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N.B.—An asterisk (*) preceding a line denotes a new variety or subspecies; a dagger (†) indicates a new species; a double dagger (‡), a new genus or subgenus: synonyms are printed in italics.

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I. ON THE PSEUDOSCORPIONS OF THE INDIAN MUSEUM, CALCUTTA.

By EDV. ELLINGSEN, *Gräsvig, Fredriksstad.*

Our knowledge of the Pseudoscorpions of the western parts of the British Indian Empire was hitherto very limited; it was therefore of great interest to me to examine the collection belonging to the Indian Museum, Calcutta, and I take the opportunity here to thank the authorities of this Museum for the liberality with which this group of the collections has been placed at my disposal.

It will perhaps be of some interest to give a list of the species of Pseudoscorpions already known from the Indian Empire. They are as follows :—

1. *Chelifer indicus*, With. Madras.
2. ,, *javanus*, Thorell. Burma.
3. ,, *navigator*, With. Burma.
4. ,, *orites*, Thorell. Burma; Madras.
5. ,, *plebejus*, With. Burma; Ceylon.
6. ,, *rotundus*, With. Nicobars.
7. ,, *vermiformis*, With. Nicobars
8. ,, *birmanicus*, Thorell. Burma.
9. ,, *concavus*, With. Nicobars.
10. ,, *Galatheae*, With. Nicobars.
11. ,, *nicobarensis*, With. Nicobars.
12. ,, *modestus*, With. Nicobars.
13. ,, *Murrayi*, Pocock. Nicobars; Burma
14. ,, *sumatranus*, Thorell. Burma.
15. ,, *bidens*, Stecker. India.
16. ,, *bisulcus*, Thorell. Burma.
17. ,, *borneoensis*, Ellingsen. Burma.
18. ,, *depressus* (Koch) Hansen. ?
19. ,, *Hansenii*, Thorell. Burma.
20. ,, *Helferi*, Stecker. India.
21. *Pseudochiridium claviger*, Thorell. Burma.
22. ,, *Thorellii*, With. Nicobars.
23. *Olpium biaroliatum*, Tömösváry. India orientalis.
24. ,, *birmanicum*, With. Burma.
25. *Microcreagris birmanica*, Ellingsen. Burma.
26. *Obisium longicolle*, Frauenfeld. Nicobars.
27. *Megathis desiderata*, Stecker. India orientalis.
28. ,, *Kochii*, Stecker. India orientalis.

Some of these species are very doubtful, such as No. 15, 20, 26, 27 and 28.

No. 18, *Chelifer depressus* (Koch) Hansen, was really not found in India but in a cargo from India, but about this species see further below.

As a result of the examination of the collection from the Indian Museum, I am able to give, as a continuation, the following list:—

Chelifer indicus, With. India.
,, *javanus*, Thorell. India; Ceylon.
,, *navigator*, With. Andamans; India; Ceylon.
,, *orites*, Thorell. India; Ceylon.
,, *plebejus*, With. India.
29. ,, *nodosus*, Schrank. India; Ceylon.
30. ,, *himalayensis*, sp. nov. India.
,, *borneoensis*, Ellingsen. Ceylon.
31. ,, *ceylanicus*, sp. nov. Ceylon.
,, *depressus* (Koch) Hansen. India.
,, *Hansenii*, Thorell. India.
32. ,, *subruber*, E. Simon. India; Ceylon.
33. ,, *superbus*, With. India.
34. *Cheiridium museorum*, Leach. India.
Olpium birmanicum, With. India.
35. ,, *Jacobsoni*, Tullgren. India.
36. ,, *longiventer*, Keyserling. India.
37. *Garypus insularis*, Tullgren. India.
38. *Teaella affinis*, Hirst. India.
39. *Ideobisium* sp. India.

Before treating the species in the collection under consideration, I shall, in connection with these, make some remarks on the *Chelifer birmanicus* group.

There are in the collection a great number of specimens of the *birmanicus*-group; but, remarkably enough, there is not a single specimen with distinct transverse grooves on the cephalothorax; thus not a single specimen could be referred to *Chelifer birmanicus*, Thorell. There are, certainly, one or two specimens of *Ch. javanus* (see further below) which on the cephalothorax have a broad transverse band, irregularly limited in front and behind, with a darker colour than the rest of the surface; but I have considered this only as an accidental irregularity; at all events it does not resemble the usual transverse grooves.

The Indian species of this group, as regards those with no transverse groove on the cephalothorax, are on the whole rather difficult to distinguish from each other, with the exception of *Ch. orites*, which on account of its very short fingers seems to take a rather isolated place, at least among those which I know. There is another species with very short fingers, *Ch. vermiformis*, With, but among the rather numerous specimens in the collection with short fingers I have found none which could be separated from the proper *Ch. orites*. *Ch. plebejus* seems to be a well-distinguished species. All specimens in the collection, belonging to this group, could be referred to species already known.

Chelifer indicus, With.

India. Calcutta: leg. Sew Rutton, 1 ♂, M. No.[1] $\frac{1387}{17}$; Calcutta: Museum premises, 1 ♀, 5-vi-1911, leg. S. W. Kemp, M. No. $\frac{1385}{17}$.—Satara district: Helvak, Koyna Valley, *ca.* 2000 ft., iv-1912, 2 ♂, 1 ♀, leg. F. H. Gravely, M. No. $\frac{1576}{17}$.

The specimen collected by Sew Rutton is not quite developed on account of its having recently cast its skin, but belongs certainly to this species. The species seems to be distinguishable from the nearly related Indian species by the proportionally slender palpal femur (2·5 : 1). The palps are a little more granulate than recorded by With (for ♀). The specimens from Helvak have the palps somewhat less granulate; the granulation is present mainly on the inner and the upper side, partly also on the hand.

Chelifer javanus, Thorell.

India. Kobo, 400 ft., 2 ♂, 1 ♀, under logs, 1911, leg. S. W. Kemp, M. No. $\frac{1410}{17}$.—Ratnagiri district: Harnai, 4 ♂, 8-v-1912, M. No. $\frac{1582}{17}$.

Ceylon: Pattipola, 6 ♂, under bark of trees, 2-vii-1910, M. No. $\frac{1401}{17}$.

Locality unknown, 2 ♂, M. No. $\frac{1391}{17}$.

The specimens numbered $\frac{1401}{17}$ are certainly fully typical, beautiful, dark coloured ones of this species, the relationship with *Ch. plebejus* is evident, but the palps are strongly granulate on the anterior side and partly also on the upper and lower side. The protuberance of the upper side of trochanter is distinct, but rather low.

As regards the specimens from Kobo and from Harnai, see my introductory remarks on the *birmanicus*-group about the transverse band of the cephalothorax which I regarded only as an irregularity or an accidental deformation of the skin.

Chelifer navigator, With.

India. Calcutta, 2 ♂, taken in the Museum buildings from a nest of *Cypselus affinis*, 15-vi-1909, M. No. $\frac{1571}{17}$.—N. Bengal: Siripur, Saran, 3 ♂, M. No. $\frac{1586}{17}$.—South India: Oorgaum, *ca.* 2500 ft., 1 ♂, 20-x-1910, M. No. $\frac{1574}{17}$; Marikuppam, *ca.* 2500 ft., 2 ♂, 19-x-1910, M. No. $\frac{1407}{17}$.

Ceylon: Peradeniya, 5 ♂, under bark of jack-fruit tree, 7-v-1910, M. No. $\frac{1397}{17}$.

Andamans: Ross I., 2 ♀, 29-iii-1911, collected by C. Paiva, M. No. $\frac{1408}{17}$.

This species seems to vary to a degree as regards the granulation of the palps; the specimens from the Andamans, from Marikuppam, and from Siripur have the anterior side of the palps somewhat granulate, which according to With also may be the case. The species seems to be well characterized by the strong, triangular protuberance of the posterior side of the palpal trochanter,

[1] M. No.=Museum No.

by the *high* femur, the long tibial stalk and the proportionally very slender hand.

Chelifer orites, Thorell.

India. Calcutta, 2 ♀, taken in the Museum buildings from a nest of *Cypselus affinis,* 15-vi-1909 (together with *Ch. navigator,* With), M. No. $\frac{1386}{17}$; 1 ♀ jun., 6-vi-1910 (badly preserved, but probably belonging to this species), leg. Nowbut, M. No. $\frac{1388}{17}$.—N. Bengal: Siripur, Saran, 3 ♀, M. No. $\frac{1395}{17}$.—South India: Marikuppam, *ca.* 1500 ft., 1 ♀, 19-x-1910, M. No. $\frac{1570}{17}$; Anamalais, Paralai Estate, 3800 ft., 1 ♀, in rotten logs, 28-i-1912, M. No. $\frac{1404}{17}$; Oorgaum, 1 ♀, M. No. $\frac{1406}{17}$.

Ceylon: Anuradhapura, 1 ♀ jun, x-1911, M. No. $\frac{1402}{17}$; Peradeniya, 2 ♂, 1 ♀, M. No. $\frac{1398}{17}$.

This species, easily recognizable from the other Indian species of this group (excl. *Ch. vermiformis*, With) by its very short fingers, seems, according to the localities above mentioned, to be widely distributed on the Indian continent as well as in Ceylon. It is also the largest Indian species of those belonging to the *birmanicus* group. A species so widely distributed must naturally vary more or less in some characters; this variation is especially pronounced as regards the granulation of the palps.

Chelifer plebejus, With.

India. Darjiling District: Siliguri (base of E. Himalayas), 3 ♂, 12 ♀, 2 jun., on bark of *Ficus religiosa*, 28-iii-1910, M. No. $\frac{1393}{17}$.—Orissa District: Puri 1 jun., i-1908, M. No. $\frac{1403}{17}$.—Travancore: Trivandrum, 1 ♂, 30-xi-1911 (Trivandrum Museum).

Ceylon: Peradeniya, 2 ♂, under loose bark of jack-fruit tree, 7-vi-1910, M. No. $\frac{1572}{17}$.

The specimens from Siliguri are well developed; I have compared them with a specimen from Burma for which I am indebted to Mr. With. The upper side of the palpal trochanter has a small, pointed tubercle, also present in With's specimen. But the exceedingly robust and nearly smooth palps are good characters, as is also the strongly curved form of the hand (including the fingers). The specimen from Puri is very young, but belongs certainly to this species; the palps are nearly smooth, with the exception of some slight granulation on the inner side of femur.

Chelifer nodosus, Schrank.

India. Calcutta, 1 ♀, Museum compound, under bricks, 17-x-1910, M. No. $\frac{1384}{17}$.—Dehra Dun (base of W. Himalayas), 1 ♂, on a wall of the dining-room of the Forest School, M. No. $\frac{1575}{17}$.

Ceylon: Peradeniya, 1 ♀, 4-viii-1910, M. No. $\frac{1400}{17}$.

There is no doubt that the specimens from Calcutta and from Dehra Dun belong to this species; the whole animal, the galea included, fully resembles German specimens with which they have been compared. The galea, as in *Ch. scorpioides,* is somewhat stag-horn like; but the pointed hairs distinguish it completely from the latter species. The animal is certainly imported from Europe where the species is often found as a pseudo-parasite on flies.

As to the Ceylon specimen, it may be noted that the outer side of the palpal trochanter has the protuberance not so well developed as is the case in European specimens and in the two Indian specimens just mentioned, but it belongs to the same species, although it is not reported to be taken in a house.

Chelifer himalayensis, sp. nov.

♂. No eyes, nor ocular spots.

Colour.—The whole animal of a deep reddish brown colour.

