Westwood, but in spite of this high authority the insect must be referred to the Elateridæ.

Elaterites laconoides, sp. n. (Pl. XVI. fig. 8 ; text-fig. 1.)

Elytron 7 mm. long and 2·5 mm. broad, formed much as in *Lacon*, the apex very obtuse. Ten striæ, bearing five round (not elongate) punctures ; near the humeral angle the second stria (counting from without) is deflected toward the third at its upper end, and in the space thus formed between the first stria and upper end of second is a little

Fig. 1.



18998.

Elaterites laconoides (sculpture).

row of four punctures. On the basal half of the elytron the punctures are very distinct, but on the apical part they are small and obscure. On the basal part the punctures are about six in a mm., and there are three striæ to a mm. transversely.

Bartonian, Bagshot Beds ; Bournemouth, near the pier. Presented by Alfred Bell. Brit. Museum, 18998.

Elaterites sculptilis, sp. n. (Pl. XVI. fig. 9.)

Elytron 7 mm. long and 1.8 mm. wide, the base truncate, the apex pointed. Nine delicate striæ, very finely punctate, the four inner ones with the punctures subobsolete, the others with distinct though very delicate punctures. The outer striæ are more closely placed than the four inner; the fifth stria (from within) is one mm. from inner margin. Punctures on outer striæ about 95–130 μ apart. Between the inner series of striæ the surface is extremely finely rugulose, with lines inclined to be transverse or oblique, but irregular, as in the living *Cardiophorus fenestratus*, Lec.

“Corfe, I. of Purbeck” (*Brodie*); Brit. Museum, 10420. “Studland Bay, I. of Purbeck, Dorset” (*Brodie*); Brit. Museum, 10422. These are the two impressions of the same specimen.

Elaterites palæophilus, sp. n. (Pl. XVI. fig. 1.)

Elytron as preserved 6 mm. long, but the ends missing; probable total length at least 9 mm. Width 2.4 mm.; dark brown, with eleven rows of round punctures; the rows close together, and the punctures so placed that often two of one row and two of the next will mark the four corners of a square space; punctures about 6 in a mm. lengthwise, and five rows transversely in a mm., but the first three rows are more widely spaced than the others.

Lower Eocene; Woolwich and Reading Beds, Peckham. Caleb Evans collection. Brit. Museum, 1467.

Someone had already labelled it “*Elater.*” (See also Smith, ‘Geologist,’ iv. (1861) p. 40.)

Curculionidæ.

Curculionites marginatus, Giebel.

Elytron convex, about 6 mm. long and 3 mm. wide; with six visible (probably one or two obliterated) longitudinal rows of very large deep punctures, squarish and somewhat longer than wide. Each row contains about 20 punctures, and there are between 4 and 5 punctures in 2 mm. longitudinally. Transversely, there are 5 rows in 2 mm. The intervals between the punctures are not larger, but often rather smaller, than the punctures themselves.

Bagshot Series, Corfe, Dorset (*Brodie*). Brit. Museum, 10417. This is the type-specimen of Giebel’s *C. marginatus*,

based on Westwood's figure. The type of Heer's genus *Curculionites* is *C. redtenbacheri*, Heer, from Radoboj. This shows only the ventral surface, but looks like one of the Brachyrhininæ (Otiorrhynchinæ). *C. marginatus*, so far as anything shows, could go in the genus *Brachyrhinus* (*Otiorrhynchus*). Pierce recognises ten families of Curculionoidea, and places these insects in a family Psallidiidæ, on the ground that *Psallidium* was the first published genus. This change does not seem to me to be necessary.

Ceutorhynchus (?) *eocenicus*, sp. n. (Fig. 2.)

Elytron convex, 3 mm. long and 2 mm. broad; inner margin concave, outer strongly convex; base broad, obtusely angulate about the middle. There are eight sharp longitudinal striæ, and no visible punctures. The striæ are about 190 μ apart.

Fig. 2.



Ceutorhynchus (?) *eocenicus*, Ckll.

Lower Eocene, Woolwich Beds; Peckham. Caleb Evans collection. Brit. Museum, 14472.

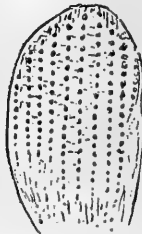
The specimen is labelled: "C. E., Peckham, 841^a. *Strophosomus* or *Cneorhinus*." It appears to have been recorded by Smith, 'Geologist,' iv. (1861) p. 40. It does not appear to me to belong to the Brachyrhininæ, but rather to have been an extremely broad-bodied weevil of the *Ceutorhynchus* type, very similar to *C. degravatus*, Scudd., from the Eocene of Colorado.

Ophryastites gardneri, sp. n. (Fig. 3.)

Elytron slightly convex, flattened on disc, about 10.6 mm. long and 5 mm. wide; eight rows of very distinct but only moderately large punctures, about 8 in 2 mm., and in addition a row of small weak punctures next to the outer margin, and a broken row next to the inner margin. The surface is irregularly transversely wrinkled.

Bartonian, Bagshot Beds; Bournemouth (*J. S. Gardner*).
 Brit. Mus. 19000; also 19005, which seems to be the
 reverse, or in any event the same species.

Fig. 3.



Ophryastites gardneri, Ckll.

This represents a large weevil, the whole insect doubtless
 15 mm. long in life. It is in all respects very similar to
Ophryastes grandis, Scudd., from the Eocene of Colorado,
 but the punctures are not connected by longitudinal striæ
 as in *O. grandis*. *Ophryastites* is used by Scudder for fossil
 insects of this affinity, but of uncertain generic position.

Baris (?) *palæophilus*, sp. n. (Fig. 4.)

Elytron 3·2 mm. long and about 1·7 mm. broad; shaped
 as in *B. interstitialis*, Say. Convex, with ten rows of closely
 placed elongate punctures. The punctures are about 80 μ
 long, and the intervals between them are about 50 μ . The
 rows are about 110 μ apart.

Fig. 4.



Baris (?) *palæophilus*, Ckll.

Bartonian, Bagshot Beds, Bournemouth (*J. S. Gardner*).
 Brit. Museum, 19016.

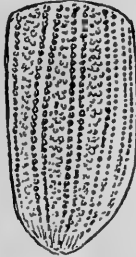
So far as can be seen, this might belong to *Baris*. There is
 a superficial resemblance to *Geralophus*, from the Florissant
 Miocene; but in *Geralophus* the small punctures are not
 over a third as long as the distance between the rows.

Chrysomelidæ.

Chrysomelites allochlamys, sp. n. (Fig. 5.)

Elytron about 7·5 mm. long and 4·3 mm. broad; moderately convex but flattened on disc, broadly truncate at base, obtuse at apex; nine lines of round rather large punctures; one near the inner margin, and four pairs of parallel lines, two near middle of disc, and two, close together, not far from outer margin; between the pairs of lines the surface is very densely covered with punctures of the same size as those in the lines. In one of the lines there are about seven punctures to a mm.

Fig. 5.

*Chrysomelites allochlamys*. 1908.

Bartonian; Bagshot Beds, Bournemouth (*J. S. Gardner*). Brit. Museum, 1908, with reverse.

The type of *Chrysomelites* is *C. prodromus*, Heer, from the Lower Lias of Switzerland, an insect certainly not congeneric with the present species. But I follow Scudder in treating the name as applicable to fossil Chrysomelidæ of unknown generic position, although it seems probable that our insect should be made the type of a new genus. It has a curious resemblance to *Smodicoptera liasina* (Heer), from the Lower Lias of Switzerland. Heer considered *Smodicoptera* to be a Buprestid (*Euchroma*), but our species certainly cannot belong to that family. In 'Die Insektenfauna der Tertiärgebilde von Oeningen und von Radoboj' (1847), plate viii., Heer undertook to illustrate the primitive or fundamental pattern of a Coleopterous elytron, and according to this system *C. allochlamys* may be considered a primitive form. Such a pattern persists in the modern *Leptinotarsa*, but that typically differs from our fossil in having the rows of punctures much more irregular and (especially *L. undecimlineata*) double at least in part, while the intervals between the

parallel rows are only very sparsely punctured*. The fossil shows no colour-bands, but they may have existed in life. There is a group of *Leptinotarsa*, represented by *L. juncta* and its immediate allies, in which the rows of punctures are single and even, as in *C. allochlamys*.

Cerambycidae.

Leptura (?) *bartoniana*, sp. n. (Pl. XVI. fig. 12.)

Elytron as preserved 9.5 mm. long, but apex lost, probable total length about 12 mm.; width 3 mm.; costal margin thickened; humeral region with the usual large rounded prominence; surface throughout coarsely punctured on the basal half, the punctures deep, suboval, inclined to be in longitudinal lines, but not regular, the intervals usually less than the width of a puncture, about seven punctures in 2 mm. longitudinally; on apical half or more of elytron the punctures are fine and well separated; on the descending outer face below the humeral angle, the punctures are large and run more or less in oblique lines.

Bartonian, Lower Bagshot, Corfe Clay; Creech, between Corfe and Wareham, Dorset (*P. B. Brodie*). From W. R. Brodie. Brit. Museum, 18997.

This agrees with *Leptura*, so far as can be seen. Compared with the living *L. cribripennis*, it differs by being much less coarsely punctured in the apical region, and by the large punctures not being at all confluent. On the other hand, the punctures on the basal half are very much larger and coarser than in *L. sexmaculata* or *L. instabilis*.

Scarabæidæ.

Pelidnotites (gen. nov.) *atavus*, sp. n. (Fig. 6.)

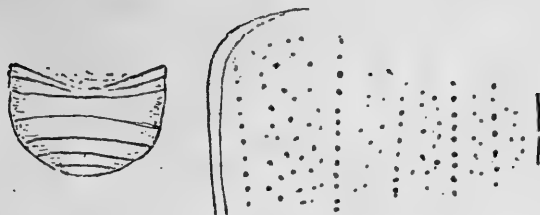
Elytron about 18 mm. long, width uncertain; surface with rows of fine punctures (6 or 7 in 2 mm.), and widely scattered irregular similar punctures between. Humeral region with a well-defined thickened edge. A row of punctures proceeds backward from the obtuse humeral angle, very slowly diverging from the margin; the next row of punctures is about 3 mm. from this on the basal part of the

* The specimen of *L. undecimlineata*, Stål, before me was collected by Mrs. Cockerell at Antigua, Guatemala. It has the pattern of head and thorax as in Tower's segregate *L. diversa* ('The Mechanism of Evolution in *Leptinotarsa*,' pl. 2. f. 4), but these parts are yellowish, nearly as in *L. panamensis*, and the elytral stripes are distinctly metallic green. It will stand as race *guatemalensis*, and is, I presume, the *L. guatemalensis* which Tower mentions but fails to describe.

elytron, but beyond the distance decreases to 2 mm.; three other rows of punctures are visible, the last only 1 mm apart.

Bartonian, Bagshot Beds; Bournemouth (*J. S. Gardner*). Brit. Museum, 19004. An abdomen, nearly 12 mm. broad, probably belongs to the same species (B. Mus., 19037). There is also a prothorax, 10 mm. broad, and 5 mm. long in middle, formed exactly as in *Cotalpa lanigera*, but impunctate, which may well belong here (B. Mus., 19040). The data for the abdomen and prothorax are the same as for the elytron.

Fig. 6.

*Pelidnotites atavus*, Ckll.

This is by far the oldest genuine Scarabæid known, but it seems clearly to belong to the Rutelini in the vicinity of *Pelidnota* and *Cotalpa*. The reference is strongly supported by the abdomen and prothorax, which show the presence of such a type in the deposit, or at least indicate a veritable Scarabæid. As it is impossible to definitely refer the insect to a living genus, I propose the name *Pelidnotites* for it.

EXPLANATION OF PLATE XVI.

- Fig. 1. *Elaterites paleophilus*, Ckll., $\times 3$. P. 458.
 Fig. 2. *Megapterites mirabilis*, Ckll., type. P. 278.
 Fig. 3. *Pycnoscelus gardneri*, Ckll., type, $\times 1\frac{1}{2}$. P. 275.
 Fig. 4. *Hammapteryx anglica*, Ckll., type. P. 276.
 Fig. 5. *Oecophylla bartoniana*, Ckll., type, $\times 2$. P. 277.
 Fig. 6. *Allopterites multilineatus*, Ckll., type, $\times 2$. P. 275.
 Fig. 7. *Elaterites perditulus*, Ckll., $\times 3$. P. 457.
 Fig. 8. *Elaterites laconoides*, Ckll., type, $\times 3$. P. 457.
 Fig. 9. *Elaterites sculptilis*, Ckll., $\times 3$. P. 458.
 Fig. 10. *Carabites gardneri*, Ckll., type, $\times 2$. P. 455.
 Fig. 11. *Formica heteroptera*, Ckll., type, $\times 2$. P. 278.
 Fig. 12. *Leptura bartoniana*, Ckll., type. P. 462.