Cephalothorax a little shorter than wide behind, strongly narrowing forwards from the posterior corner, with convex lateral margins; the slightly convex front margin is only $\frac{1}{3}$ of the length of the posterior margin. Two very strong and deep transverse grooves, especially deep in the central part; the anterior groove about in the middle and straight, the posterior one at about the same distance from the anterior groove and the back margin, in the central part angularly curved backwards. The surface somewhat glossy, slightly but distinctly and regularly granulate. The hairs, most of them crowded along the front and the lateral margins, are truncate.

Abdomen very robust and broad, somewhat broader than long, but very much contracted. The tergites are certainly divided by a longitudinal line, but this line is very indistinct, on account of the contracted abdomen; for the same reason the anterior sclerites are also placed somewhat angularly to each other (which is often the case in species belonging to the subgenus *Chernes*); the surface is glossy and distinctly shagreened; on each sclerite there is in the middle a darker spot; the hairs, situated along the posterior and the lateral margins, are partly truncate and partly (on the posterior somites) nearly pointed; on the last somite there are some longer tactile hairs. The sternites are still more indistinctly divided longitudinally, glossy and minutely shagreened, with numerous, long and pointed hairs along the posterior margins.

Palps somewhat longer than the body[1], very robust. Coxa glossy and slightly granulate; the other palpal joints glossy and distinctly granulate, including the fingers. The clothing of hairs very dense, the hairs rather long, pointed, but distinctly dentate; the hairs of the fingers nearly simple. Trochanter subglobose, in front nearly semicircular, behind with a rounded protuberance, above with a very strong and rounded one. Femur with a distinct and strong stalk, very robust (about twice as long as wide), in front and especially behind strongly widened from the stalk, the front margin slightly convex in the basal half and slightly concave in the distal half, the posterior side slightly convex; femur in all of rather equal width throughout and truncate at the tip (the femur as well as the tibia resembles very much With's figure of

[1] But see note above regarding the contraction of the abdomen.

Ch. australiensis). Tibia a little shorter and somewhat broader than femur, with very strong stalk, on the posterior side moderately and regularly convex, in front somewhat more convex, or rather somewhat swollen. Hand with a distinct stalk, and the base somewhat obliquely truncate with the inner corner broader and more rounded than the exterior one; the hand is about as long as, but considerably ($1\frac{1}{3}$ times) wider than tibia, and about as high as broad, the inner side strongly convex (nearly semicircular), the outer side much less so, on both sides passing gradually into the fingers. Fingers robust, strongly curved and a little longer than the hand; the fixed finger exteriorly with 9-10 small accessory teeth in the distal half; on the inner side both fingers have 2 to 3 small accessory teeth near the tip; the fingers do not gape at all.

Mandibles: Galea with robust trunk and deeply tripartite tip, and along one side of the trunk provided with 7 long filiform teeth, increasing in length towards the base.

Legs minutely granulate with slightly clavate and dentate hairs. The trochantin of the two posterior pairs of legs perpendicularly articulated. Coxa IV very robust, much broader than trochanter, along the posterior margin provided with dense rows of long hairs. The tibia of all legs considerably longer than the tarsus. Claws simple.

The species belongs certainly to the *cimicoides*-group, as the sexual area as well as the whole appearance seems to indicate; the animal reminds one very much of a large *Chelifer cimicoides*.

Length 3·6 mm., length of abdomen 2·25 mm., width 2·30 mm.

Measurements.—Cephalothorax: long. 1·36; lat. 1·49. Femur: long. 1·07; lat. 0·52. Tibia: long. 0·93; lat. 0·57. Hand: long. 1·00· lat. 0·76. Fingers: long. 1·07 mm.

Habitat.—India: W. Himalayas, Mussoorie, 7000 ft., 1 ♂, M. No. $\frac{1587}{17}$.

The only species among the Asiatic-Australian forms, with which the new species has a nearer relation, is *Chelifer australiensis*, With; yet there are some essential characters in which the two species differ from each other, so they certainly cannot be united. Contrary to the characters mentioned above in the description of the new species, With's species (from Queensland) is distinguished as follows: "Two *rather distinct* grooves" on cephalothorax; "traces of lateral projections or keels on the tergites"; galea has only some shorter teeth at the tip; "the palps are indistinctly granular"; the protuberances of the trochanter have another shape; the hand "higher than broad"; the fingers also interiorly with "accessory teeth" near the middle. The differential characters are not great, but taken together they are certainly sufficient to distinguish the two species.

Chelifer borneoensis, Ellingsen.

Ceylon: Peradeniya, 1 ♂, under loose bark of jack-fruit tree, 21-vi-1910, M. No. $\frac{1399}{17}$.

The specimen is somewhat smaller in size than the type from Borneo, but is apparently a fully mature male. The cephalothorax is completely smooth and there are no traces of teeth on the claws. These seem to be the only two characters of importance in which males of this species differ from those of *Chelifer Mortensenii*, With.

Chelifer ceylanicus, sp. nov.

♂. No eyes, but ocular spots present.

Colour.—Cephalothorax, tergites and palps palish brown, fingers somewhat darker; the other parts of the animal whitish.

Cephalothorax a little longer than wide in the middle, where it is broadest; behind the anterior groove nearly parallel-sided, in front of it roundly narrowing forwards, the front margin slightly convex. A deep transverse groove about in the middle; before reaching the lateral margin it curves forwards, and the cephalothorax in this place is thus somewhat depressed and widened, attaining here, as mentioned, its greatest width. The posterior groove is scarcely visible, in some specimens indicated. The surface minutely, but distinctly and regularly granulate and only a little glossy. The hairs short, thick and slightly clavate.

Abdomen: The tergites divided longitudinally by a fine line, except the last one. The surface nearly glossless and minutely shagreened; the hairs somewhat longer than those of cephalothorax and slightly clavate; on the last somite some long, tactile hairs. The sternites divided like the tergites, glossy and slightly shagreened, with long, pointed hairs; on six sternites but the last one (4-9) provided with large, broad and laterally narrowing areas with dense bristles.

Palps somewhat longer than the body (with abdomen extended). Coxa smooth and glossy. Trochanter, femur and tibia nearly glossless and minutely, but distinctly granulate, hand very glossy and minutely granulate, fingers smooth. The hairs of trochanter and of the inner side of femur and part of the tibia slightly clavate, those of the outer side of the same joints and those of the hand more or less pointed; the clothing of the hand very dense; the hairs of the fingers dense and pointed with longer tactile ones. Trochanter pedicillate and proportionally slender, nearly twice as long as wide, the inner side somewhat convex, the outer side with a low triangular protuberance near the base, the upper side with a large, much rounded protuberance Femur slender, nearly four times as long as wide, with a distinct stalk, the inner side nearly straight except for a short concave portion near the tip, behind suddenly widened from the stalk, the hind margin slightly convex, rounded at the tip; femur in all rather parallel-sided, yet a little narrower at the tip than at the base. Tibia a little longer than femur, long and slender, about 4 times as long as wide, with a short and curved stalk, somewhat club shaped, *i.e.* gradually increasing in width from base to tip, the hind margin nearly straight only a little convex near the tip, the inner side slightly and evenly convex throughout. Hand broader than tibia (*ca.* 1·4 times), with a distinct stalk, and regularly rounded base, long and narrow ($2\frac{1}{2}$ times as long as wide), rather parallel-sided, the inner side nearly straight, the outer side slightly convex, rather abruptly passing into the fingers. Fingers robust, slightly curved, much shorter than the hand (3 : 5).

Mandibles: Galea minute, with some very small teeth at the tip.

Legs granulate on the outer side, on the inner side as well as on trochanter and coxa smooth and glossy. The hairs partly truncate, partly pointed. Claws simple.

The species belongs to the *subruber*-group.

♀. The female resembles the male in all essential characters, except the palps which are somewhat more robust, the femur being $3\frac{1}{4}$ times as long as wide, the tibia $2\frac{1}{2}$ times and the hand $1\frac{3}{4}$ times as long as broad, but the length of the fingers proportionally to that of the hand is about the same. The shape of the palpal joints is also somewhat different: the femur is distinctly curved (concave) on the inner side and somewhat more convex behind (than in the ♂), the tibia is nearly regularly convex on both sides (and therefore not so distinctly club-shaped), which is also the case as regards the hand. The galea is considerably more robust and with larger teeth at the tip.

♂. Length 2·65 mm.

Measurements.—Cephalothorax: long. 0·72; lat. 0·64. Trochanter: long. 0·36; lat. 0·20. Femur: long. 0·79; lat. 0·21. Tibia: long. 0·83; lat. 0·20. Hand: long. 0·72; lat. 0·28. Fingers: long. 0·43 mm.

♀. Length 2·93 mm.

Measurements.—Cephalothorax: long. 0·64; lat. 0·50. Trochanter: long. 0·28; lat. 0·17. Femur: long. 0·60; lat. 0·18. Tibia: long. 0·54; lat. 0·21. Hand: long. 0·57; lat. 0·33. Fingers: long. 0·36 mm.

Habitat.—Ceylon: Peradeniya, 10 ♂, 1 ♀, June, 1910, M. No. $\frac{1396}{17}$.

On examination of these specimens I thought at first that I had before me *Ch. sumatranus*, Thorell, but certain essential differences hindered their union, in spite of the resemblance, especially in the shape of the palps. Thorell says about his species, that the cephalothorax is "non granulosus," only "subtillisime coriaceus"; the new species has the cephalothorax distinctly granulate. Thorell's species is further said to have "sulcis duobus transversis," and the palps "laeves, nitidi," which does not agree with the Ceylon specimens.

The new species is related to certain species of the same group from Africa, such as *Ch. angulatus*, Ellingsen, with which it has, for instance, the lack of eyes in common, but the measurements of the palps are different.

Chelifer depressus (C. L. Koch) Hansen.

India. Calcutta, 1 ♂ jun., M. No. $\frac{1383}{17}$.

The specimen is very young, but the sex is certain on account of the coxae of the IV pair of legs, with the coxal sac, and of the keels of the sclerites which are very well developed on the 5 first tergites; the cephalothorax, too, has its postero-lateral spine. The galea is very small with some fine teeth in the distal third. The cephalothorax is slightly granulate, but glossy. The palps are very slender; the femur about four times as long as wide, the stalk included; for this as well as for other reasons the specimen cannot well belong to *Ch. superbus*, With, with which it is however very closely related. The palpal fingers gape very much, both being distinctly "concave" (and not as in *Ch. superbus*, one of them "obtuse-angled") and in the concavity quite destitute of teeth; the straight concurrent part of the extremity is not quite so long as shown in With's figure. It is, however, with some hesitation that I have referred the specimen from Calcutta to the above species, partly because it is so young, partly because *Ch. depressus* has not yet been captured in India, but only in Denmark in a cargo of rice from India. However, there is reason to believe that the species is an Indian one.

Chelifer Hansenii, Thorell.

India. Satara Distr: Hills near Medha, Yenna valley, *ca.* 2200 ft., 1 ♂, iv-1912, collected by F. H. Gravely, M. No. $\frac{1578}{17}$.

Thorell, in 1889, described a Pseudoscorpion under the above name, from Bhamo in Burma. He remarks that the single specimen he had for examination seemed not to be adult. The sex is not mentioned, but as he says that the galea is "sat fortis," it may perhaps have been a young female.

I have identified the above ♂ from Medha with Thorell's species, as his long and good description agrees well, taking into consideration that his specimen was young and perhaps a ♀, while the male from Medha is adult.

I shall state a little more about the species (if my identification be right) and about the differences from Thorell's description.

The cephalothorax and palps are of a very dark brown colour, the sclerites of the tergites light brown with a darker central spot.