[Figs. 2, 3, 4, 5, 6, and 11 illustrate the paper in the March issue; figs. 1, 7, 8, 9, 10, and 12 belong to the present paper.—Eds.]

LXII.—*The Irish Otter.* By MARTIN A. C. HINTON.

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LONG ago Ogilby (P. Z. S. 1834, p. 111) described the Irish otter as a distinct species, *Lutra roensis*, "on account of the intensity of its colouring, which approaches nearly to black both on the upper and under surface; of the less extent of the pale colour beneath the throat as compared with the common otter, *L. vulgaris*, Linn., as it exists in England; and of some difference in the size of the ears and in the proportions of other parts." Ogilby added that he had "long considered the Irish otter as constituting a distinct species."

The type of *L. roensis* was presented to the Zoological Society by Miss Anna Moody of the Roe Mills, Newtown Lemavaddy, near Londonderry; later it passed into the British Museum (reg. no. 57.12.14.4), where it is now preserved. The nearly black colour described by Ogilby has become, from exposure, a nearly uniform deep reddish brown.

The Museum has just received three female otters from Co. Galway, caught during the last winter. These, as regards colour, accord perfectly with Ogilby's description; they are much darker (practically black above) than any English specimens examined by me. In my opinion, therefore, the Irish otter should be regarded as a distinct subspecies, for which the name *L. l. roensis* is available. Such a variation characterized by colour-saturation is, of course, exactly what is to be expected in the more humid climate of Ireland.

The following measurements will form a useful supplement to those given in Miller's 'Catalogue of the Mammals of Western Europe':—Females 1 and 2: head and body 710, 635 mm.; tail 430, 440; hind foot 114, 114; ear 25, 25.

*Skulls.**Lutra lutra roensis.*

	Type.	Females, Co. Galway.		
		1.	2.	3.
Condyllo-basal length.....	..	..	108.3	..
Zygomatic breadth.....	..	64.7	65.8	65.3
Mastoid breadth.....	58.4	60	61.2	60.4
Postorbital constriction.....	14.5	14.2	..	13.8
Interorbital constriction....	16.9	18	19.4	18.7
Breadth of rostrum over canines.	25.2	24.7	24.7	24.7
Occipital depth.....	..	..	34.7	..
Maxillary tooth-row (canine-m.).	33.1	33.7	33.2	32.8
Mandible.....	66.6	68	68.2	68
Upper carnassial.....	10.4×7.9	10.6×7.9	10.5×7.9	10.7×7.9
Upper molar.....	7.7×10.6	7.7×10.6	7.9×10.7	7.8×10.6
Lower carnassial length....	12.6	12	12.9	11.8

LXIII.—*New or little-known Tipulidæ (Diptera).*—III.
Ethiopian Species. By CHARLES P. ALEXANDER, Ph.D.,
 Urbana, Illinois, U.S.A.

THIS paper is a continuation of the preceding parts under this title. The material included herein is based on collections made in Cameroun by the Rev. J. A. Reis and in Eastern Transvaal by Mr. H. K. Munro. In addition, a few species from the Paris Museum sent to me for determination by the Curator of the Diptera, Mons. Eug. Séguy, have been included. The holotypes are preserved in the collection of the writer, unless stated otherwise.

AMPHILIMNOBIA, gen. nov.

Head moderately large, the eyes separated both above and below. Legs long and slender; tibiæ unspurred; claws small, simple, subterminal, empodia present. Wings with vein *Sc* very long, *Sc*₁ ending opposite cross-vein *r*; *Sc*₂ far before the tip of *Sc*₁, the latter vein alone being about equal to the basal deflection of *R*₄₊₅; *r* present, located far before the tip of *R*₁, this portion of *R*₁ beyond *r* being a little longer than the deflection of *R*₄₊₅; cell 1st *M*₂ open by the atrophy of the outer deflection of *M*₃; basal deflection of *Cu*₁ at the fork of *M*; anal veins long and straight. Male hypopygium with the ninth tergite small, the caudal margin feebly concave; pleurites moderately elongated, the proximal face with a cushion of numerous short spinules; pleural appendages two, the outer appendage shortest, flattened, the apex obtuse; inner pleural appendage larger and more elongated, irregularly twisted, the apex with a few setigerous tubercles; no distinct gonapophyses; penis-guard a subflattened lobe of nearly uniform width for its entire length. Ovipositor with the valves moderately elongate, powerful, the tergal valves much exceeding the rather weak, acutely pointed sternal valves.

Genotype.—*Amphilimnobia leucopezæ*, sp. n. (Western Ethiopian Region).

The curious fly that is made the type of the above new genus is represented in the writer's collection by three specimens in poor condition. The fly possesses structural features that preclude its disposition in any genus known at the present time. Although the general appearance of the fly is much like a *Dicranomyia*, the details of structure seem to

place it in a position much nearer *Dicranoptycha* and *Rhamphidia*. The principal generic characters are derived from the claws, the structure of the male and female genitalia, and, especially, the wing-venation. Unfortunately the tips of the antennæ are broken and the number of segments cannot be accurately determined.

Amphilimnobia leucopeza, sp. n.

General coloration dark brown; legs dark brown, the tarsi white; wings with a strong brownish tinge; *Sc* long, cell 1st *M*₂ open.

Male.—Wing 7.8 mm.

Female.—Length about 8 mm.; wing about 6.4 mm.

Rostrum, palpi, antennæ, and head dark brown.

Thorax dark brown. Head dark brown. Legs brown; fore tarsi, except the basal two-thirds of the metatarsus, pure white; the other legs are all detached; in some the white of the metatarsus is much more restricted, occupying only the narrow apex, in others the entire tarsus is white excepting only the base of the metatarsus. Wings with a strong brownish tinge, the wing-tip more suffused; stigma a little darker brown than the remainder of the wing, elongate-oval; veins dark brown. Venation as described under the generic characterization; *Rs* long, strongly arcuated or even angulated and spurred at origin; *r* on *R*₂₊₃ nearly twice its length beyond the fork of *Rs*; *r-m* less than one-half the deflection of *R*₄₊₅; petiole of cell 2nd *M*₂ approximately as long as this cell; the abortive vein behind *Cu* distinct.

Abdomen brown, indistinctly bicolorous; posterior margins of the segments narrowly darker.

Hab. Cameroun.

Holotype, ♂, Olama, altitude 2000 feet, July 24, 1919 (J. A. Reis).

Allotopotype, ♀, in copula with the type.

Paratopotype, a fragment.

The type is mounted in balsam.

Erioptera (Erioptera) carior, sp. n.

Antennæ with the scapal segments brownish yellow; flagellum dark brown; vertex brownish grey, broadly whitish adjoining the inner margins of the eyes; mesonotum shiny dark brown; legs yellow; wings pale brown, the costal and subcostal cells and a narrow band at the cord light yellow; male hypopygium with the inner pleural appendage unbranched (branched in *carissima*), the head enlarged into

a structure that resembles the head and beak of a crested bird; gonapophyses deeply bifid.

Male.—Length about 5 mm.; wing 4.3 mm.

Rostrum and palpi dark brown. Antennæ short, the scapal segments brownish yellow; flagellum dark brown, verticils only moderately elongated. Vertex brownish grey, broadly whitish adjoining the inner margins of the eyes; eyes of the male very large as in this group (*péringueyi* group) of species, broadly contiguous beneath.

Mesonotum shiny dark brown, the præscutum with the three usual stripes confluent, the humeral region and lateral margins a little paler yellowish brown. Pleura dark brown. Halteres brown, the knobs dark brown. Legs with the coxæ and trochanters brown; remainder of the legs light yellow, the distal three tarsal segments and the tips of the others dark brown. Wings pale brown, sparsely marked with dull yellow; the costal and subcostal cells are light yellow; the stigma dark brown, elongate-oval, and very distinct; the cells proximad of the cord are largely pale brown, those distad of the cord dull yellow, the veins broadly seamed with brown; the cord is narrowly margined with yellow. Venation as in *E. carissima*, but the deflection of Cu_1 is more perpendicular.

Abdomen dark brown. Male hypopygium very distinct from either *E. péringueyi* or *E. carissima*; outer appendage slender, as in *carissima*; inner appendage with a short, twisted stem that is inserted in the elongated, transverse head near the middle of its length; this head somewhat resembles the head and beak of a bird with a long, curved crest; of this structure, the compressed, obliquely truncated beak is directed laterad; the curved crest is directed proximad and cephalad, covered with numerous short erect setæ. Gonapophyses deeply bifid, the proximal arm longest, the tips acute and blackened, subdecussate with their fellow of the opposite side; the lateral arm is a little shorter, largely blackened, suddenly narrowed into the short, acute tip.

Hab. Eastern Transvaal.

Holotype, ♂, "Lot 30, De Kaap Block B," near Kaapmuiden, October 9, 1919 (*H. K. Munro*).

Erioptera nigrolatera brevipilosa, subsp. n.

Female.—Wing 5-5.1 mm.

Generally similar to typical *nigrolatera*, Alexander (Nyasa-land), differing as follows:—

Legs without the conspicuous erect pubescence found in

nigrolatera; this may be a sexual character, however, as only males of typical *nigrolatera* and females of the new variety have been made known. In the present form the pubescence of the legs is very short, appressed, and not at all conspicuous. The wings are much paler, greyish subhyaline; vein Sc considerably shorter, ending far before the fork of R_{2+3} ; Sc_2 is closer to the tip of Sc_1 , Sc_1 alone being only about two-thirds R_{2+3} ; in typical *nigrolatera* Sc_1 is longer than R_{2+3} ; anal veins a little more divergent at the wing-margin. The valves of the ovipositor are short and fleshy as in the group.

Hab. Eastern Transvaal.

Holotype, ♀, "Lot 30, De Kaap Block B," near Kaapmuiden, October 11, 1919 (*H. K. Munro*).

Paratopotype, ♀, a badly injured specimen, October 10, 1919.

Molophilus camerounensis, sp. n.

Rostrum and palpi black; antennæ of the male elongate, the basal segments yellowish; general coloration dark brown, the mesonotal præscutum brighter brown; wings greyish, the veins clothed with long dark-coloured hairs; male hypopygium with three conspicuous chitinized appendages on either side.

Male.—Length 4.8 mm.; wing 4.4 mm.

Rostrum and palpi black. Antennæ of the male elongated, almost as in the Nearctic *M. pubipennis*, O.-S., the basal segments light yellow, the distal segments a little more brownish; flagellar segments elongate-cylindrical, clothed with long, pale, outspreading hairs. Head dark brown.

Mesonotal præscutum rather light brown, the remainder of the mesonotum and the pleura dark brown. Halteres dark brown. Legs with the coxæ and trochanters brown; remainder of the legs dark brown. Wings with a strong grey tinge, the costal and subcostal cells more brownish; veins and pubescence dark brown, giving a dark colour to the wings. Venation: R_{3+4+5} long, about one-half longer than the basal deflection of Cu_1 ; fork of M far proximad of the fork of Rs ; inner ends of cells R_3 and R_5 in alignment; petiole of cell M_3 more than three times the basal deflection of Cu_1 or about two-fifths of vein Cu_1 beyond it; basal deflection of Cu_1 perpendicular, nearly twice as long as the basal deflection of M_3 .

Abdominal segments brown, indistinctly bicolorous. Male

hypopygium with the armature unusually developed even for a member of this genus; three powerful chitinized appendages on either side, the longest and most powerful of which is enlarged apically into a two-edged complicated head.

Hab. Cameroun.

Holotype, ♂, Olama, altitude 2000 feet, July 24, 1919 (J. A. Rees).

CERATOLIMNOBIA, gen. nov.

Vertex behind the antennal bases with a flattened white lobe or cornicle. Tibiæ unspurred. Wings with Sc long, Sc_2 close to the tip of Sc_1 ; tip of R_1 atrophied or nearly so; cell 1st M_2 closed; basal deflection of Cu_1 before mid-length of cell 1st M_2 . Male hypopygium small, with two pleural appendages, the longest recurved into a U, at the bend of which is a cylindrical minutely branched arm.

Genotype.—*Ceratolimnobia munroi*, sp. n. (Southern Ethiopian Region).

By means of all existing keys to the Tipulidæ this crane-fly would run to the genus *Gnophomyia*, to which it is obviously not closely allied. *Gnophomyia* is gradually becoming a receptacle for many diverse Eriopterine elements, and it seems advisable to remove the present fly from such an incongruous gathering and erect a separate genus for it. The presence of a snowy-white corniculus, much as in the Ethiopian species of the genus *Ceratocheilus*, Wesché, offers the most ready means for distinguishing this genus from similar crane-flies.

Ceratolimnobia munroi, sp. n.

Head light grey, with a snowy-white cornicle on the vertex; general coloration dark brown, the mesonotal præscutum narrowly margined laterally with silvery white; legs dark brown, the tips of the femora and tibiæ narrowly white, the fore tarsi largely white; wings dusky, the costal region more yellowish, with six large dark brown blotches; veins beyond the cord broadly seamed with brown.

Male.—Length about 2.7 mm.; wing 3.8 mm.

Rostrum and palpi black. Antennæ with the scapal segments black; flagellum broken. Head with a light grey pubescence, the middle of the vertex and the postgenæ more blackish; on the fore part of the vertex immediately behind the antennal bases and between the anterior end of the eyes

is inserted a flattened snowy-white lobe or corniculus that is directed cephalad, very much as in the African species of *Ceratocheilus*.

Pronotum dark brown. Mesonotum dark brownish black, the lateral margins of the præscutum narrowly silvery white, this beginning on the sides of the pronotum, continued backward to the wing-root; tuberculate pits a short distance behind the anterior margin of the præscutum. Pleura and sternum dark brownish black. Halteres pale brown basally, the knobs broken. Legs with the coxæ dark brownish black; trochanters dark brown; femora dark brown, darkest before the tips, which are abruptly and narrowly white; tibiæ brown, the tips narrowly white; fore tarsi with the basal two-thirds of the metatarsus brown, the remainder of the tarsi white; the other legs are detached, but the middle and hind tarsi are presumably uniform brown, and what are probably the hind legs lack the white tibial apices. Wings with a strong brownish tinge, especially on the basal half; beyond the cord the membrane is subhyaline, with the veins broadly seamed with brown; six darker brown costal blotches, the first at the arculus, the second at the origin of R_s , the third at Sc_1 , the fourth at the tip of R_1 ; the fifth and sixth at the ends of veins R_2 and R_3 ; costal and subcostal cells more yellowish; pale areas occur between the dark costal areas, at the ends of cells R , M , Cu , $1st A$, and $2nd A$; veins dark brown, the pale spaces on veins C , Sc , and R yellow. Venation: Sc long, ending about opposite two-thirds the long R_s , Sc_2 close to the tip of Sc_1 , Sc_1 equal to about twice Sc_2 ; tip of R_1 atrophied; r oblique, inserted at the fork of R_{2+3} ; R_s longer than R_3 ; R_{2+3} a little shorter than R_2 ; inner ends of cells R_3 , R_5 , and $1st M_2$ in direct alignment; $r-m$ a little longer than the basal deflection of R_{4+5} ; cell $1st M_2$ long and comparatively narrow, longer than vein Cu_1 beyond it; basal deflection of Cu_1 just before mid-length of cell $1st M_2$.

Abdomen dark brown. Male hypopygium small; pleurites rather short and stout, covered with microscopic hairs and a few long setæ; two pleural appendages, the longest strongly recurved into the form of a **U**, the free end-directed outward, the tip narrowed and acute; on the side at the bend of the **U** with a conspicuous cylindrical arm that is minutely branched; inner pleural appendage small and flattened, narrowed to the blunt apex, which bears several long setæ; gonapophyses small, flattened, triangular, directed proximad.

Hab. Eastern Transvaal.

Holotype, ♂, "Lot 30, De Kaap Block B," near Kaapmuiden, October 8, 1919 (*H. K. Munro*).

It is with great pleasure that this interesting new species is dedicated to its discoverer, Mr. H. K. Munro.

Trentepohlia (Trentepohlia) aurantia, sp. n.

Generally similar to *T. speiseri*; mesonotal præscutum light orange-yellow, with a delicate reddish-brown median line; legs yellow; posterior tibix with two strong black bristles before the tip; abdomen yellowish brown.

Male.—Length 7.6 mm.; wing 7 mm.

Female.—Length 8.8 mm.

Described from alcoholic specimens.

Rostrum and palpi pale brownish yellow. Antennæ with the scape light brown; flagellum broken. Head brownish.

Mesonotal præscutum light orange-yellow, with a delicate reddish-brown median line, the lateral margins behind the pseudo-sutural foveæ narrowly infuscated; scutal lobes reddish brown, the median area and the scutellum pale; postnotum yellowish brown. Pleura brown, darker on the sternum. Halteres pale, the knobs white. Legs with the coxæ yellow; trochanters dull yellow; femora and tibix yellow, the tips not darkened; tarsi broken; posterior femora with a series of six or seven short blackened spinules at the base; tibix with two widely separated black bristles before the tip. Wings subhyaline, the costal margin strongly yellowish, the anal cells dusky grey; a rather heavy brown pattern, somewhat as in *T. speiseri*, but more restricted; the blotch at the origin of *Rs* is entirely solid, but comparatively small; the apical mark includes only the veins, the centre of cell *R*₂ yellowish subhyaline; vein *Cu* seamed with darker.

Abdomen yellowish brown, the apical segments darkened.

Hab. Reunion.

Holotype, ♂, 1903 (*Blanchard*).

Allotopotype, ♀.

Type in the collection of the Paris Museum.

This species is, perhaps, closest to *T. speiseri*, Edwards, from which it is told by the bright colour of the mesonotum and the different wing-pattern.

Tipula ellenbergeri, sp. n.

Head indistinctly reddish; thorax black; wings with the

costal margin and apical half brownish black, the basal half whitish hyaline; basal abdominal segments reddish, the posterior margins black.

Sex? (probably a male).—Wing 14·6 mm.

Described from an alcoholic specimen.

Frontal prolongation of head comparatively short, the sides eddish brown, the dorsum narrowly darker; nasus distinct; palpi dark brown. Antennæ dark brown, the flagellar segments more reddish basally; the flagellum is broken, but detached segments in the vial with the type presumably belong to this species; in these the distal flagellar segments are elongate-oval, slightly constricted basally. Head reddish, darker-coloured between the eyes.

Thorax uniformly deep black, apparently shiny in dried specimens. Halteres black. Legs black, the femora and tibiæ slightly paler basally; legs slender, especially the tarsi; claws reddish, the distal half blackened, at about mid-length with a small, acute, ventral tooth. All of the legs are detached in the vial, and but few still remain. Wings with the costal region and the apical half of the wings black, the basal half conspicuously and abruptly whitish hyaline; the dark apex includes all of the cells beyond the cord as well as the outer ends of cells *R*, *M*, *Cu*, and *1st A*; stigma small, dark brownish black; veins dark brown. Wings broad.

Abdomen with the first segment black; second segment reddish, the caudal margin narrowly blackened; third segment reddish basally, the apex of the abdomen broken beyond this point.

Hab. French Congo.

Holotype, sex ♂?, Lambaréné, Ogoway R., 1911 (*R. Ellenberger*).

Type in the collection of the Paris Museum.

This beautiful crane-fly is readily told from all described African Tipulinæ by the beautifully dimidiate wings. The claws bear a small, acute, ventral tooth that is only visible when the foot is viewed from the side. The presence of this tooth would indicate that this fly is a male. This interesting species is named in honour of its collector.

LXIV.—*New Species of Reithrodon, Abrocoma, and Scapteromys from Argentina.* By OLDFIELD THOMAS.

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A. A FURTHER COLLECTION FROM SR. BUDIN.

After making the collection in Jujuy, of which an account was given in February *, Sr. Budin went back to Catamarca, and paid further visits to Chumbicha and Otro Cerro, localities at which he had obtained so many interesting novelties in 1918. Lists of specimens from both places have already been published †, and I now only propose to describe two more novelties from Otro Cerro, additional to the previous list, together with a couple of other new forms of *Reithrodon*.

Attention should be again called to the fact that Otro Cerro is not in Rioja, as erroneously stated in the title to my earlier paper, but is in Catamarca, about 18 km. N.N.W. of Chumbicha.

The discovery of a second Argentine species of *Abrocoma*, quite different from that of Jujuy, is the most noteworthy result of the fresh collection.

Reithrodon caurinus, sp. n.

A buffy rabbit-rat with whitish belly and nearly white tail.

General colour more strongly buffy than usual. Back clay-coloured heavily lined with the black ends to the longer hairs. Sides, or at least a band bordering the under colour, buffy, often ochraceous buff, the rump also more or less of this colour. Under surface whitish, not sharply defined laterally, but almost entirely without the buffy or cinnamon found in all the other species, the sternal region only being dull buffy; hairs broadly slaty at base except in the inguinal region, where they are wholly white. Head and ears with the piebald markings characteristic of the genus particularly well developed. A strongly marked buffy supraorbital line, and distinct patches at the bases of the ears. Proectote blackish; metentote buffy. Hands and feet white; soles more naked than in the southern species, the hairs ceasing entirely behind the posterior pads. Tail white, the darker colour of its upper side reduced to a narrow inconspicuous line.

* *Ann. & Mag. Nat. Hist.* (9) v. p. 188 (1920).

† *Op. cit.* (9)-iii, pp. 115 & 489 (1919).

Skull apparently without marked characteristics.

Dimensions of the type:—

Head and body 139 mm.; tail 99; hind foot 30.5; ear 25.

Skull: greatest length 36.8; condylo-incisive length 33.6; zygomatic breadth 19.7; nasals 16.6; breadth of brain-case 15.6; palatal foramina 9.8; upper molar series 6.8.

Hab. Otro Cerro, Catamarca. Alt. 3000 m.

Type. Adult male. B.M. no. 20. 3. 17. 23. Original number 808. Collected 13th November, 1919, by E. Budin. Presented by Oldfield Thomas. Seven specimens.

The species of *Reithrodon* are all exceedingly closely allied, so far as the characters of their skulls and teeth are concerned, these being almost the same in all. But the geographical forms may be distinguished by colour and by the degree of hairiness of the soles, the southern *cuniculoides*, *hatcheri*, and *flammarum* having the plantar hairs coming forward to the anterior pair of sole-pads, the intermediate *auritus*, Desm. (with which my *pampanum* is probably synonymous), having the main mass of the hairs ceasing at the posterior pair of pads, but with a certain number of hairs between the pads. Finally, the more northern forms from Uruguay, Corrientes, and now that of Catamarca all have the pad region naked.

In colour all but *caurinus* have the belly mostly buffy, but in *auritus* of Buenos Ayres Province the thighs are white in front.

The type-locality of *auritus* was the Pampas south of Buenos Ayres, and in this region there seems to be no animal but a *Reithrodon* which can be fitted to Azara's description of his "rat oreillard," the basis of Desmarest's *Mus auritus*. My *Reithrodon cuniculoides pampanus* would therefore be a synonym of *auritus*, unless a form with less buffy on the belly proves to occur in the open country just south of Buenos Ayres itself.

But in the less dry south-eastern corner of Buenos Ayres Province there is a duller form, due no doubt to more saturate conditions, which may be distinguished as

Reithrodon auritus marinus, subsp. n.

Essential characters of true *auritus*, but duller throughout, less buffy, the ears almost uniformly dark, without bright buffy metentote, the under surface wholly dull greyish washed with buffy, the inguinal region and front of thighs not white as in *auritus*.

Dimensions of the type:—

Head and body 155 mm.; tail 104; hind foot 32; ear 27.

Skull: greatest length 37·5; condylo-incisive length 35; zygomatic breadth 21; upper molar series 7·2.

Hab. Mar del Plata, on the south-eastern sea-coast of Buenos Ayres Province.

Type. Adult female. B.M. no. 12. 12. 11. 1. Brought home alive by W. A. Smithers, Esq., and presented by the Zoological Society. Lived about a month at the Zoological Gardens. Two specimens from Mar del Plata, and another from "Buenos Ayres" received in 1882 from Mr. A. W. White.

And an exactly similar colour-modification occurs on the north side of the La Plata among the more naked-soled forms. Here the typical *R. typicus* from Maldonado is the dull sea-coast form, and the following the inland one:—

Reithrodon typicus currentium, subsp. n.

General characters of *R. typicus*, with soles similarly naked to behind the posterior pads, but colours throughout more brightly contrasted. Back mixed buffy grey, sides and belly strongly washed with buffy. Area round eyes reaching back to ears and bases of proectote buffy, terminal part of proectote dark brown; metentote buffy. A well-marked patch on sides of neck below ears brown, contrasted with the pale areas round it. Hands and feet white; tail almost white, the usual darker line along its top quite inconspicuous.