The sternites 7-9 (the last sternite regarded as the eleventh) have in the middle of the broad, light, longitudinal band, a round area, limited on each side by a dark, irregularly crescentic band (interrupted in front and behind, and thus not being a circular band); the round area is provided with bristles, pointing obliquely towards the median line. This quite corresponds with the much larger bristle-covered areas in most species of the *subruber*-group, to which the species also belongs.

The galea is small, with no traces of teeth.

The hand of the palps, as Thorell states, is glossy, but minutely shagreened; as regards the rest, Thorell's description as to granulation and hairs agrees well, the hairs being on the inner side of trochanter and femur slightly clavate, the other hairs only truncate, or on the fingers simple. The hand is only $1\frac{1}{3}$ times as broad as the tibia (Thorell says *ca.* $1\frac{1}{2}$ times). Differing most from Thorell's description are the shape and the dimensions of the fermur, but this may perhaps depend on the age and the sex (see above). The femur of the male (from Medha Hills) has a slender stalk and is (seen from above) not a little wider at the base than at the extremity, thus narrowing distally (a rare case in the Chelifers); laterally seen the femur is abruptly, nearly perpendicularly widened from the stalk and very high at the base, but with the upper surface regularly slanting towards the tip. The length of the femur is about $2\frac{1}{3}$ times the width at the base; Thorell says of his specimen, that this proportion is $3\frac{1}{2}$.

The length of the specimen from the hills near Medha (with abdomen extended) is 3 mm.

The other measurements are as follows:—Cephalothorax: long. 0·93; lat. 0·57. Femur: long. 0·60; lat. (at the base) 0·25. Tibia: long. 0·57; lat. 0·25. Hand: long. 0 57; lat. 0·34. Fingers: long. 0·43 mm.

Chelifer subruber, E. Simon.

India. Dehra Dun (base of W. Himalayas), 1 ♀, on the wall of the dining room in the Forest School, M. No. $\frac{1416}{17}$.

Ceylon: Peradeniya, 1 jun., under loose bark of jack-fruit tree, 7-v-1910, M. No. $\frac{1573}{17}$.

The species is a cosmopolitan one. The specimen from Ceylon is rather young and badly preserved, but it may belong to this species.

Chelifer superbus, With.

India. Travancore: Maddathoray (W. base of W. Ghats), 1 ♀, on a monkey (*Macacus sinicus*), 17-xi-1908, M. No. $\frac{1411}{17}$.—W. Dun (base of W. Himalayas), 2 ♀, 2 jun., under bark of dead Sal (*Shorea robusta*), 19-xi-1910, M. No. $\frac{1418}{17}$.—Kobo, 400 ft., 1 ♀, under logs, collected by S. W. Kemp (Abor Expedition), M. No. $\frac{1409}{17}$.

There were also in the collection 4 ♀ from an unknown locality, M. No. $\frac{1412}{17}$, with the notice on the label, that they were taken on a Cerambycid ("infesting *Batocera*").

All the specimens had the character in common, that the fingers were nearly as long as the hand, and that at least some of the claws of the legs had teeth, but there is no doubt that such teeth may be absent. In connexion with the specimens numbered $\frac{1412}{17}$, it may be of interest to note that With's type specimens also were taken on a *Batocera*, from Celebes.

Cheiridium museorum, Leach.

India. Calcutta, 1 ♀, taken in the Museum buildings from a nest of *Cypselus affinis*, 27-vii-1909, M. No. $\frac{1390}{17}$.—Dehra Dun (base of W. Himalayas), 1 ♂, on the wall of a bathroom in Dehra Dun College, M. No. $\frac{1417}{17}$.

There is no doubt that this species, of common occurrence in Europe in museums and other buildings, has been imported into India.

Olpium birmanicum, With.

Syn.: ? *Olpium biaroliatum*, Tömösváry.
? *Olpium Ortonedae*, Ellingsen.

India. Bombay, 1 ♂, June, 1911, M. No. $\frac{1581}{17}$; Bombay: Girgaum, 1 jun. (♀?), 4-viii-1912, M. No. $\frac{1585}{17}$.

Assam. Kannyhati, Shamshernager, Sylhet, 2 ♂, collected by G. Mackrell, June 17, 1911, M. No. $\frac{1394}{17}$. The label in the tube was inscribed: "Caught in box of old books, etc., Kannyhati bungalow, feeding upon the mites which were in abundance round some dead Coleoptera."

These four Indian specimens (3 ♂ and 1 immature) certainly belong to With's species. The noteworthy feature as With points out is "a broad transverse stripe" on the cephalothorax. This "transverse stripe" is absolutely invisible as a transverse *groove*, and is scarcely to be seen when the animal is in a dry state; in alcohol on the contrary it is more or less visible as an inner division, but also in that case nearly invisible in the middle, though more distinct towards the lateral margins. I observed just the same thing in my specimens of *Olpium Ortonedae* (from Ecuador, see my description of this species), and on comparing my specimens from Ecuador with the Indian ones, I can find *no specific differences* between them. Three of the Indian specimens are males; among the specimens from Ecuador there are also females; these have their palps somewhat more robust and their galea a little longer.

The reason that I do not employ the name of *Olpium Ortonedae* for the Indian specimens is because another question arises. Are not both species synonymic with *Olpium biaroliatum*, Tömösváry? With has himself not been without the same sentiment, but finds that Tömösváry's description is "too insufficient for a sure determination." In this he is certainly right, but Tömösváry's description, short as it is, agrees nevertheless remarkably well, and that Tömösváry may possibly have believed he saw another "obsolete" transverse stripe, can easily be understood. I should be inclined to unite the three species, and then Tömösváry's name would have the priority. That I, in spite of this, do not do it, is because With's name for the species is at all events a safe one. Tömösváry's species was from "India orientalis."

To With's description I shall add the following remarks: I will not, like With, say that the palpal femur wholly lacks a stalk, but that it is rather indistinct, and that all tergites may be divided longitudinally, except the last one.

The young specimen from Girgaum agrees in all respects with the adult ones, but is of a paler colour and smaller size, and with the palps not quite so well developed. The stripe of the cephalothorax is no more developed than in the older examples.

As With has not given any measurements of this species, I shall here give some from an excellent specimen (♂) with extended abdomen, from Assam.

Length 2·72 mm.

Measurements.—Cephalothorax: long. 0·72; lat. 0·50. Femur: long. 0·61; lat. 0·16. Tibia: long. 0·43; lat. 0·18. Hand: long. 0·47; lat. 0·27. Fingers: long. 0·53 mm.

There are in the collection of the Indian Museum a number of specimens of a form or rather of two forms, quite different from the preceding species, and nearly allied to the Palæarctic *Olpium pallipes*, Lucas. In a paper on Pseudoscorpions from Formosa I have mentioned a species of *Olpium* from this island, which I referred to *Olpium longiventer*, Keyserling, yet fully attentive to a species, *Olpium Jacobsoni*, described by Tullgren from Java, so that I thought it best to consider the latter as a form of the former. The Indian specimens, just mentioned, have to a certain extent confirmed this opinion, but they prove nevertheless that there is really one form with somewhat more slender palps (*O. longiventer*) and another form with more robust palps (*O. Jacobsoni*), and I have therefore arranged the Indian specimens under each of these species or forms, as follows:—

Olpium longiventer, Keyserling.

India. W. Dun (base of W. Himalayas), Karwapani, 9 specimens, on the newly whitewashed walls of a resthouse, M. No. $\frac{1415}{17}$.

These specimens agree well with Keyserling's description and figures, among other things in the *slender* palps, the femur of which is about four times as long as wide, as Keyserling reports it; the fingers are about as long as the hand; the palps are quite smooth. I and II pairs of legs have the femoral pars basalis a little longer than pars tibialis.

In this as well as in the following species it is to be noticed that the femur of the I pair of legs has the basal part only *a little* longer than the tibial one (not at least $1\frac{1}{2}$ times as long, as With states in his diagnosis of the genus *Olpium*), but there is no doubt that the two species mentioned here, by their whole appearance and their affinity to *Olpium pallipes*, belong to the true *Olpium*. This feature is present in the Indian specimens as well as in those from Formosa and in Tullgren's types from Java; Keyserling says that the femur is divided in the middle, which really is the case.

Olpium Jacobsoni, Tullgren.

India. Calcutta, 1 specimen, running in sunshine on bathroom wall, Museum premises, 22-x-1911, M. No. $\frac{1389}{17}$.—Satara District: Koyna Valley, Talashi, 2000 ft., 1 specimen, iv-1912, collected by F. H. Gravely, M. No. $\frac{1583}{17}$; Hills near Medha, Yenna Valley, 2500-3500 ft., 2 ♀, collected by F. H. Gravely, M.

No. $\frac{1577}{17}$; Ratnagiri District: Karajgaon (10 miles N. of Dabhol), 1 specimen, v-1912 (S. P. Agharkar coll.); Harnai, 1 specimen, 8-v-1912 (S. P. Agharkar coll.). Dehra Dun, 1 jun., M. No. $\frac{1414}{17}$.—N. Bengal: Siripur, Saran, 1 specimen, under bark of Siris tree, M. No. $\frac{2052}{17}$.

All the specimens are distinguished by having their palps proportionally more robust than is the case in the preceding species: the palpal femur is in all about 3 times as long as wide, and all the characters agree well with Tullgren's description and figures.

Garypus insularis, Tullgren.

India. Madras Presidency: Vizagapatam, 1 ♂, 21-iv-1910, collected by S. W. Kemp, M. No. $\frac{1405}{17}$.

I have no doubt that the above specimen belongs to this species, described by Tullgren from the Seychelles, and it is not very remarkable that this species has also been taken in India, although in the eastern part of the Deccan. The Indian specimen is a male, while Tullgren's type was a female. The galea of the male is, as is usual in *Garypus*, of somewhat smaller size than that of the female, but like this, with some minute teeth at the tips, at least this is the case in one of the galeas. The fingers are strongly curved and nearly $1\frac{1}{2}$ times as long as the hand, which also may be concluded from Tullgren's figure to have been the case in the type, though Tullgren says nothing about it in his description. The length of the Indian specimen is about 4 mm., while the type was 3·3 mm. The species is distinguished by its long and slender palps and, as mentioned, by its proportionally long fingers.

Feaella affinis, Hirst.

India. Chota Nagpur Div., Manbhum District, Purulia, 1 ♀, 10-ii-1912, collected by F. H. Gravely, M. No. $\frac{1392}{17}$.

There is certainly no doubt that the above specimen belongs to the species described by Hirst under the name *Feaella affinis*, from the Seychelles. This is, in the collection under consideration, the second proof of the zoogeographical connection between the Seychelles and the Indian Continent, the first being the preceding species, *Garypus insularis* The capture of a species of the genus *Feaella* in the Indian Continent is of the greatest interest, though the Seychelles are geographically a connecting link between India and Africa, which must be considered as the cradle of the genus *Feaella*.

S Hirst, in describing his species, points out the great resemblance with *F. mucronata*, Tullgren. This resemblance is still greater than Hirst supposes, as one of the distinguishing characters, in my opinion, must drop. He points out, that of the four prominences of the front margin of cephalothorax, the two lateral ones are broader than the two central ones in his species, the contrary being the case in that described by Tullgren. But *F. mucronata*, in reality, may show a similar development, as

I have seen it in South African specimens. As Hirst rightly observes, the prominence of the anterior side of the palpal trochanter is much smaller in *F. affinis* than in *F. mucronata*, but there are strictly speaking, no real "prominences on the anterior side of the base of the femur" (Hirst) in either of the species, though the corner is perhaps a little more pronounced in *F. mucronata* than in *F. affinis*. "Die Vertiefung" (Tullgren) or "the gap" (Hirst) between the coxa of the II pair of legs is in the ♂ entirely and in the ♀ almost entirely filled up by a prominence from the posterior side of the coxae of the I pair. There is one other character which may be used to distinguish the two species: the first tergite, which is very short, has in each antero-lateral corner a rather large thorn-like projection, pointing forwards in *F. mucronata*; this projection is not present in *F. affinis*.