Dimensions of the type:—

Head and body 139 mm.; tail imperfect (another specimen 108 mm.); hind foot 31; ear 26.

Skull: greatest length 36·5; condylo-incisive length 34; zygomatic breadth 19; upper molar series 7·3.

Hab. Corrientes. Type from Goya.

Type. Adult male. B.M. no. 98. 12. 3. 4. Original number 9-1. Collected 23 July, 1895, by Mr. R. Perrens. Presented by Oldfield Thomas.

The original type of Waterhouse's *R. typicus*, collected at Maldonado by Darwin, is now much faded, but it evidently never had the well-contrasted markings of the Corrientes form.

Abrocoma budini, sp. n.

A drab-coloured *Abrocoma* with large feet and tail and shorter ears than *A. cinerea*.

Size about as in *A. cinerea*. Fur similarly soft and fine, hairs of back about 17 mm. in length. General colour above near Ridgway's "drab," very uniform everywhere, the back little darker than the sides. Under surface greyish drab, the hairs broadly slaty for three-fourths their length, their tips pale drab; hairs of sternal gland white to their roots. Chin greyish white; underside of neck stronger drab. Head without special markings. Hands and feet pure white, the latter of more normal length than in the curiously short-footed *A. cinerea*. Tail of medium length, iron-grey above, white below.

Skull agreeing with that of *A. cinerea* in the normal minuteness and separation from each other of the posterior palatal foramina, as in the majority of rodents, while in *A. bennettii* and *murrayi* these are of exceptional size and are fused into a single median foramen. Nasals markedly narrowed and pointed posteriorly. Malars not much expanded, but differing from others by being so twisted that, instead of forming a nearly vertical plate, their inner side can be broadly seen from above, facing upwards and inwards towards the supraorbital edges. Interorbital region very narrow, more so than in any other species. Bullæ smaller than in either *A. murrayi* or *cinerea*.

Incisors not so reduced as in *A. cinerea*, about as in *A. bennettii*. Molars of the usual pattern.

Dimensions of the type:—

Head and body 201 mm.; tail 144; hind foot 31; ear 24.2.

Skull: greatest length 50; condylo-incisive length 47; zygomatic breadth 24.5; nasals 20.5 × 5.5; interorbital breadth 6.4; least breadth across brain-case 20; palatilar length 22; diagonal length of bulla 16.2; bimeatal breadth 25; upper cheek-tooth series (crowns) 10.2; dental length 26.6.

Hab. Otro Cerro, Catamarca. Alt. 3000 m.

Type. Adult male. B.M. no. 20. 3. 17. 62. Original number 817. Collected 15th November, 1919, by E. Budin. Four specimens.

"Caught among-rocks, in the clefts of which it lives."—

E. B.

This fine chinchilla-rat, as Sr. Budin calls it, adds to the genus *Abrocoma* a fourth and very distinct species, readily distinguishable externally by its colour and proportions, and cranially by its narrow interorbital region, small posterior palatal foramina, and the other characters above detailed.

I say fourth species, because there is no doubt that Waterhouse's *A. cuvieri* is the same as *A. bennettii*—so that with *A. murrayi*, Wolffs., there are two in Chili, while Sr. Budin had previously discovered *A. cinerea* at Casabindo, Jujuy.

I have pleasure in recognizing Sr. Budin's keenness in his search for new animals by naming this most interesting species in his honour.

B. THE *SCAPTEROMYS* OF THE PARANA DELTA.

When giving an account of the mammals obtained on the islands of the Parana delta by Mr. R. Kemp in 1917*, I assumed without very close enquiry that the interesting black and white water-rat of the genus *Scapteromys* was referable to *S. tomentosus*, based on Lichtenstein's *Mus tomentosus* † from the Rio Uruguay, collected by Sellow.

But further consideration indicates that this is not the case.

In the first place, the localities would appear to be by no means so adjacent as I had supposed, for although the Rio Uruguay runs out close to the Parana delta, *Mus tomentosus* was said to have come from the "waldigen Gegenden" of that river—in other words, from the Upper Uruguay, where alone the country is really forested, and where the fauna would be appreciably different from that of the water-logged Parana delta ‡.

Then the delta animal, as suits its locality, is by colour, the texture of its fur, and its known habits distinctly a water-animal, while there is no indication of water-characteristics in the coloration of *tomentosus*, nor has its tail got the swimming fringe below that occurs in the delta species.

In size *tomentosus* would appear to exceed considerably both *tumidus* and the delta form, as its hind foot, including claws, is said to be 2 inches in length.

In consequence, I propose to describe the delta *Scapteromys* as

Scapteromys aquaticus, sp. n.

Size less than in *S. tomentosus*. Upper surface slaty

* Ann. & Mag. Nat. Hist. (8) xx. p. 96 (1917).

† Darst. Säug. pl. xxx. fig. 1 (1830).

‡ But just as this paper is in the press Prof. Matschie informs me that Sellow's collections were made near Maldonado, where *S. tumidus* was obtained by Darwin—a region faunally very different from the Parana delta. He also gives me some measurements of the type which are confirmatory of the marked inferiority in size of *S. aquaticus*.

blackish, little browner on the rump, sides dark slaty grey, abruptly changing halfway down to the greyish white (sometimes tinged with buffy) which covers the whole of the under surface and inner sides of the limbs, though the hairs are everywhere slaty greyish at base. Crown black. Ears thickly hairy, dark brown, the proectote blackish. Upper surface of hands and feet whitish, often with darker metapodials. Tail heavily haired, the hairs below longer than those above, so as to form a swimming fringe; blackish brown above, lighter brown, sometimes even dull whitish below.

Dimensions of the type:—

Head and body 168 mm.; tail 154; hind foot 36 (with claws 39, therefore barely $1\frac{1}{2}$ inch English, and decidedly less than $1\frac{1}{2}$ inch French or German); ear 22·5.

Skull: greatest length 39; condylo-incisive length 37·2; zygomatic breadth 19; nasals 15; interorbital breadth 6; breadth of brain-case 16; zygomatic plate 3·7; palatilar length 17·3; palatal foramina 8·8; upper molar series 6·4.

Hab. Islands of Parana delta. Type from Isla Ella, other specimens from Los Cisnes, Rio Carabelas.

Type. Adult male. B.M. no. 17. 6. 1. 6. Original number 2843. Collected 15th February, 1917, by R. Kemp. Presented by Oldfield Thomas. Fifteen specimens obtained by Mr. Kemp and eight by Mr. H. E. Box.

Besides its difference in size, Lichtenstein's animal appears to have had nothing like the extent of the whitish on the under surface so prominent in *S. aquaticus*, where the white rises nearly halfway up the sides. In *tomentosus* no white is shown in the plate, and the description runs "Mitte der Bauchseite matt aschgrau." A casual note of my own on the type in Berlin says "belly but little lighter," so there is certainly nothing of the striking bicolor coloration characteristic of *S. aquaticus*.

This is one of the interesting delta animals which, in order to carry on at all, have either to swim or climb, for their habitat is completely flooded whenever the waters of the La Plata estuary are banked up by the south-east wind.

LXV.—*Preliminary Descriptions of some new Species and Subspecies of Indo-Malayan Sphingidæ.* By Lord ROTHSCHILD, F.R.S.

THESE Sphingidæ form part of collections sent to the British Museum by Major F. B. Scott and Mr. C. J. Brooks.

1. *Ambulyx liturata obliterata*, subsp. n.

♂. Differs from *l. liturata* in its much paler coloration and the almost complete obliteration of the minor markings of the fore wings and the great reduction of the markings of the hind wings. Head, thorax, and abdomen much paler, buffish not so vinaceous as in *l. liturata*. Fore wings stramineous buff, tinged with rosy cinnamon, not vinaceous brown as in the typical form; the rufous-brown bands on veins 4, 6, and 7 absent and the rest of the nervures much less distinct, the dark bands running in from costa absent, only the one crossing vein 6 slightly indicated, the olive patch on vein 1 and the smaller one above vein 2 both very much larger than in *l. liturata*; subternal patch larger, better defined vinaceous mauve, and without the streaks present in *l. liturata*. Hind wing paler, yellower, less suffused with rufous, the red freckling and median band much reduced.

Hab. Lebong-Tandai, Benkoelen District, Sumatra, 1912-1919 (C. J. Brooks); 1 ♂.

2. *Oxyambulyx pryeri sumatranus*, subsp. n.

♀. Differs from *pryeri pryeri* in the presence strongly marked of a crenulate median black band and an ante-median angled line from cell to inner margin. The black basal patch and the black transverse bands on hind wing are also more strongly developed.

Hab. Lebong-Tandai, Benkoelen District, Sumatra, 1912-1919 (C. J. Brooks); 1 ♀.

3. *Clanis brooksi*, sp. n.

♂. Nearest to *bilineata*, Walk., and *stenosma*, Rothsch. & Jord., but apparently much larger; this ♂ having the fore wing 70 mm., equalling the ♀ of *stenosma*, and as in all the known species the ♀ ♀ are larger than the ♂ ♂, the ♀ ♀ of *brooksi* will probably prove to be much larger. The pale area running in from the costa on fore wing much longer than in *bilineata*, but not so long as in *stenosma*, not reaching second line, first and second lines much straighter, not angled and crenulated. Black area of hind wing less extended

towards apex, pale areas of abdominal and distal margins greyish olivaceous brown. Body and wings above with whole ground-colour olivaceous, not ochraceous. Below fawn-olive, broad basal area below median nervure of fore wing deep blackish brown.

Length of fore wing 70 mm.; expanse 155 mm.

Hab. Lebong-Tandai, Benkoelen District, Sumatra, 1912-1919 (*C. J. Brooks*); 1 ♂.

4. *Marumba cristata titan*, subsp. n.

♀. Very much larger and darker than *cr. cristata*; the bands on the fore wing are much broader and the four basal ones wider apart. Ground-colour deep sooty grey-brown with a purplish violet suffusion, with no rufous or sandy tinge whatever. The subternal spot on fore wings is very large and broadly ringed with orange. Abdominal area on hind wings grey.

Length of fore wing, ♀ *cristata cristata*, 60 mm.; expanse 132 mm.

Length of fore wing, ♀ *cristata titan*, 74 mm.; expanse 163 mm.

Hab. Lebong-Tandai, Benkoelen District, Sumatra, 1912-1919 (*C. J. Brooks*); 1 ♀.

5. *Marumba scotti*, sp. n.

♂. Nearest to *sperchius gigas*, Butl., but smaller, at once distinguished by its grey colour, the sandy and buff tints being entirely absent, and by the presence of an extra oblique band from costa passing through the stigma and joining band 4 on vein 1, where they stop short. Band 5 and the following shadow band are much closer to the stigma than in *sp. gigas*. Hind wing deep brown washed with grey, and nervures chestnut; margins much less crenulated.

Length of fore wing 43 mm.; expanse 98 mm.

Hab. Shillong, Assam, 1919 (*Major F. B. Scott*).

"The larvæ were common in Shillong (Khasia Hills) during July and August 1919, feeding on Spanish Chestnut and a species of Oak. I did not find the egg.

"The larva is coloured as follows:—Head and body green varying from apple-green to nearly white. A whitish stripe on either side of front of head ending in two short points. Head and body dotted with white tubercles, sometimes with reddish points. A whitish lateral stripe on the first to the third segments and seven oblique stripes, whitish edged above with dark green, on the usual segments. The lower portion of the anterior oblique stripe widens out into an irregular quadrate spot. A white ventral [?lateral, *R.*] stripe from

the fourth segment to the anal claspers. Horn dark green, straight and tuberculate. Spiracles blue. Length full-grown 4 inches=100 mm. Before pupating the larva turns pink. The pupa has a rough shagreened surface, is brown, and has two small projections to the head. Two moths emerged in August 1919, the remainder are still (Feb. 1920) in the pupal stage.

"This larva is often attacked by small black flies. I counted as many as ten on a single larva; but apparently they do not cause any injury, as this particular larva produced a perfect moth."—*F. B. S.*

6. *Cechenena scotti*, sp. n.

♂. This very beautiful species is unlike any other of the genus.

Antennæ above milky white shading into pink basad; palpi orange-buff, third joint pale olive; head deep green, bordered broadly by pinky greyish white; thorax deep green, patagia (rectius tegulæ) bordered with silver-grey and with an obsolescent orange streak in the centre, centre of thorax pale pinkish grey; abdomen, basal two segments above deep green, rest of abdomen above slightly paler and more olive, mixed here and there with bronze; dorsum with two broad pinkish silver-grey lines, within which are two narrow hair-lines of same colour and a broad median band dark green on basal one-third and bronze for rest of its length; anal tuft olive-green mixed with grey. Fore wing: ground-colour pinkish buff-grey, basal half below stigma rosy pink; basal one-fifth of costa and basal three-fifths of wing above median nervure dark green, within which is a black stigmatic dot. Below the green area from inner margin to costa before apex run two indistinct, partially obliterated, faint olive oblique lines; from inner margin beyond these to apex is a heavy double oblique dark green band, and beyond this and between it and the termen are several ill-defined waved dark green lines and cloudings. Hind wing: basal half irregularly black, rest of wing pale pinkish buff suffused with black, which suffusion forms a broad outer terminal band, leaving tornal half of disc almost without suffusion.

Length of fore wing 36 mm.; expanse 82 mm.

Hab. Mussoorie, 1918 (*Major F. B. Scott*).

"At Mussoorie in August 1918 I found several eggs on Virginian Creeper. These eggs were green and spherical. Before hatching they turned white. The newly hatched larva was greenish yellow with a very long black horn, and the body smooth and cylindrical.

"After the first moult the head was yellow, the body green,
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long and thin, swollen at the fifth segment; horn long and straight, brown with tip black and white. Towards the end of this stage an ocellus appeared on the swollen fifth segment, green centre ringed with white and black.

"After the second moult the head and body were green; the fifth segment much swollen and coloured pink, with the ocellus coloured as before. Horn purple, anal segment and underside pink. After third moult the head was green, and body yellowish green; the fifth segment still more swollen brick-red, with the ocellus blue in front, reddish behind, the reddish portion dotted with yellow, the whole ringed with white and black. A lateral stripe on third and fourth segments brick-red; the dorsal line, the lateral segmental oblique stripes on segments 6-12, and the subdorsal spots also brick-red. Legs, prolegs, and underside brick-red. Horn curved downwards, yellow closely dotted with black.

"After fourth moult there were two forms, a green and a brown. The green form was coloured as follows:—Head and body to fifth segment green, remaining segments dorsally white, green laterally and below with dark green strigæ. A green dorsal line; a pale lateral line, edged above on third and fourth segments with green. An ocellus on the swollen fifth segment, dark blue in front, green behind, with two white spots in the green portion, ringed in front with blue, behind with yellow, the whole outwardly ringed with green. A light-coloured waved subdorsal line, and light oblique stripes edged with green on segments 6-12. Legs pink with white bands, prolegs and claspers green. Spiracles ochreous. Horn purple and curved down.

"Length $3\frac{1}{2}$ inches = 89 mm.

"The brown form was marked identically the same, but coloured pale and dark brown instead of dark and light green.

"The pupa was contained in a slight cocoon near the surface of the soil. Head, thorax, and wing-cases dark brown with paler markings, the wing-cases having rows of raised black dots. A black circular flattened sheath in front of head. Abdomen brown-pink, with a dark dorsal stripe and dark strigæ. Spiracles black.

"Length 49 mm."—*F. B. S.*

7. *Cechenena lineosa subangustata*, subsp. n.

♂. Differs from *lin. lineosa*, Walk., in the buff subterminal band on the hind wings being very much narrower.

Hab. Lebong-Tandai, Benkoelen District, Sumatra, 1912-1919 (*C. J. Brooks*); 1 ♂.

I hope later to give detailed accounts of the genitalia and other structures.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

January 7th, 1920.—Mr. G. W. Lamplugh, F.R.S.,
President, in the Chair.

The following communications were read:—

1. 'On *Syringothyris* Winchell, and certain Carboniferous Brachiopoda referred to *Spiriferina* D'Orbigny.' By Frederick John North, B.Sc., F.G.S.

This paper is the outcome of a suggestion made in 1913 by Prof. T. F. Sibly, who pointed out the desirability of an attempt to remove the uncertainty which had hitherto existed in the naming of the British species of *Syringothyris*, and of the Carboniferous Spiriferids possessing a lamellose surface ornament, which it was customary to refer to *Spiriferina* because there was no other genus for their reception, although it had long been recognized that few, if any of them, really belonged to that genus.

After indicating the exact sense in which certain frequently occurring terms are used, and reviewing the history of previous research, the Author discusses the history in Avonian times of the genus *Syringothyris*, and suggests a classification of its species.

Variations due to time, to environmental conditions, and to distribution in space, are recognized, and distinctive names are given to the mutations characteristic of certain horizons.

The syrinx (it is suggested) was a special arrangement called into existence to control the direction of, and to support the adductor-muscles, as the area of the shell increased in height. It, and the transverse plate to which it was attached, originated as a modification of an apical callosity such as existed in many Spiriferoid shells. It was initiated in Middle Devonian times, and reached its acme early in the Carboniferous Period.

All known species of *Syringothyris* have the fold in the brachial valve, and the sinus in the pedicle-valve, smooth. Species such as *S. distans*, in which the fold and sinus are plicated do not possess a syrinx, and are incorrectly referred to *Syringothyris*.

The form described by McCoy as *Spirifera laminosa* is referred to a new genus, since it has neither the punctate shell-structure of *Spiriferina*, nor the internal characters of *Syringothyris*. The genus is represented in the Lower Avonian by mutations of the species *laminosa* McCoy, and in the Upper Avonian by the species *subconica* Martin.

Syringothyris and *Spiriferina* are in no way related, either morphologically or phylogenetically.

The small Carboniferous shells that have hitherto been referred

to *Spiriferina* include two types characterized by external differences. Of these two types, one, in which there are numerous ribs and a relatively-large rounded fold and sinus, is relegated to a new genus; while the members of the other type, which include shells with a few large angular ribs, are for the present retained in *Spiriferina*, although the type-species of that genus was derived from the Lias. The subdivision here suggested for the Carboniferous forms will, it is believed, prove to be applicable to the later species also.

2. 'Jurassic Chronology: I—Lias. Supplement 1, West England Strata.' By S. S. Buckman, F.G.S. (Read, in the absence of the Author, by Dr. W. D. Lang, M.A., F.G.S.)

In this communication the following points are discussed:—

(1) The Ammonite and some Brachiopod faunas of the Lias of Gloucestershire and Worcestershire.

(2) A method of faunal plotting as an aid to faunal analysis.

(3) That in the collection, analysis, and comparison of faunas, the following causes of failure have to be considered:—Stratal, Depositional, Faunal, Dispersal, Exposure, Collection, Arrangement, Nomenclature, Fossilization, Preservation, Extraction, Zonalization, Publication; but several of these are not applicable to results derived from the investigation of limited areas.

(4) The evidence appears not only to support the conclusions of the Author's former paper, but to show that in certain cases a fuller sequence of faunal episodes may be required.

(5) The fauna of small Ammonites in these Liassic beds, especially that of small *Schlotheimia* at Gloucester, suggests comparison with the faunas of Hierlatz and Spezia. The use of technical terms for different sizes of organisms, especially for small forms, is briefly-illustrated.

(6) It is suggested that the strata and faunas of these Continental localities are not so exceptional as they appear to be at first sight; and that English localities may be studied with advantage, in comparison with and explanation of the features of these Continental deposits.

(7) It is found that the preserved strata of the Gloucestershire-Worcestershire Lias under consideration happen in the main to be deposits of dates when the living Ammonites were rather small; while there is faunal failure and presumably stratal failure of the times when large Ammonites flourished. The converse phenomena are mainly illustrated by North-Somerset deposits.

(8) The times when large and small Ammonites lived appear to follow one another like waves, illustrated even in a short table of Liassic deposits.

(9) As a result of the investigations connected with this paper it seems to be advisable, for recording purposes at any rate, to make further subdivisions in the scheme set forth in the Author's former paper.

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END OF THE FIFTH VOLUME.

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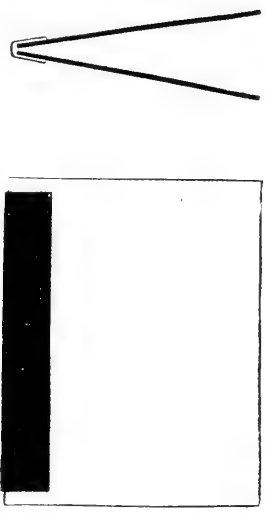


FIG. 9.

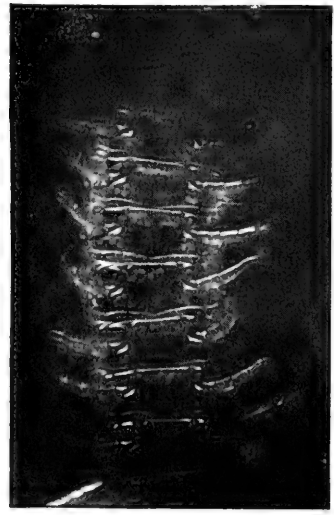


FIG. 10.

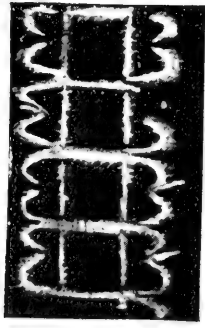


FIG. 8.

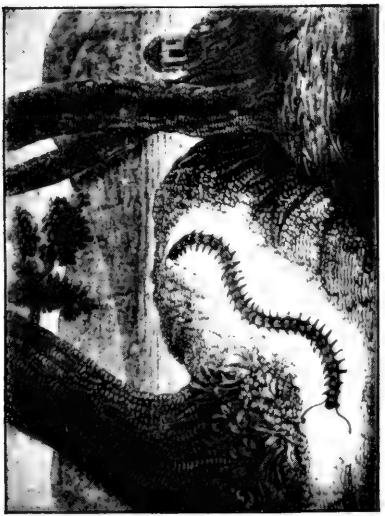
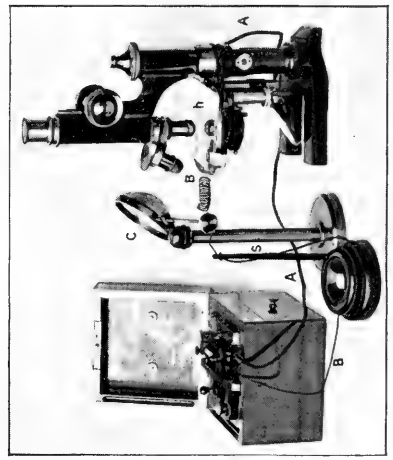


FIG. 11.

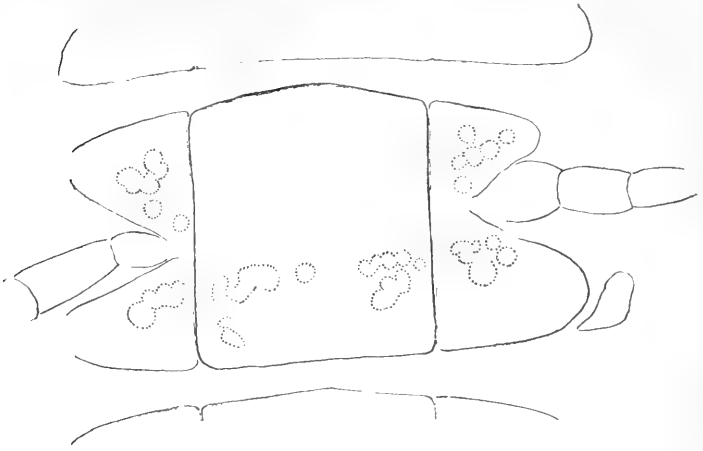


FIG. 12.