Hirst says: "These differences are, perhaps, not important enough to be regarded as of specific value, and it is possible that this form should be regarded as a local variety of *F. mucronata*." This cannot well be so any longer, the species having also been taken in India, but the two species have very much in common and have no *very* clear distinguishing characters, and it may be that forms of transition should be found.

Ideobisium (Ideoblothrus) sp.

India. Malawany, near Bombay, 1 jun., 10-vii-1912, M. No. $\frac{1584}{17}$.

The specimen is very young and of small size (0·8 mm. long). The animal belongs to no species of the subgenus *Ideoblothrus* hitherto described, but as it is so immature and not well preserved, I do not wish to describe it as a new species. It is, however, the first specimen of this subgenus found on the continent of Southern Asia; from the whole south-eastern region of Asia only one species of *Ideoblothrus* is hitherto known, *Ideobisium* (*Ideoblothrus*) *bipectinatum*, Daday, originally described from New Guinea, and later recorded from the Bismarck-Archipelago (Ellingsen); but this species has its palps quite different from the Indian specimen. The species from New Guinea, too, is of small size. The galea of the Indian specimen is small and simple.

At all events this capture proves that the Indian Continent is inhabited by an *Ideoblothrus*.

II. CRITICAL REVIEW OF "GENERA" IN CULICIDAE.

By E. BRUNETTI.

PREFATORY REMARKS.

The present paper is written primarily for the systematic dipterologist and is an endeavour to reduce the multitudinous genera proposed by culicidologists to their taxonomic level from the point of view of the systematist.

The standard of validity adopted in the present paper is precisely that which would, so far as I can judge, be accorded by the average systematist in reviewing proposed genera in any family of diptera other than *Culicidae*.

A word first to the new names proposed by me in the Supplement to my Annotated Catalogue of Oriental *Culicidae*.[1] These were stated at the time to be purely *nomina nova*, the names they were intended to displace being preoccupied (the bulk of them, it may incidentally be mentioned, in the order diptera itself, which shows conclusively how little the culicidologists concern themselves with what has been already done in diptera); but I now regret having encumbered the literature of the family to any further extent.

It must be borne in mind that all the considerations and conclusions herein offered rest on the validity of other authors' statements and descriptions, since on the great majority of points at issue there has been no opportunity of independent examination.

For any false deductions of mine in the present treatise, due to incorrect or incomplete descriptions, I claim exoneration on these grounds, but for any due to misconceptions or erroneous judgments of my own I freely accept full responsibility.

GENERAL CONSIDERATIONS ON TAXONOMY IN DIPTERA.

There is no intention in the present paper of drawing an exhaustive comparison between the characters adopted of late years in distinguishing so-called genera in *Culicidae*, and those that have hitherto been employed in the diptera for the same purpose; but all who have any practical acquaintance with this order are aware that, until the influx of students to the study of *Culicidae* caused by the comparatively recent discovery of their direct connection with malaria,[2] the known species of this family were

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1 Rec. Ind. Mus., iv, 403 *et seq.*

2 The first announcement that yellow fever was carried by mosquitoes, and probably malaria also, was made as far back as 1848 by Nott. Nothing more

comfortably provided for under eight genera only, *Anopheles*, *Megarhinus*, *Sabethes*, *Psorophora*, *Culex*, *Aedes*, *Corethra* and *Mochlonyx*.[1]

The latest set up of these was the latter, in 1844, after which no new genus was proposed till Arribalzaga, by the first splitting up of *Culex*, in 1891, erected *Janthinosoma*, *Ochlerotatus*, *Uranotaenia*, *Taeniorhyuchus* and *Heteronycha*.

The next author to dismember the old genera was Theobald, the pioneer of the school of exclusive culicidologists, who in the first two volumes of his Monograph (1901) erected *Toxorhynchites*, *Mucidus*, *Stegomyia*, *Armigeres*,[2] *Panoplites*,[3] *Deinocerites*, *Aedeomyia*, *Wyeomyia*, and *Trichoprosopon*. In the meantime, *Haemagogus*, Will. (1896) was established, and this is apparently a sound genus.

From about 1901 onwards nearly 200 new "genera" have been proposed, the greater number of them on the most slender and inconstant characters

It must be admitted that the general tendency of modern writers is to recognise a far greater number than formerly of families, genera and other related groups in all orders of the animal kingdom, but it is quite open to question whether such a course is either zoologically correct, or even advisable on the grounds of expediency. The number of families for instance in such groups as birds, fishes, beetles, etc. is much greater now than was the case say half a century ago, and this quite apart from strikingly distinct forms since discovered.

It must also be admitted that the confinement of one's studies to a single group, to the exclusion of all others, more especially a group much restricted both in extent and variety, infallibly narrows one's view of the science as a whole and equally infallibly distorts one's sense of taxonomic proportion; thus mere racial varieties become species, small groups of a few species with perhaps but a single kindred character are promoted to genera, and any such "genus" varying slightly from a very narrow and well beaten track is elevated immediately to the dignity of a subfamily.

Specialists who are also competent all-round zoologists or even good general entomologists are rarer year by year, but a general

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seems to have been done till 1880 when Laveran discovered the actual parasite of malaria, after which it was 1894 to 1896 before a definite mosquito theory was propounded. (*Vide* Brit. Med. Jour., Dec. 8th, 1894; Mar. 14th, 21st, 28th, 1896). Ross first found the malaria parasite present in a mosquito's stomach in 1897, and studied the complete cycle of *Plasmodium* in birds in 1898. Grassi proved *Anopheles* to be the general carrier in 1899, since which time mosquito theories have been advanced by Pfeiffer and Koch, Mendini and others. Bovine malaria was traced to the agency of ticks by Smith and another in 1893.

The above medical notes were very generously compiled for me by Capt. R. B. Seymour Sewell, I.M.S., to whom my thanks are heartily tendered.

[1] *Mochlonyx* Lw. is synonymous with *Corethra* as pointed out by me in Rec. Ind. Mus. iv 317.

[2] Owing to supposed preoccupation renamed *Desvoidea*, Blanch., also preoccupied, renamed *Blanchardiomyia* Brun.

[3] Preoccupied, renamed *Mansonia*, Blanch.

knowledge of the values of ranks in other groups of the animal kingdom is, or should be, imperative in any author who aspires to new classifications on weak characters, more especially if in direct defiance of the expressed views of systematists. In no group of insects has such a lamentable want of technical knowledge been shown than in the writings of the modern authors on *Culicidae*,[1] almost none of whom are dipterologists; in fact they include, as Professor Williston has observed, "some indeed, whose only papers on Entomology have been those proposing new subfamilies!"[2]

He continues, "Their ignorance of related diptera has more than once been deplorably shown by writers on the *Culicidae*," adding, "no one is competent to discuss philosophically the classification of any group of animal life who is not well grounded in the principles of taxonomy as applied to related animals," * * * * because "the mosquitoes are not organisms isolated from all other living creatures."

He further, whilst accrediting "the right kind of scientific work" with its full dues, postulates that opinion with the observation that "one must learn the value of characters in classification before he can be successful in instructing others or in making his discoveries known. And this knowledge can only be acquired by long and faithful study of living things In days gone by the profuse maker of genera was ridiculed, and his labours were largely ignored, but I fear even Desvoidy's shade would turn pale with envy in the contemplation of some of the proposed genera of the modern culicidologists" (Man. N.A. Dipt., 3rd Ed. Intro. 15). He vigorously denounces the numerous proposed genera and subfamilies in this family.

Rondani as well as Desvoidy, I believe, suffered to some extent for the same reason, and many of his genera are still unrecognised owing to insufficient characterisation.

As regards classification above the rank of genera, this has no place in the present paper; suffice it to note that every culicid writer adopts a system more or less modified to meet his own views. It seems incumbent on me, however, to notice a very elaborate colour scheme classification offered by Major Christophers quite recently in *Anophelini*, and though I cannot herein examine it critically, it is certain that the characters used in separating the groups are very indefinite and open to various interpretations according to the reader, whilst it is incredible that the variation of species will not render the tables to a great extent inoperative.

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1 With the exception of one or two, like Col. Alcock and Mr. Edwards, who have endeavoured to stem the tide of genus and subfamily making.

2 Criticising the 2nd edition of James and Liston's "Monog. Anoph. Mosq. India" Mr. C. S. Banks says, "Had the authors stopped at 'describing the different species in such manner that any specimen collected [might] be easily identified,' their work would have been less liable to adverse criticism by systematists, but they, like so many medical men not trained in systematic zoology, have attempted to dabble in generic legerdemain, thereby increasing the confusion already present in culicid classification and adding to the burden of synonymy which must be borne, not by men of their profession but by the already encumbered entomologist." (Phil Jour. Sci. vii. Sect. D., p. 207, June 1912.)

The erection of what the author evidently intends as super-genera is to be deprecated, as is, in fact, any system that introduces a multiplicity of divisions.

COMPARATIVE EXAMINATION OF STRUCTURAL VALUES.

GENERAL.—Most families of the diptera, whilst quite well circumscribed and distinct in themselves, exhibit fairly wide diversity in several characters, whilst those parts of the body that vary considerably in one family may be tolerably constant in adjacent families or variable to a very much less extent, this being exclusive of families with but a single genus each. For instance, whilst the shape of the body and form of the antennae in *Syrphidae* exhibit considerable variety (*Baccha*, *Syrphus*, *Eristalis*, *Microdon*, *Ceria*), the venation is strikingly uniform; whereas in the *Tipulidae*, the reverse is the case, the shape of the body throughout the family being markedly uniform, whilst the venation shows a large number of modifications. Other instances could be cited, well known to dipterologists.

It will now be my endeavour to compare the variation (or otherwise) of the organs in *Culicidae* usually treated of, with the variation of the same organs, speaking broadly, in other families of diptera.

THE PROBOSCIS.—The proboscis throughout the diptera is exceptionally variable, ranging from the enormously prolonged, conspicuous organ in *Pangonia*, *Rhaphiomidas*, *Bombylius*, *Nemestrina* and other genera; its lesser but still conspicuous and elongate nature in *Geranomyia*, *Empis*, etc. to the very restricted forms in many families: also from its long horny form in *Stomoxys* and *Drymeia* to its soft prehensile nature in most *Muscidae* and Acalyptrata; and again to its vestigial form in such species as apparently take no nourishment in the adult state.

In both comparative size and structure the proboscis varies widely throughout the order, but usually not much within the genus, and its range of variability is much greater in many families than in the *Culicidae*.

So far as structure goes, the proboscis is consistently uniform throughout the subfamily *Culicinae*, whilst in the only other subfamily (*Corethrinae*) the mouth is not formed for piercing. The length varies in relation to the body, and this organ may be thin throughout, swollen apically into a more or less elongated club, or it may be foreshortened and thickened throughout. The modifications are not striking, and occur chiefly in the genera relegated by Theobald to his *Uranotaeninae* and amongst those referred to the Sabethini.

The mere comparative length, unless very striking and consistent, is not of generic value, as has been shown by its wide range in *Pangonia*, *Bombylius*, *Empis*, etc.

THE PALPI.—Throughout the order, the palpi exhibit great diversity, but usually conform to one of two forms, the elongate, generally 4-jointed form in the Nemocera, and the (generally) 2 or 3-jointed form in the bulk of the rest of the diptera In some groups they are only one-jointed and are then of but slight value in restricted classification. One of the earliest classifications was built primarily on the palpi; long (4 or more joints) in Nemocera, and short (2 or 3 joints) in the Brachycera (i.e. the remaining diptera exclusive of Pupipara); and as a ready method of dividing the order into two great groups there is even to-day no better method, especially for the general entomologist.