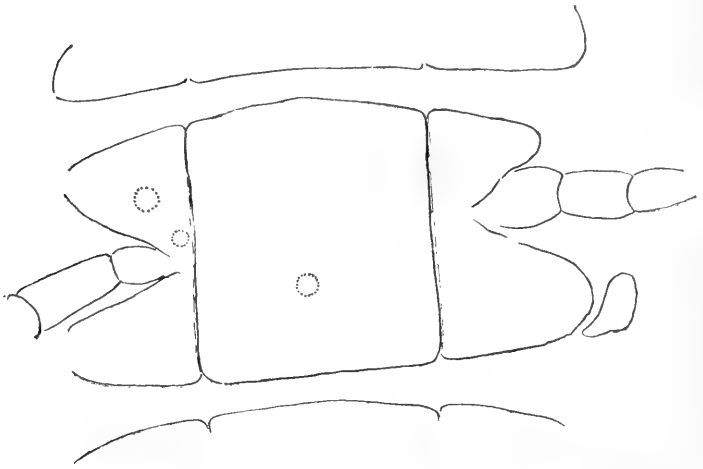
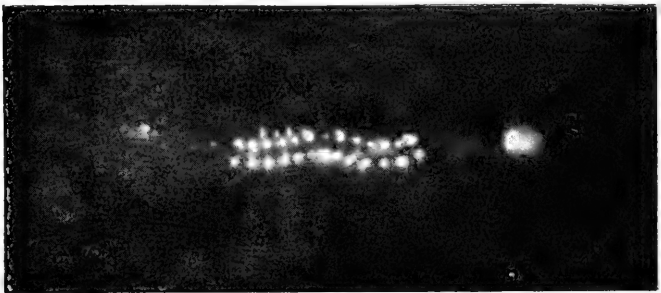
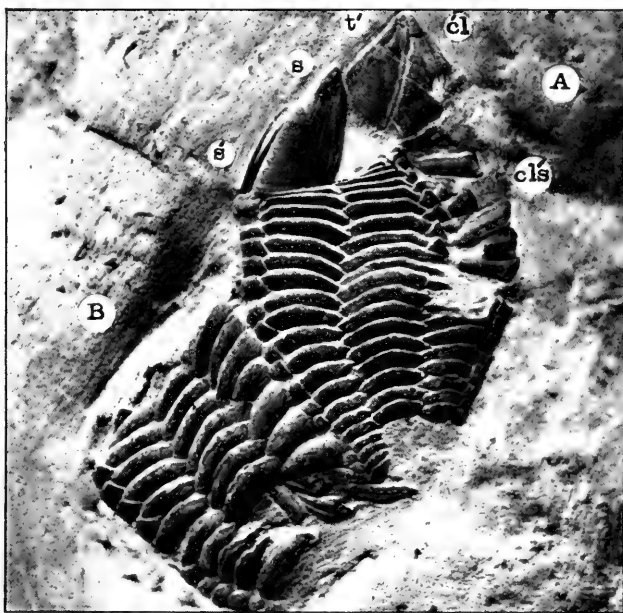


FIG. 13.



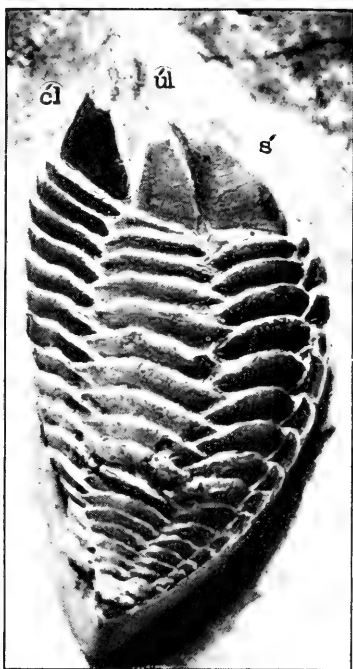




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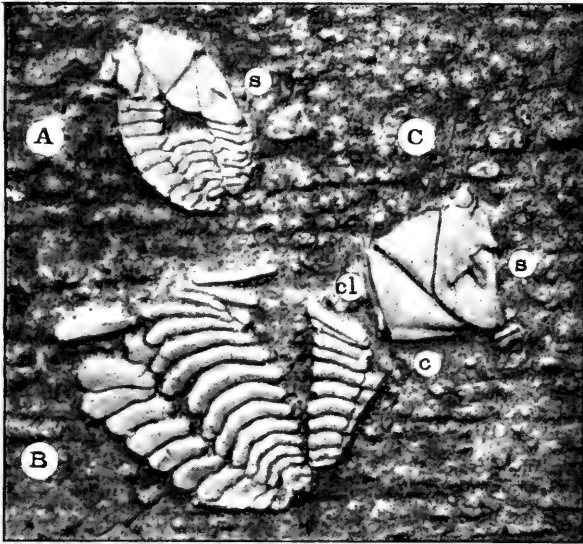


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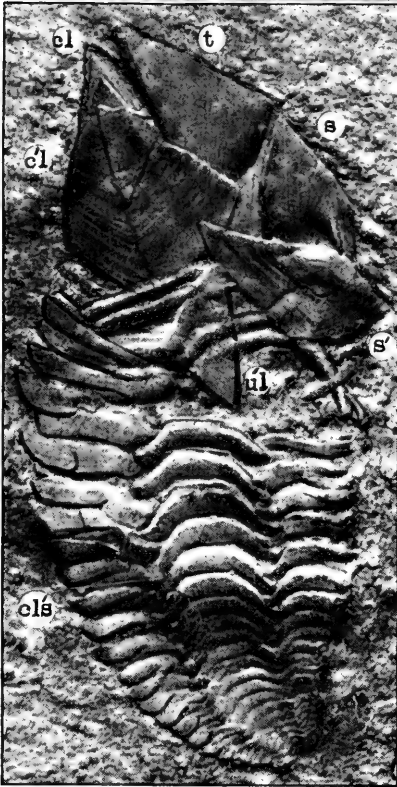
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STRAMENTUM PULCHELLUM

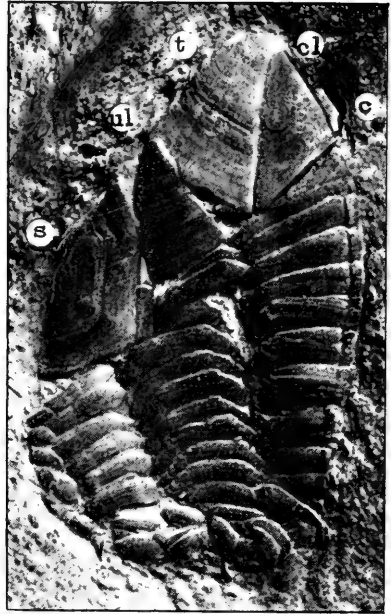
G. B. Sowerby, Junr., sp.



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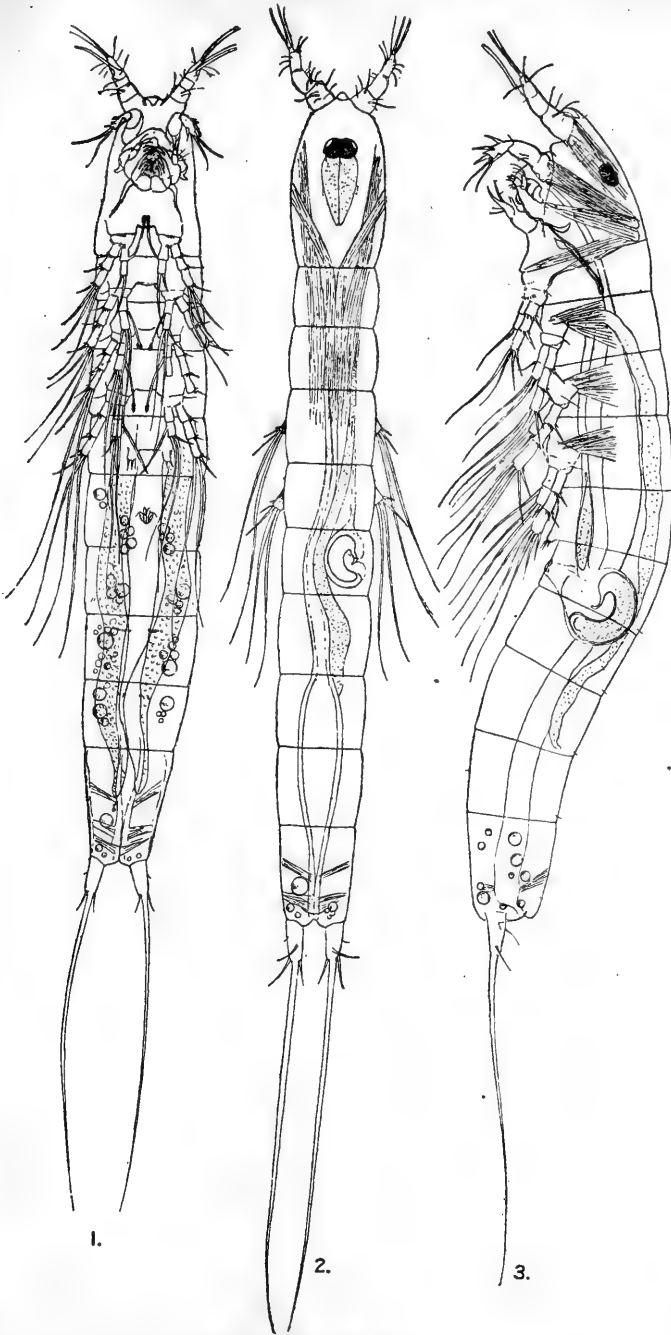


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STRAMENTUM HAWORTHII

S. W. Williston, sp.



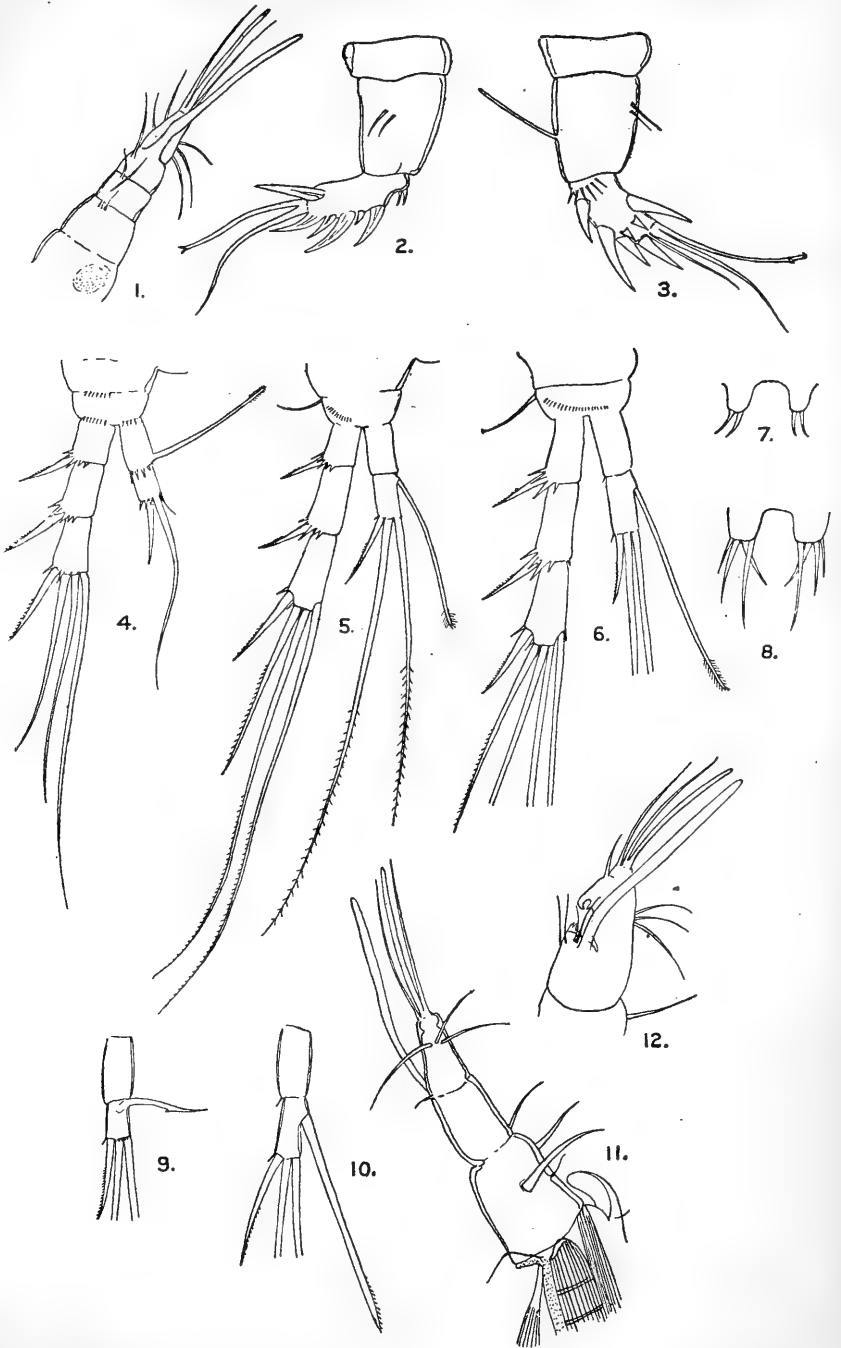
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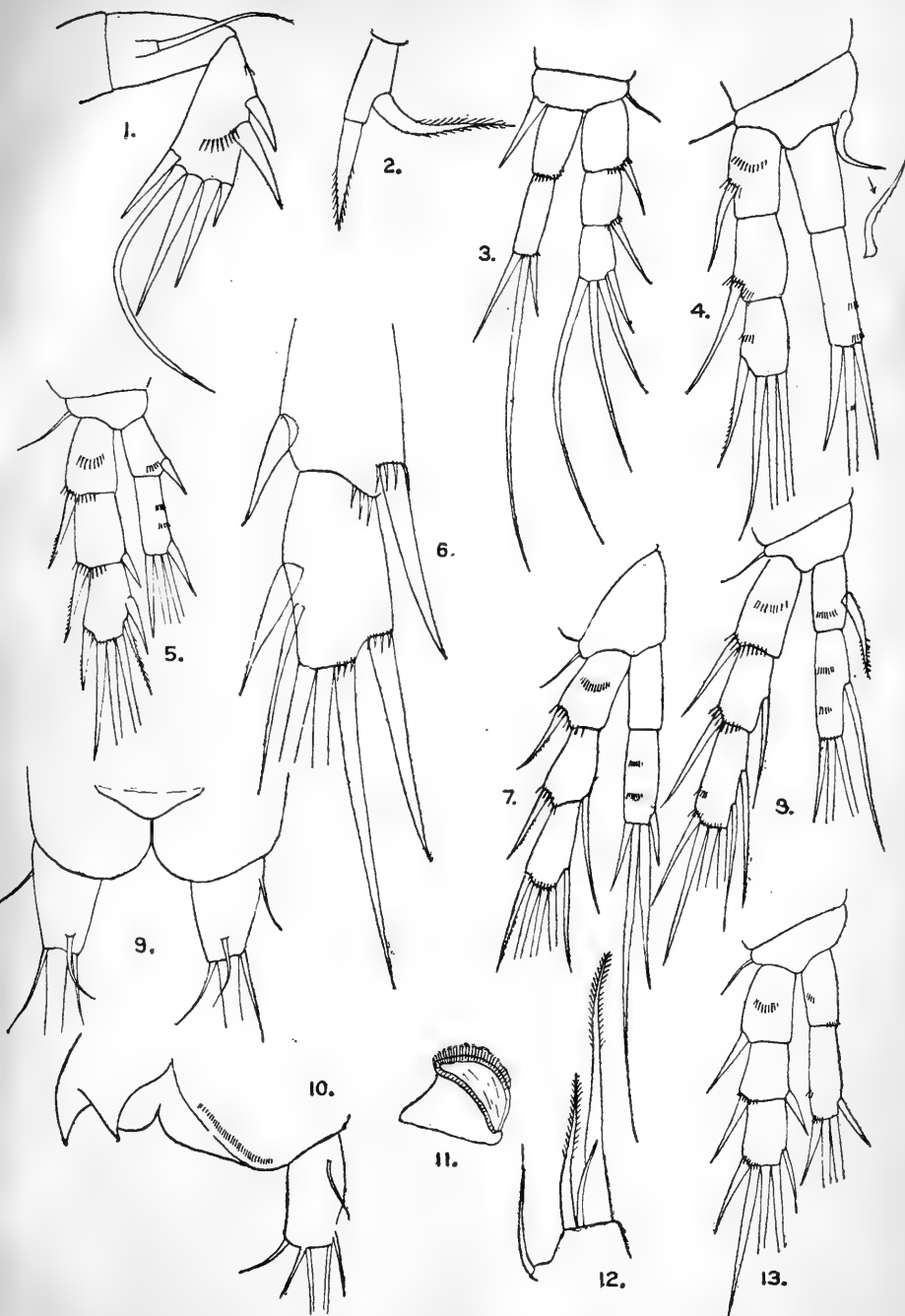
HorsIELla brevicornis (Van Douwe).