The palpi in *Culicidae* vary more than any other organ and to a greater extent than in the allied nemocerous families.

Theobald, even in his first volume (p. 4) says the palpi "vary in each group, and are of specific but not always generic value," and in a footnote to page 16 adds, "the subject of the palpi is a very complicated one, and will take some time to work out. Arribalzaga figures the constrictions as joints."

In his latest volumes (iv, 15) he says "the classification by means of the relative lengths of the palpi, is, however, not satisfactory, as we get so many intermediate forms," and again (v. Intro. p. vi), "owing to the dense coating of scales, what look like palpi of 3 segments may really consist of 4, 5 or 6."

It is difficult to obtain definite information as to their structure in many genera without mutilating the unique types, a course from which most authors have refrained.

The ♂ palpi is said by Theobald to be especially liable to shrinkage after death, rendering exact examination difficult.

Besides it is not only the density of the scales, but the actual ill-defined nature of the joints themselves in many species that constitute a real stumbling block, though the taxonomic value in such cases must be considered to be correspondingly reduced. All degrees have been seen to occur from palpably mere constrictions to well-defined joints.

This uncertainty has led many writers to speak of the apical, penultimate and antepenultimate joints, by this means avoiding any statement of the exact number instead of the 1st, 2nd and so on, counting from the base, as is invariably done in diptera.

Possibly under the circumstances this is the safest method, but none the less it is consequently impossible for a reviewer to be precise in his deductions.

Study is also not facilitated by the obscure use of terms, some authors for instance speaking of a joint being "larger" than another when they presumably mean *longer*.

The figures do not always agree with the descriptions, as for example *Anopheles maculatus*, Theob. (Monog. i, 171), though several cases of discrepancy could be mentioned; whilst further ones of ambiguity of description are numerous. Patton figures 4 distinct joints to *A.* (*Nyssorhynchus*) *tibani* ♂, the first two quite long and the 3rd and 4th subequal to one another, and of about the normal lengths of the two apical joints in *Anopheles*, yet he does not say whether 4 joints are definitely present or not.

Personally I am disposed to regard the relative length of the palpi to the length of the whole body instead of to the proboscis only (itself an organ of some variation in length), or better still to the length of the head and thorax taken together, as of greater value than the relative length between the sexes, and in any case the number of joints, if quite definite, is of higher taxonomic value than the relative lengths of any of them

This uncertainty amongst authors renders it very difficult to estimate satisfactorily the taxonomic value of palpal lengths and joints, but in regarding both cases as of comparatively secondary importance except when well marked or in the broad sense as understood by the oldest authors, my views will be but in keeping with those of the most recent writers on this family.

A brief review of palpal variation in *Culicidae* is now attempted.

In *Anopheles* (*s. str.*) the palpus is long in both sexes; in the ♂ 3-jointed, the 1st long, the 2nd and 3rd generally subequal, considerably shorter than the 1st and often thicker or forming an elongate club: in the ♀ 4-jointed, approximately elongated, the joints slightly variable in their relative lengths, the last 2 joints generally less thickened than in the ♂.

Taxonomically therefore the palpi in *Anopheles* both in regard to their relative and actual length are tolerably uniform.

Megarhinus has palpi of 4 or 5 joints, long and cylindrical, about as long as the proboscis; in the ♂ rather longer than in the ♀ the last joint in both sexes tapering, the 1st very short. In *M. purpureus* ♀ there are only 3 long joints, in addition to the usual very short basal one.

Ankylorhynchus differs from *Megarhinus* only in the last palpal joint in the ♀ being rounded, not pointed, and this may be a good genus though founded on a female character only.

Toxorhynchites differs from both *Megarhinus* and *Ankylorhynchus* by the palpi in the ♀ being not more than one-third as long as the proboscis, and of 3 joints only, thicker than in *Megarhinus*, the 3rd with rounded tip.

The Culicini must include both the genera of the *Culex* group and those around *Aedes*, but the two groups appear more or less natural divisions although connected by *Mimomyia*, *Gualteria* and *Cacomyia* and probably others. Theobald (Monog. iv, 520) regarded *Finlaya* and *Orthopodomyia* as intermediate between *Culex* and *Aedes*, apparently mainly on the length of the palpi, but he afterwards (*l.c.* v) replaced them in the Culicini without comment.

The palpi in the *Culex* group may be thus described:—

In the ♂ with 3 distinct joints (occasionally, owing to annulations 6 *apparent* joints being visible); one genus (or group of genera according to one's views, *Ludlowia*, having only 2 joints, though even this point seems to be open to question.

In the ♀ there are 3 or 4 joints, or with constrictions or annulations, 5.

In the ♂ the 1st joint is elongate, generally as long as or longer than the 2nd and 3rd together, and is often constricted at or near the middle, or else a band of pale scales occurs there. The 2nd and 3rd joints may taper to a point or retain a nearly uniform width to the tip, or may be thickened separately, or, taken together, may form a more or less distinct club. Of the "genera" sunk in *Culex* in the present paper 6 are described as possessing clavate ♂ palpi, 11 as having the ♂ palpi more or less swollen at the tip, 21 as having non-clavate palpi, whilst of 15 the ♂ is unknown.[1] Of the remainder the information is insufficient or has been unavailable, some being synonyms only.

Many intermediate stages being known to occur, no great value can be attached to these differences. The question of 3 or 4 joints in the male in *Culex* rests practically on the division or otherwise of the long 1st joint; that of 5 joints, if so many are ever present, on the presence of a small basal joint, which, moreover, may perhaps be an antennal protuberance only, such as exists in many diptera and which (as in some species of *Phlebotomus*) has frequently given rise to controversy as to its exact nature.

Yet when we come to the *Aedes* group there is little to erect genera on except the palpal joints.

In *Mimomyia* (type species only), *Ludlowia*, *Megaculex*, *Banksinella*, *Radioculex* and others the ♂ has only 2-jointed palpi clavate apically, and it is on the strength of this character alone that *Mimomyia* (with which must be united the others as synonyms) is in the present paper admitted as a good genus. The venation differs slightly in the shape of the marginal cell, and perhaps in some cases the shorter forked cells.

The palpi in the *Culex* group, therefore, are seen to vary only in the cylindrical or clavate nature of their tips in the ♂, or in being either 2 or 3-jointed in that sex; whilst in the ♀ they are 3 or 4-jointed, or with constrictions, 5.

The palpi in the *Aedes* group consist in the ♂, of 2 or 3 joints (5 in *Haemagogus*), the divisions less clearly marked than in the *Culex* group. The ♀ palpi vary from 2 to 5 apparent joints, the basal joint often sufficiently constricted for one author to regard it as two joints when another would admit only one constricted joint.

Haemagogus, Will. has 5 distinct joints as shewn in Theobald (Monog. ii, 239) and thereon ranks as a good genus. *Hodgesia*, Theob. is said to have single-jointed ♀ palpi (the ♂ being unknown), and this appears to be a good genus also.

The palpi in the Sabethini shew much the same limits of variation as in the Culicini; they are long in the ♂ and moderately long in the ♀ in at least one genus (*Eretmapodites*), long in the ♂ and short in the ♀ in others (*Trichoposopon*, *Hyloconops*), and short in ♂ and ♀ in yet others (*Sabethes*, *Wyeomyia*).

As regards the number of joints they vary from 2 to 5, the latter number reputed to exist in *Eretmapodites* ♂, whilst

[1] These numbers subject to be modified by later investigations or by literature overlooked by me.

Wyeomyia has ostensibly 4, *Sabethes* 3 (doubtful in ♂) and *Sabethoides* 2 only in ♂ and ♀.

A general vagueness pervades the references to these organs in this group in most writings, or else their length is spoken of irrespective of the number of joints.

THE ANTENNAE.—These exhibit extensive and even extraordinary modifications in many families (*Stratiomyidae*, *Tabanidae*, *Bombylidae*, *Cyrtidae*, *Empidae*, *Syrphidae* and some *Acalyptrata*), ranging from conspicuously elongate or variously shaped structures down to a minute, almost globular form. The number of joints often varies within the same family, *Chironomidae*, *Cecidomyidae* and *Tipulidae*, for example, in the latter varying from 6 to 28 joints.[1] They attain the most extraordinary forms in isolated genera (*Pityocera* in *Tabanidae*, *Talarocera* in *Tachinidae*, *Ctenophora* in *Tipulidae*); and vary to a very wide though less fantastic extent in *Syrphidae*, *Empidae*, *Bombylidae* and some groups of *Acalyptrata*, so that by comparative analogy there is hardly any family (containing more than a single genus), in which they are not infinitely more diverse than in the *Culicidae*.

In this matter, indeed, we meet with no such difficulties as with the palpi. The normal number of joints is 15 in the ♂ and 14 in the ♀, exceptions being rare. Normally densely plumose in the ♂ and pilose in the ♀, exceptions are uncommon except in some Sabethini when though they should be pilose in both sexes, though generally a little more densely so the ♂, the degree of plumosity or pilosity in the ♂ may give rise to doubt.

Only quite a few genera have specialized antennae.

The very fanciful form of ornamentation of these organs in *Lophoscelomyia* ♂ substantiates its erection as a distinct genus, whilst in *Deinocerites* and *Dinomimetes* the excessive length of the 2nd joint also justifies their separation. In *Megarhinus* the 1st scapal joint in the ♂ is conspicuously annular or bead-like, the 2nd being elongate, thickened and densely scaled. One or both scapal joints may be scaled in one sex or both sexes (*Chagasia*, *Calvertina*), and may be enlarged or not, irrespective of scales, in others.

In *Finlaya* an apparent discrepancy occurs, the ♀ being reputed to possess 15-jointed antennae, but there seems to be only Theobald's original statement for this, and, it is true, the absence of contradiction by subsequent authors, but no figure has been available and if the 15th joint proves but a constriction of the 14th the alleged anomaly disappears. The two basal joints are also scaled.

To sum up, the antennae in the *Culicidae* may be regarded as generally consistently uniform, which justifies the exceptions (*Lophoscelomyia*, *Deinocerites* and *Dinomimetes*) being regarded

[1] Some authors have claimed 39 joints in *Cerozodia* (*Cecidomyidae*), but others have regarded some of these as annular impressions only. However, at least 17 joints are definitely present in some genera of *Tipulidae*, others having, equally certainly, only 6.

as good genera, whilst the somewhat lesser modifications exemplified in *Megarhinus* and the Sabethini are also constant *inter se.*

THE SCALES.—There is no analogy in other families of diptera respecting classification by the scales which clothe the greater part of the body, legs and wings in nearly all *Culicidae*, and Theobald may be regarded as the pioneer of a classification built mainly on this character.

An exhaustive examination of the scales is however unnecessary here, since to any unbiassed examiner it must soon become obvious that any serious attempt at classification of genera on this character alone is foredoomed to failure.

The continual shifting of species from one genus to another, according to the views of each writer, and of the same author at different periods, illustrates on what a slender basis such a classification rests. The difficulty of deciding the exact shape of the scales, the quantity of them requisite to throw a given species into one genus or another, and their exact surface distribution; in each case according to each writer's interpretations of other authors' impressions, as well as to those of his own, is self-evident at the outset. Even mosquito workers themselves are admitting this difficulty.

Scale characters are admittedly useful in sorting species into groups, but it is impossible to regard these even as subgenera on account of the presence of so many intermediate forms.

More recently still, Mr. Edwards says (Bull. Ent. Res. iii, 3), "scale characters have practically been discarded as of value in generic definition," and it must be admitted the general tendency is in this direction. Col. Alcock regards them as quite unsatisfactory, Edwards sinks wholesale, genera so made, and Felt and Dyar and Knab consider genitalic and larval structure as of higher value. One or two recent authors place the construction of the claws before the scales. Only when scales or chaetae, or both together are present on the *metanotum*, a part of the body normally unadorned in diptera, at least with anything stronger than pubescence, can they be regarded of generic importance. In my paper on taxonomic values[1] I underrated their systematic importance when on this part of the body, and the Sabethini section are sufficiently differentiated by this character alone.

As regards scales on the legs, these afford no assistance beyond specializing two or three genera (*Psorophora*, *Mucidus*, *Lophoscelomyia*) in which their length and outstanding nature give the insect a ragged appearance. Yet tufts or fringes of long outstanding scales are found on the legs of several species of *Empis*, in some *Bombylidae* (*Hyperalonia*, *Exoprosopa*) and in other genera in diptera without such species being accorded thereon generic rank.

THE CLAWS.—Theobald at first (Monog. i, ii) attached much value to the claws and Coquillett still does so (Can. Ent. 1876, p. 43, and Science xxiii, 313—1906) but the former admitted later

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[1] Rec. Ind. Mus. iv, 53.

the inferior nature of the character (Monog. iv, 15) and considered Coquillett wrong in upholding their importance. He says (*l.c.* iv, 122), "unless both sexes are seen, it is quite impossible to place any culicid in any of the sections into which the family is divided."

I am not yet disposed to admit any high value to this character unless there is good evidence that practically all individuals can be definitely allotted to one or other of the alleged subdivisions; and in other works I have ventured to question the supposed high taxonomic value of what is perhaps a somewhat analogous character, the presence or absence of small (often very minute) spines at the tips of the tibiae in *Tipulidae*, to which much importance is attached by some authors. Mr. Edwards however finds sufficient reliability in the claws to use them as of primary importance in differentiating genera, but this method places *Stegomyia* in the *Aedes* group which does not seem to me its natural affinity. Besides, a character dependent on the female sex alone is nearly always a doubtful one.

THE VENATION.—There are several families amongst the diptera of which each family possesses a type of venation entirely peculiar to itself.

In addition to those with practically but a single genus each, *Rhyphidae*, *Dixidae*, *Simuliidae*, and *Orphnephilidae*; the *Leptidae* (with the *Tabanidae*), the *Stratiomyidae*, and *Syrphidae*, also the *Tachininae* and *Anthomyinae* subfamilies of *Muscidae*,[1] all possess strikingly specialized types of venation, each peculiar to one family only. The *Culicidae* undoubtedly form another family of the same category, offering as pronounced an example of uniformity of venation as can be found. The Psychodid wing is closely allied but differs fundamentally in the basal proximity of the cross veins.

On the other hand, in *Tipulidae*, *Mycetophilidae*, *Chironomidae*, *Bombylidae*, *Cyrtidae*, *Empidae* and others we find extensive modifications of the type venation peculiar to each.

Genera founded on the presence or absence of certain veins or cells are ordinarily quite valid and constant, but exceptions are not rare, and individual aberration has to be allowed for. In *Culicidae* the genera varying most would appear to be *Megarhinus*, *Mucidus*, *Uranotaenia*, and *Culex*.

Exact precision cannot be expected, and in the matter of venation a little wider range of individual variation must be allowed for, even to the two wings of an individual specimen, such instances being not at all infrequent in many families. This margin of individual variation is known to every depterologist. The venation has, however, been largely ignored by culicid writers

[1] It may be noted that in the *Muscidae*, *sensu latissimo*, I recognise but a single family, with the *Tachininae* (including the Dexids and Sarcophagids), *Muscinae* and *Anthomyinae* as three subfamilies; each of the Acalyptrate groups ranking also as subfamilies of equal rank with these three. The Acalyptrata as a group possess technically the same type of venation as the Anthomyinae, but modified forms are found, each more or less peculiar to one subfamily only.

because it is less amenable than other characters to the microscopic differences that culicidologists delight in, but which, nevertheless, *have no real specific value in nature.*

Theobald in fact says (Monog. iv, 381) after mature deliberation " the venation is too variable to take with any degree of seriousness." The truth is, that whilst of all taxonomic characters in *Culicidae* the venation, speaking broadly, is by far the most uniform, a single typical form continuing through the family with but two or three minor modifications, affording no opportunity to found thereon a multiplicity of genera, yet it has both in the species and in the individual a sufficiently wide variation to have precisely the same restraining effect as regards species and varieties.

As regards modification, first there is the exact position of the posterior cross vein in *Mucidus*, which, theoretically, is beyond, even if only slightly, the anterior cross vein. This would be a good character if constant (always allowing for individual aberration), but in one or two species (*alternans* and *sudanensis*) this cross vein is evidently so little beyond the anterior cross vein as to discount the generic value of the character. In *Trichoprosopon* the two cross veins are theoretically in a line, but the genus is sufficiently differentiated by the scaled metanotum.

In *Tipulidae* and many families of Brachycera the posterior cross vein is (generically) as often beyond as before the anterior cross vein whilst very many genera have them practically in a line with one another, the presence or absence of a discal cell between them, of course, making no morphological difference.

The validity of *Mucidus* on the position of the posterior cross vein alone is precarious, but the genus seems to be substantiated by the peculiar nature of the scales.

The second modification is the shortened 1st submarginal and 2nd posterior cells (called by culicid writers the " forked cells ")[1] in certain genera, one of the principal characters of the Megarhini being the shortness of the forked cells, especially the 1st submarginal, while Theobald would distinguish his subfamily Uranotaeninae by the very small 1st submarginal cell.

As regards the generic value of the short forked cells in *Uranotaenia* doubts may be held, as though they are quite short in many species, their length, according to Theobald's figures, which form the only evidence before me, varies considerably, and closely approaches in some species their length in such species of *Culex* (*s. latiss.*) as have these cells rather shorter than usual. In *Culex* they may be regarded as about $\frac{1}{4}$ to $\frac{1}{3}$ the length of the wing, in *Uranotaenia* and *Megarhinus*, theoretically less than $\frac{1}{4}$, and even though in some species they may be less than $\frac{1}{5}$ of the wing, the border line between the longer celled species and *Culex* is very indefinite.

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[1] There seems no objection to this term, which is certainly lucid and conveniently brief.

Felt's distinctions of his *Culicelsa*, *Culicada*, *Ecculex*, *Culicella*, *Culiseta* and *Protoculex* in the matter of forked cells, and the position of the posterior cross vein cannot be regarded as having any taxonomic weight whatever, nor can I personally conceive them possessing any constancy.

A further character in *Megarhinus* should be the more proximal position of the anterior and posterior cross veins. No specimen of the genus is before me, and Theobald's plates in his monograph do not attempt any venation but in his text figures of *M. solstitialis* and *chrysocephalus* (iv. 134, 135 137) the cross veins are in their normal position, that is, near or just beyond the middle of the wing.

What apparently is a third modification occurs in *Heptaphlebomyia* in which the presence of an alleged 7th vein with scales caused Theobald to erect a special subfamily for its reception. This view is a misconception and the point is discussed under the generic notes.

There are three folds (sometimes others) in the wing which appear with more or less distinctness in some species of *Culicidae*, in some individuals more vividly than others, and which may easily be mistaken for veins.

Such folds in the wing are well known to the dipterologist, and give rise in the family *Blepharoceridae* to what is known as the secondary venation. The "spurious" vein, one of the principal characters of the great family *Syrphidae* (being constant throughout it with the exception of a single genus) is similarly caused, whilst indistinct "veins" of similar nature occur in *Chironomidae*, *Mycetophilidae*, *Simulium* and other groups, and have, it is true, given rise to erroneous conceptions as to their true nature and value. They must not, however, be confounded with the fixed normal venation.

The first of the three folds referred to is in a line with the longitudinal part of the 3rd vein and certainly might easily be mistaken by a beginner for the basal part of that vein, were it not for the definite statement of dipterologists to the contrary.

As, however, the recent school of workers in mosquitoes mostly appear to deliberately disregard all writings outside of those of their own way of thinking in this particular family it is no wonder that serious errors are perpetuated.[1]

The second and third folds of the wing lie respectively behind the 5th and 6th veins and have even been regarded as veins by the author of the British Museum's little brochure, "How to collect mosquitoes." This view is quite erroneous. The hindermost of these folds seems to be thickened somewhat in *Heptaphlebomyia*, and by bearing a row of scales led Theobald astray.

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[1] The study of related diptera by means of Schiner's Fauna Austriaca, Williston's "Manual of North American Diptera" 3rd Ed., and Verrall's two splendid volumes on "British Flies" would give the student all necessary information on venation. See also my explanation of the venation, with diagram, in Rec. Ind. Mus. iv, 408

As regards terminology in venation the culicid workers are in many ways completely wrong and it is remarkable how most of the mistakes are adhered to.

I have dealt elsewhere (Rec. Ind. Mus. iv, 408) with the usual mistakes of modern writers, so need not recapitulate, except to emphasise yet once again that the so-called "supernumary cross vein" is *not a cross vein at all*, but the *basal portion of the 3rd longitudinal vein*, which *always issues from the 2nd longitudinal vein*, in spite of Theobald's deplorable statement (Monog. i, 19) that "In a large number of *Culicidae* the 3rd long vein passes some way into the basal cell and certainly does not arise from the 2nd longitudinal vein!" This view he again expresses in defining *Desvoidia* (Monog. i, 322) (as *Armigeres*), "the wings have the 3rd long vein continued on, into and through the basal cell as a distinct unscaled line."

The fact is, the 3rd longitudinal vein is frequently sharply angled at the end of its basal section, and, as very frequently occurs in many genera outside of the *Culicidae*, it often throws off an appendix at the point of angulation, which adds to the appearance of the vein itself being straight or nearly so, whilst the short basal section of it, being so often at right angles to the remainder heightens the effect of such basal section being a cross vein.

Such an appendix is frequently found in other parts of the wing in different families but gives rise to no misinterpretation. It is quite common adventitiously as well as specifically and more or less generically in some *Bombylidae*, *Asilidae*, *Therevidae* and *Tabanidae*, whilst in many *Syrphidae* it is more often the rule than the exception at the bend of both the 4th and 5th longitudinal veins (see Verrall, "British Flies," *Syrphidae*, 133) and it occurs at the same spots in numberless Tachinids. Apart from *Tipulidae* and *Culicidae* such an appendix is uncommon in the Nemocera.

In *Toxorhynchites* this appendix is considerably lengthened and the anterior cross vein joins this appendix to the 4th vein, which is quite an abnormal character

In many cases the 3rd vein emerges in a curve, or at an acute angle from the 2nd longitudinal, and without any appendix, thus proving its regular place of origin, and a large number of Theobald's wing figures confirm this.

Blanchard gives an excellent diagrammatic wing of *Culex* (after Van der Wulp, be it noted), distinctly shewing the natural origin of the 3rd vein and the very obvious anterior and posterior cross veins, but his own figures of *Anopheles* and *Culex* are very slovenly drawn, and exhibit all the common errors of mosquito students. He adheres to these in the text and even introduces still more cross veins that have no existence in *Culicidae*. Giles also speaks of a subcostal and a marginal cross vein and proffers the extraordinary intelligence that the anterior cross vein is *absent* in *Culicidae*! It would be superfluous to enumerate here the errors of all the recent writers on this group, since they have in the main copied one another, with an individual addition or two, but I think all without exception are unanimous in the hypothetical "supernumary cross vein."

Even Col. Alcock commits one serious error in describing the venation.