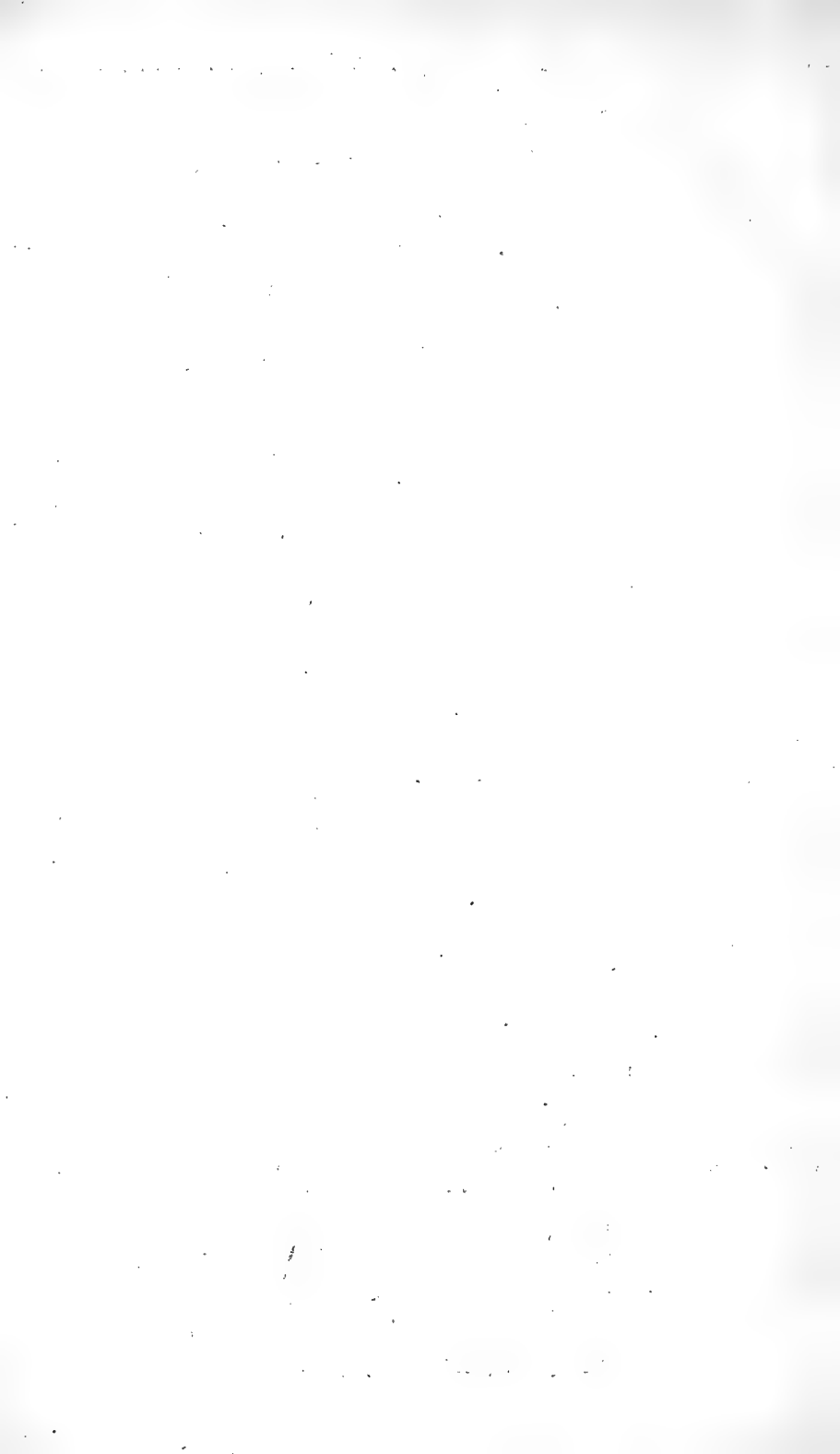


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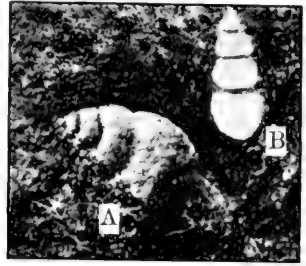


D'Arcythompsonia scotti, sp. n.

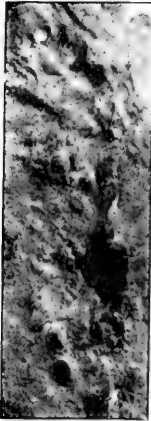




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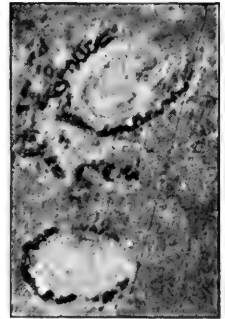
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6 x 5



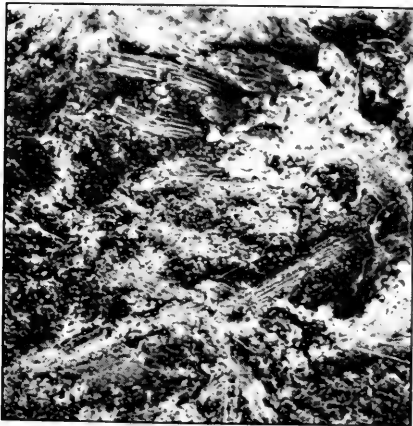
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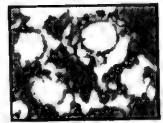
9 x 20



7 x 8

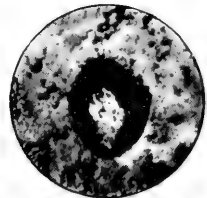


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8 x 10

4 x 7



5 x 7

R. D. Newton, direx.

GASTROPOD AND CHAROPHYTE

Remains in a Chalcedonised rock from Central South Africa.



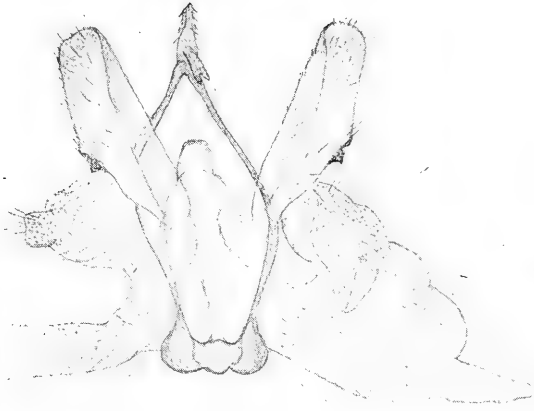


Fig. 1.



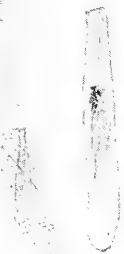
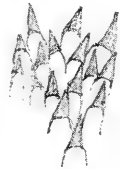
Fig. 2.



Fig. 3.



Fig. 4.



1. *A. exacta.* 2. *A. mesogona.* 3. *A. sabulifera.* 4. *A. involuta.*



Fig. 5.



Fig. 6.



Fig. 7.

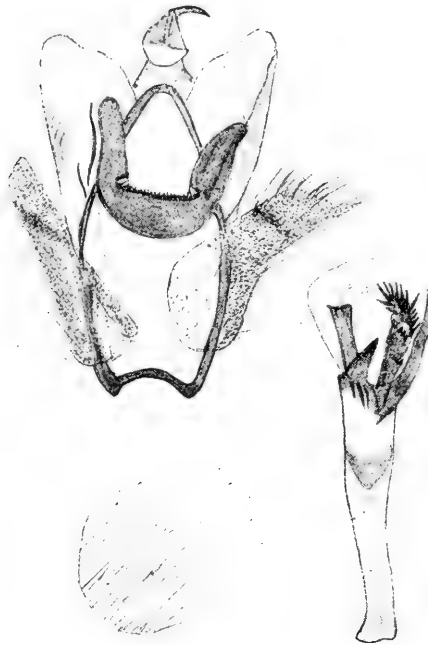


Fig. 8.

5. *A. dona.*

6. *A. brima;*

7. *A. fulvida.*

8. *A. busana.*

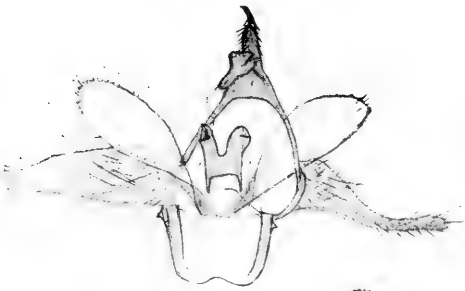


Fig. 9.



Fig. 10.