His wing of *Tabanus* is quite correct. In his wing of a mosquito, waiving the point that his 2nd marginal cell is more usually termed the 1st submarginal (since this is a matter that can be regarded from two points of view), he commits a serious error in not recognising the very obvious posterior cross vein, which he terms his "anterior basal cross vein," stating that the posterior cross vein is not present at all and that therefore there is no enclosed anal cell. The presence or absence of the posterior cross vein has no bearing whatever on the anal cell, which is always the cell that lies behind the 5th longitudinal vein, or the lower branch of it when this vein is forked, and it may be open or closed quite independently of the posterior cross vein.

Far be it from my desire, let it be understood, to in any way condemn or undervalue Col. Alcock's valuable chapters on diptera, than which I have seldom perused anything more concise and clear, and it is refreshing to see that he eschews that, to me, particular bugbear, Theobald's "supernumary cross vein" and recognises its true character, as the basal section of the 3rd longitudinal vein.

A new and still more deplorable misconception than Theobald's "supernumary cross vein" is provided by Major Christophers in a recent paper on the wing markings of the Anopheline group.[1] This author postulates that "if the 2nd longitudinal vein itself formed a direct junction with the 1st, etc., etc.," continuing "some authors figure the vein as acting in this way, but I have not found any example of an *Anopheles* wing shewing this arrangement," though he admits it "appears to occur" in some other *Culicidae.*

This author therefore actually seriously suggests that the 2nd longitudinal vein does not emerge from the 1st either in a curve or at a sharp angle (with or without an appendix at the flexure) but that it is joined to the 1st vein by a cross vein. The 2nd longitudinal vein does most emphatically *not* "continue past this cross vein," etc., to "lose itself in the wing membrane," but both 2nd and 3rd veins emerge from the 1st and 2nd respectively in *Culicidae, as they do in other families.* Is it not extraordinary that present-day writers on mosquitoes find veins that giants of dipterology like Wiedemann, Zetterstedt, Loew, Schiner and the late Osten Sacken and Verrall (two exceptionally gifted exponents of venation in diptera) all overlooked and that the 2nd and 3rd longitudinal veins in *Culicidae* are suddenly found to have totally different methods of origin to those in every other family of diptera?

[1] Ann. Trop. Med. and Paras. vii. No. 1. 57, March 31, 1913.

I protest emphatically against Major Christophers' statement that "it seems absurd to term the longitudinals by numbers and the much less important cross veins by a hybrid nomenclature only partially descriptive. The omission of the radio-sector cross vein,[1] which is every bit as important as the others, is also absurd."

Now firstly, the numbering of the longitudinal veins is correct, concise and easy to remember; and secondly the writer shews a strange ignorance of the comparative value of the veins in diptera when he asserts that the cross veins are "much less important" than the longitudinals, as exactly the reverse is really the case. The anterior and posterior cross veins are of *infinitely more importance taxonomically* than the branching of the longitudinal veins, as is shewn by the absolute fixity in most families of diptera of them both, and especially the former, which any dipterologist of experience can locate with absolute precision in almost every instance.

His discovery that the "radio sector cross vein" is "every bit as important as the others" is stultified by the absolute fact that there is *no cross vein there at all.* Some authors would construe as a cross vein every vein that starts at anything approaching a right angle.

It seems strange that every fresh writer on mosquitoes must introduce new terms for veins and cells, apparently oblivious of the fact that for at least half a century the venation in diptera has been thoroughly understood by dipterologists and two standard systems of terminology accepted, either of which is legitimate, the one employed by the late Mr. G. H. Verrall in his wonderfully accurate and explicit volumes on the British Diptera, the other as used by the late Baron Osten Sacken and by most of the principal dipterologists of today. These two authors were perhaps unequalled in their elaborate knowledge of the classification of the diptera, of the taxonomic value of the different characters dominating each group and in their precise and correct terminology.

Finally it is beyond the present writer's comprehension why recent workers on mosquitoes have from the first so *studiously ignored* both of the two accepted systems of venation used by dipterologists for over half a century and which are morphologically unassailable.

To sum up, the venation in the *Culicidae* as a family, dipterologically speaking, is throughout remarkably uniform, and is tolerably constant, generically and specifically within reasonable limits; the only points of variation being the positions, relatively or absolutely, of the cross veins in *Mucidus* and *Megarhinus*, the shortened fork cells in the latter and in *Uranotaenia*, and the alleged 7th vein in *Heptaphlebomyia*, all of which I have endeavoured to dispose of satisfactorily.

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[1] By which is meant the actual, often angulated base of the 2nd longitudinal vein. James and Liston also erroneously regard this basal section as a cross vein, the "marginal transverse vein." One or two others have made the same deplorable error.

THE ♂ GENITALIA.—Though the value of the ♂ genitalia in allied families to the *Culicidae* (*Tipulidae*, *Mycetophilidae*, and, I believe, *Chironomidae* also) has long been known to dipterologists, Osten Sacken describing and figuring them very conscientiously in his classic monograph of the North American *Tipulidae brevipalpi* in 1869, it is not until Theobald's 4th volume of his work (pp. 7, 9) that the subject is broached in this family by him, nor do contemporary authors deign more than an incidental reference to these parts, ignoring them altogether in the specific descriptions. That culicidologists should ignore the male organs is not to be wondered at considering the pernicious precedence consistently accorded by them to the ♀, in spite of dipterologists having pointed out that characters and especially external markings are almost always more fixed in the ♂ than the ♀ and, as the former sex is less bloodthirsty there is, in specimens of it, less discoloration due to imbibed blood.

Dr. Dyar says "genitalic divisions are more natural than those recently founded on scales and palpi," but Theobald, replying (Monog. iv, 13) asserts that he himself supports characters "which are common to both sexes, such as the scales" adding "such we find to be the case, not only from a structural but also from a bionomic point of view." Theobald observes (i, 327) that the ♂ genitalia "vary so much in closely related gnats," but the subject is then shelved.

The genera set up by Felt, *Culicada*, *Culicella*, and the allied others exhibit a reasonable amount of variation in these organs, but not sufficient to separate them generically from *Culex* (*s. latu*). In fact far more diversity is found in them in the very large and homogeneous genus *Tipula*, whilst they vary widely within the limits of the genus in many cases in allied nemocerous families. Generic subdivision on these organs alone is to be deprecated. Dr. Dyar (Proc. Ent. Soc. Wash. vii, No. 1—1905) gives a table of genera (including four new ones), reproduced by Theobald (iv, 11), constructed solely on the ♂ genitalia. Felt (N. York State Mus. Bull. No. 79, Ent. 22—1904) also endeavours to classify similarly, supplementing this character by those of the veins, the scales and the larvae, but his distinctions do not appeal to me as at all convincing and it does not seem conceivable that all the characters hold good in all his genera.

It may well be that the ♂ genitalia are much less diverse than in some allied families, and if used with caution and in conjunction with other characters they should prove a useful adjunct in discriminating species, but they are hardly likely to prove of generic value in this family except possibly in rare instances.

The female genital organs in diptera hardly ever offer much in the way of distinctive characters.

THE LARVA.—Classification by larval characters is not easily criticised unless one has some considerable knowledge of this branch of study. Perhaps Messrs. Dyar and Knab have advanced farthest in this line, and in their view the principal features in the

Anophelinae are the frontal hairs of the head and the structure of the antennae and the palmate hairs; in the *Culicinae*, the form of the clypeus, the siphon and the so-called comb at its base, the antennal structure and the number and structure of the spines forming the pecten. Theobald adds (iv, 6) a table by Felt classifying a certain number of species by larval characters including species widely different in the adult stage. As a matter of fact, according to Felt's own diagnoses, the larva shows considerable difference in their so-called genera *Culicelsa*, *Culicada*, *Ecculex*, *Culicella*, *Culiseta* and *Protoculex*, all of which are inseparable from *Culex*, proper. It must also be noted that Theobald and others of his school contend that classification by larval characters is most untrustworthy, separating very closely allied species, and bringing together widely different ones. Moreover, animals are classified on their adult forms and not on transitional stages. It is also well known in diptera that closely allied species are not infrequently widely different in their early stages.

In Dyar and Knab's lengthy paper on the larvae of *Culicidae*, classified as independent organisms, they combat the value of scale structure as a character of generic values (*t.* Th. iv, 13). In this paper they sink all the anopheline genera in *Anopheles*, yet raise one species, *barberi*, Coq. to generic rank, (*Coelodiazeses*), a species that Theobald considers so near *bifurcatus*, L., as to be hardly separable. These authors admit three sub-families, *Anophelinae*, *Culicinae* and *Sabethinae*; they refer several of Theobald's species to other genera, and sink *Ochlerotatus*, *Haemagogus*, *Stegomyia*, *Grabhamia*, *Howardina*, *Verrallina*, *Culicelsa*, *Culicada*, *Ecculex*, *Protoculex*, *Gymnoptera*, *Lepidoplatys* and *Pseudoculex* in *Aedes*.

Haemagogus has every appearance of a good genus, whilst the prospect of *Stegomyia* proving a natural group is strong. *Aedes* is certainly distinct from the genera around *Culex*.

The sole substantial character drawn from larval stages that does not interfere with adult classification, is the absence of a respiratory siphon in the *Anophelinae*, an organ which is present in the other groups.

One very useful piece of information gleaned from larval characters is the absolute affinity of the *Corethrinae* with the *Culicidae*.

"Even when the most is made of the difference between the larva of *Culex* and the larva of *Corethra*, there still remains the fact that the larva of *Mochlonyx* (whose adult is indisputably corethrine) possesses the structural peculiarities of the larva both of *Corethra* and of *Culex*, besides exhibiting in its four clypeal bristles one of the peculiarities of the larva of *Anopheles*" (Alcock, Ann. Mag. Nat. Hist. (8), viii, 240 and Entom. for Medical Officers, p. 59).

In further support of the larval characters alone being an insufficient guide to real affinity, Prof. Mienert may be drawn upon. "The likeness between the imagines of the genus is the more remarkable as the difference between the larvae and pupae and especially between the larvae, is so great; but on the other hand there are other genera among the true *Culicidae*, such as *Culex* and *Anopheles*, of which the imagines, at any rate in one sex[1] are so like as to lead to confusion while the larvae are exceedingly different. * * * ."

ABNORMAL CHARACTERS.—Genera founded on legitimate variation of bodily structure are very few, *Dactylomyia*, *Lophoceratomyia*, *Rachionotomyia*, *Deinocerites*, *Dinomimetes* and *Runchomyia*, all dealt with further on, are, apparently, all that can be found in *Culicidae*.

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SUBFAMILIES AND SECTIONS IN CULICIDAE.

Having compared the principal characters in *Culicidae* with the same characters in other families of diptera we can proceed to examine the genera proposed of late years and estimate their validity.

The *Culicidae* form only two subfamilies[2] *Culicinae* and *Corethrinae* and the former should be divided into four sections only.[3]

Table of sections in CULICINAE.

Scutellum simple, never trilobed; palpi long in ♂ and ♀; larva without respiratory siphon .. .. .. *I Anophelini.*
Scutellum trilobed; palpi variable, generally shorter in ♀ than ♂; larva with respiratory siphon.
  Metanotum nude.
    Proboscis strongly recurved .. *II Megarhini.*
    Proboscis normally straight; never recurved as in the Megarhini .. .. *III Culicini.*
  Metanotum with scales, chaetae or both .. .. .. *IV Sabethini.*

Section I. **ANOPHELINI.**

The genus *Anopheles* in the original sense is a very well defined and natural one, characterized by the non-trilobed scutellum in conjunction with the long palpi in both sexes. A secondary character is the larva being without a respiratory siphon, whilst the generally maculated nature of the wings in the adult, formed

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1 Meinert adds in a footnote "Thus with regard to *Culex nemorosus* see Zett. (Dipt. Scand. 3458, note):—"caveas ne hunc cum *Anophele bifasciato* confundas.""