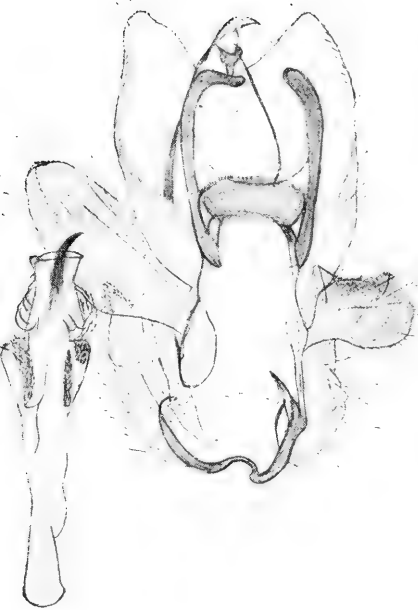


Fig. 11.

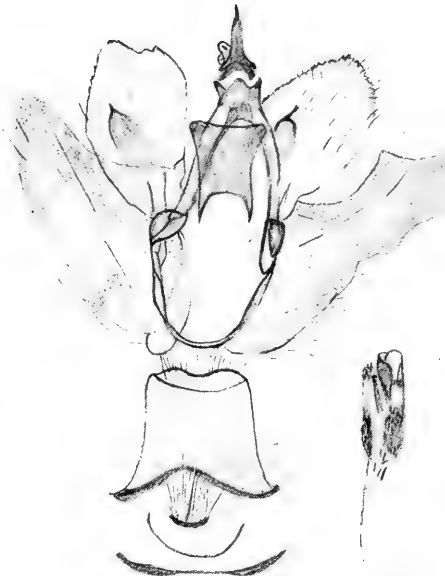


Fig. 12.





Fig. 13.

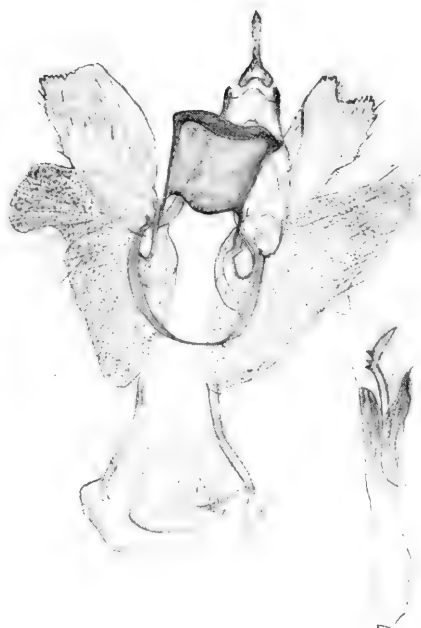


Fig 14.

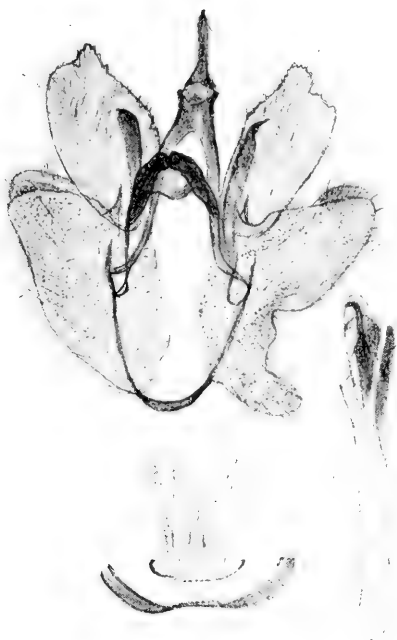
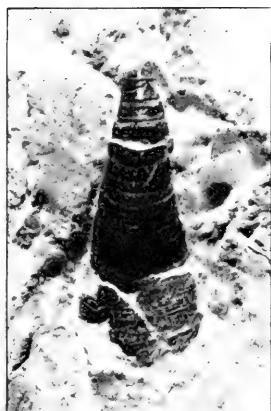


Fig. 15

13. *A. albitibia.*

14. *A. commoda.*

15. *A. metaxantha.*



2



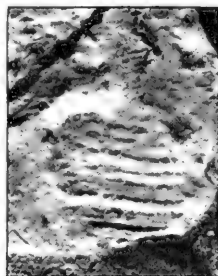
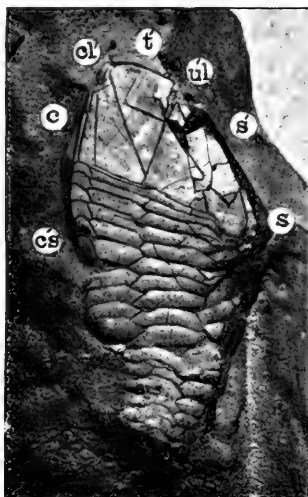
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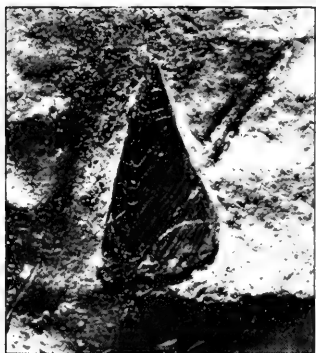
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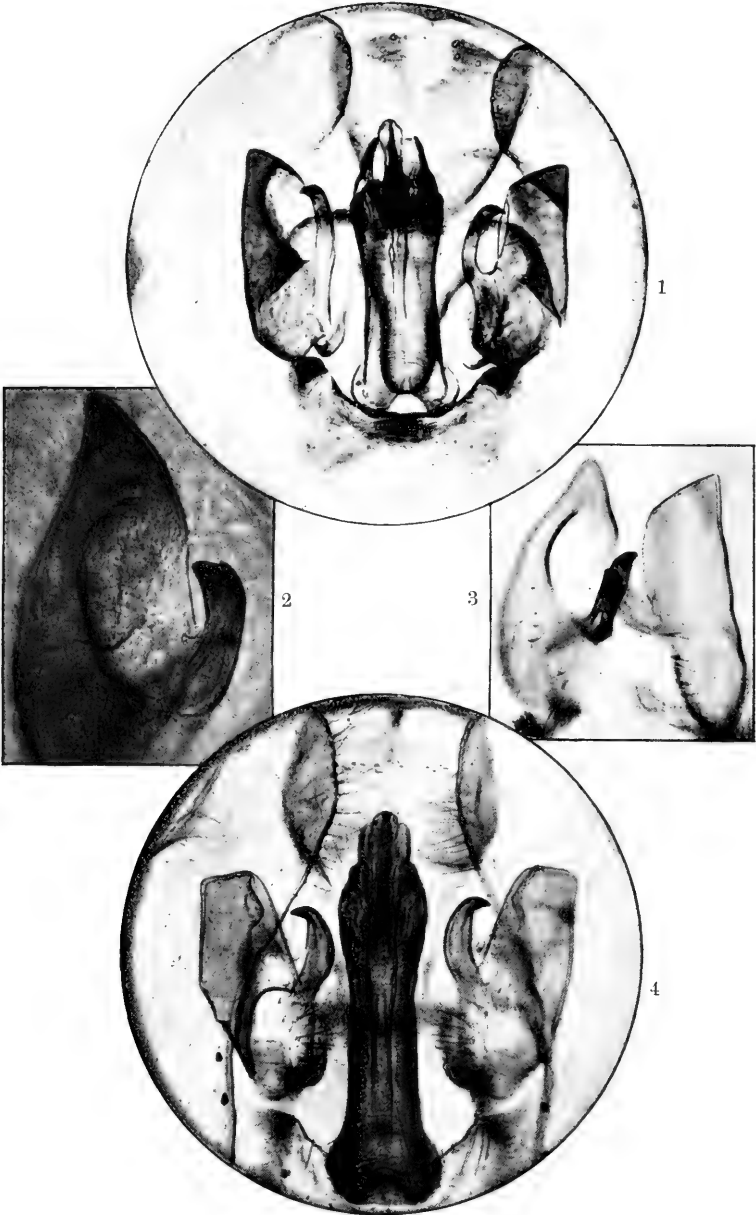


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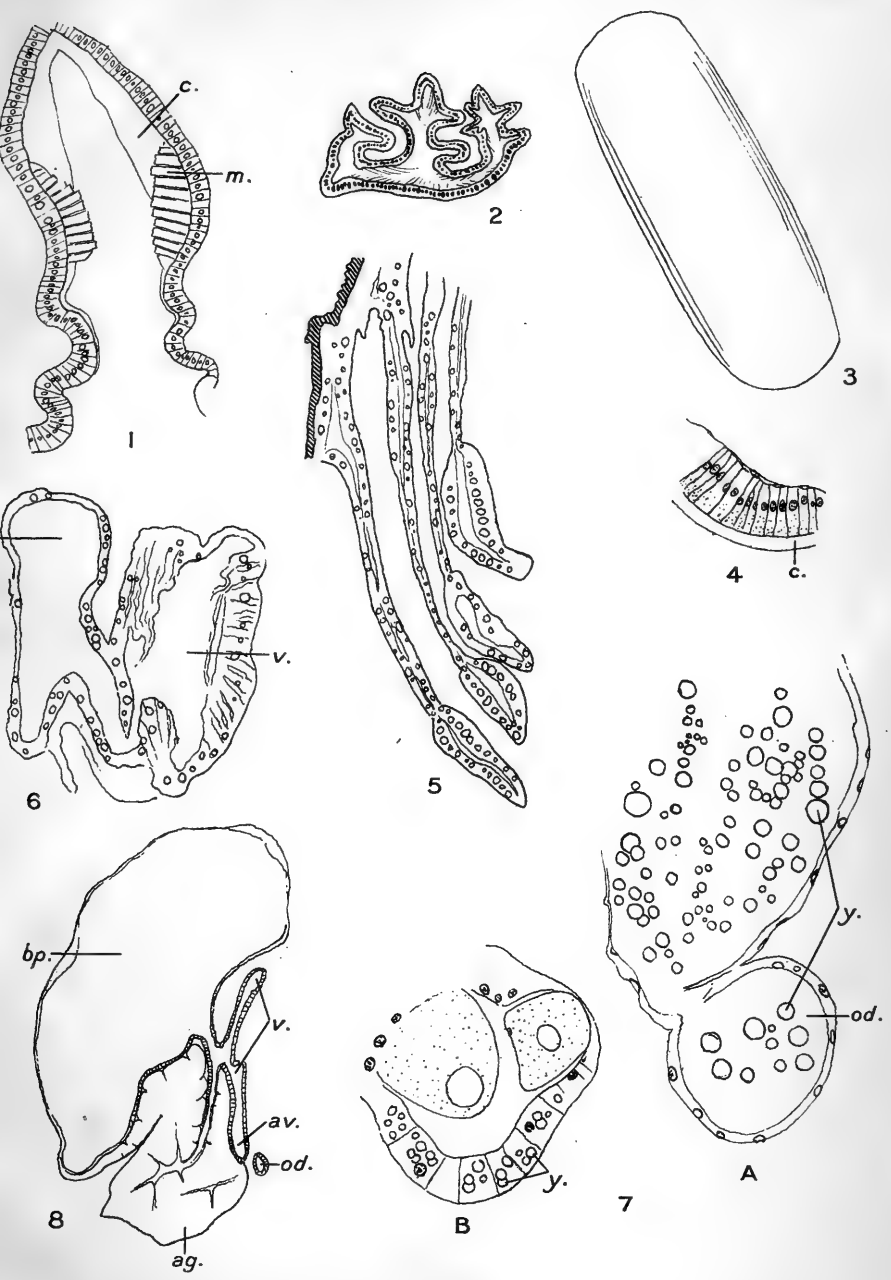
J. H. Leonard, photo.

Fig. 1. STRAMENTUM.

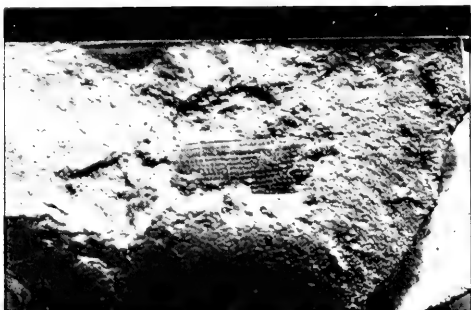
Figs. 2-8. SCILLÆLEPAS.



Genitalia of *CROCOTHEMIS*.



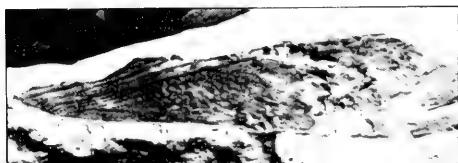




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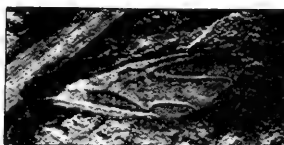
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