2 Mr. Edwards desires to add the *Dixinae* as a third subfamily, but though this view has the support of as sound an authority as Prof Williston, I think *Dixa* is best separated from the family.

3 Mr Edwards uses practically the same names, though I had personally decided on them months before his paper was seen by me

by spots and lines of black, white or yellowish scales is a prevailing feature of the genus in Meigen's sense.

Of over twenty genera proposed since *Anopheles*, I can only personally recognize four, *Chagasia*, Cruz, *Calvertina*, Ludl., *Bironella*, Theob. and *Dactylomyia*, Newst. and Cart.

Two of the latest workers in this group, Col. Alcock and Mr. Edwards, are disposed to return the bulk of the known species to *Anopheles* proper, that is, in Meigen's sense. All the recent genera set up merely on scale characters are utterly untenable and must be abandoned by the systematist.

Col. Alcock shows (Ann. Mag. Nat. Hist. (8) viii, 240, etc.) how many of the so-called genera in the Anophelini grade into one another and concludes "the so-called 'genera' of the proposed subfamily '*Anophelinae*' cannot be separately focussed as distinct generic conceptions, but must all be merged in a generalization."

Mr. Edwards (Bull. Ent. Res. iii, 241) observes that the so-called genera "grade imperceptibly into one another and are not founded on any structural differences, while *Anopheles* in the broad sense is a very well defined genus easily recognizable even by an amateur."

He deprecates the erection of a number of even subgeneric names as tending to obscure larger relationships and increase the difficulty of determination. "The differences found in the larvae, like those between the adults are very slight, and moreover they do not seem to support the classification by scale characters."

In an earlier volume (loc. cit. ii, 141) the same author in writing on the West African species of *Anopheles* agrees with sinking most of the recently established genera of Anophelina in *Anopheles* but provisionally respects *Stethomyia*, *Chagasia*, *Calvertina* and *Bironella*.

It is striking that three out of four of his retained genera should be the same as those admitted by me working on quite independent lines. *Dactylomyia* had not been proposed at the time he wrote. I can also agree with Mr. Edward's remarks on synonymy (l.c., p. 141).

The differences between the genera admitted here are sufficiently shown in the following table:—

Table of genera in ANOPHELINI.

A	1st submarginal cell subequal to the 2nd posterior cell, both of normal length.	
B	Antennae without whorls of scales.	
C	No shoulder tubercle	*Anopheles*, Mg.
CC	A finger like tubercle on each shoulder	*Dactylomyia*, Newstead and Carter.
BB	Antennae with whorls of scales (Dense long outstanding scales at sides of thorax) ..	*Chagasia*, Cruz.

AA 1st submarginal cell only about half as long as 2nd posterior cell.

D Antennae with whorls of scales .. *Calvertina*, Ludl.

DD Antennae without whorls of scales *Bironella*, Theob.

Generic notes in ANOPHELINI.

Anopheles, Mg. A natural and easily recognized genus, of which no criticism is necessary.

None of the following proposed genera can be accorded generic rank, and from the feeble lines of demarcation between most of them they cannot be regarded systematically as even subgenera. No special sequence is adopted in listing them here.

Patagiamyia, James.
Myzomyia, Blanch.
(*Grassia*, Theob.)
Neomyzomyia, Theob.
Cycloleppteron, Theob.
Nototricha, Coq.
(*Nototnotricha*, Theob. *em.*)
Feltinella, Theob.
Neostethopheles, James.
Nyssomyzomyia, James.
Stethomyia, Theob.
Pyretophorus, Blanch.
(*Howardia*, Theob.)
Myzorhynchella, Theob.
Arribalzagia, Theob
Conchyliastes, Theob.
Myzorhynchus, Blanch.
(*Rossia*, Theob.)
Christya, Theob.
Lophoscelomyia, Theob.
(*Lophomyia*, Giles.)
Nyssorhynchus, Blanch.
(*Laverania*, Theob.)
Cellia, Theob.
Neocellia, Theob.
Aldrichinella, Theob.
(*Aldrichia*, Theob.)
Kerteszia, Theob.
Christophersia, James.
Manguinhosia, Cruz.
Coelodiazeses, Dyar and Knab [1]

The following four genera appear distinct, and are differentiated in the table.

Chagasia, Cruz.
Calvertina, Ludl.
(*Calvertia*, Ludl.)
Bironella, Theob.
Dactylomyia, Newstead and Carter.

Mr. Edwards thinks *Dactylomyia* may be identical with *Anopheles deceptor*, Don. and *Myzomyia thorntoni*, Ludl. Apparently the ♂ is unknown of *Chagasia* and the ♀ of *Bironella.*

Section II. MEGARHINI.

The Megarhini form a compact group of 3 or 4 genera characterized by the strongly recurved proboscis, the position of the posterior cross vein *beyond* the anterior cross vein, and the

[1] Erected on larval characters alone and therefore inadmissible: the adult is known and cannot be separated from *Anopheles.*

generally much shortened second submarginal and first posterior wing cells. They are mainly the giants of the family, with tufts of brilliantly coloured scales on the abdomen. The genera are differentiated as follows, but the table is not a satisfactory one, being built on sexual characters, so that it is impossible to generically identify males unless the known corresponding females are present also.

Table of genera in MEGARHINI.

Palpi long in ♂ and ♀ (in ♀ only a little shorter than in ♂).	
Last palpal joint in ♀ truncate or rounded.	*Megarhinus*, R. Desv.
Last palpal joint in ♀ long and pointed.	*Ankylorhynchus*, Lutz.
Palpi long in ♂, not more than one-third as long as proboscis in ♀. ..	*Toxorhynchites*, Theob.

Generic notes in MEGARHINI.

Megarhinus, R. Desv. This is, of course, a well-marked genus of long institution. *Lynchiella*, Lahille, in Peryassu, is synonymous.

Ankylorhynchus, Lutz. A somewhat unsatisfactory genus built on the ♀ palpi only, but if this character is constant it would appear to be a natural group

Toxorhynchites, Theob.
Worcesteria, Banks.
Teromyia, Leices.

One of *Teromyia's* alleged distinctions is that the ♀ palpi are only half as long as the proboscis, and 5-jointed, as compared with *Toxorhynchites*, in which they are from one-quarter to one-third as long as the proboscis, and 4-jointed. The palpal length, anyway, seems very difficult of exact determination and too arbitrary to be a natural distinction

A far stronger distinction, if it really exists, is in the alleged cross vein between the subcostal and 1st longitudinal veins, claimed by Leicester for all his species. This would, of course, be the subcostal cross vein, but it is difficult to conceive that that author is not mistaken, as this vein has never been dipterologically recorded in the family. The juxtaposition of two veins often results in a slight thickening of both which appears at first sight as a cross vein, and in my studies in *Tipulidae* and *Mycetophilidae* few points have given me more trouble than the decision as to the presence or absence of this cross vein, which in both these families is found in some genera and not in others.

Section III. CULICINI.

Although the Anophelini, Megarhini and Sabethini form natural groups, each represented by a limited number of valid genera, we are confronted in the Culicini (with which must be united the Aedines, as it is clear that, though they appear to be more or less natural groups, we can at present draw no satisfactory line of demarcation between them) with a very extensive series of closely allied forms exhibiting great variety within narrow limits.

Of over 100 groups admitted by Theobald as generic, to which must be added about a dozen others of later erection, only a very small number stand out clearly as valid independently of characters of indefinite or disputed nature, such as the exact number of joints of the palpi and the relative or actual length of these organs, sexually, specifically and generically, and of course apart from any scale characters.

After eliminating these few tolerably well defined genera there are hardly any characters left in the remaining forms on which to construct even sub-genera, and though culicidologists also consider the *Culex* and *Aedes* groups as more or less natural ones, intermediate forms occur, which after all is not surprising.

The original distinctions of palpi in ♂ long, in ♀ short—in *Culex*, and short in both sexes in *Aedes* sufficed for the few species known to the early authors, but, both by the now proved variety in length of this organ within the narrow limits as thus defined, and by the actual indefinite formation of its joints in many "genera" these differences hold good only in a very general way.

Cacomyia and *Gualteria* are acclaimed as intermediate and though Theobald recently puts *Cacomyia* with the Aedines I have retained it here as of uncertain position. Theobald at one time (Monog. iv, 520) regarded *Finlaya* and *Orthopodomyia* as also intermediate, though later (*l.c.* v) he replaces both in his *Culicinae* without comment, whilst Col. Alcock, one of our latest (and incidentally one of the soundest) authorities on the classification of this family, considers *Myxosquamus*, *Carrollia*, *Eumelanomyia*, *Acartomyia*, *Bancroftia*, *Catageomyia*, and *Boycia* all as "annectant forms between *Culex*, *Stegomyia* and *Aedes*."

Psorophora also has been adjudged intermediate, but this can, at any rate considered solely as a genus, be sufficiently easily recognised by its peculiar leg scales.

Mr. Edwards divides the *Culex* group from the *Aedes* group as follows: In the former the "eggs are laid in masses, the last segment of the ♀ abdomen is broad and immovable, and the claws in the ♀ are never toothed." Genera: *Culex*, *Taeniorhynchus*, *Aedomyia*, *Theobaldia*, *Uranotaenia*, etc.; in the latter group the "eggs are laid singly, the last segment of the ♀ abdomen is narrow, usually completely retractile into the penultimate and the ♀ claws, at least the anterior ones, are nearly always toothed." Genera: *Mucidus*, *Psorophora*, *Janthinosoma*, *Ochlerotatus*, *Stegomyia*, *Aedes*, etc. I regret I cannot consider any of the three characters of sufficient weight, and though palpal characters are also unsatisfactory, they have been adopted in the present paper, pending some quite decisive method of dividing these two groups.[1]

After a critical survey of the proposed genera in the Culicini, founded on the descriptions of the promoters (since little else is available to me) it appears as though, from the systematist's point of view the only valid genera in the *Culex* group are: (1) *Deinocerites*, distinguished by its exceptionally long 2nd antennal joint; (2) *Lophoceratomyia*, by the fantastic abdornment of the ♂ antennae; (3) *Rachionotomyia*, by the spine-like production of the scutellum; (4—6) *Psorophora*, *Janthinosoma* and *Mucidus*, by the outstanding scales on the legs, these latter three differentiated amongst themselves by fairly good characters; (7) *Ekrinomyia*, by the posterior cross vein being placed beyond the anterior cross vein, assuming this to be definite and constant in conjunction with the *absence* of outstanding leg scales; (8) *Mimomyia* (with several synonyms) by the 2-jointed, more or less clavate ♂ palpi; and (9) *Stegomyia*, by the 5-jointed ♂ and 4-jointed ♀ palpi, but this latter genus is admitted herein on the presumption that this character is definite and constant, which, by the way, is not too certain.

The following good genera occur in the *Aedes* group: (1) *Haemagogus*, distinguished by the distinctly 5-jointed antennae in both sexes; (2) *Harpagomyia*, by the elbowed proboscis; (3) *Hodgesia*, by its 13-jointed antennae and one-jointed palpi, in both cases in the ♀ only, the ♂ being unknown.

The remainder of the Aedines[2] should fall in *Aedes* or *Skusea*, technically distinguished by a 2-jointed ♂ and 4-jointed ♀ palpi in the former, and a 3-jointed palpi in both sexes in the latter, and it seems wise to acknowledge both genera. *Aedes* is, of course, a quite sound genus of many years' standing, but much uncertainty attaches to the descriptions of most of the recent genera and species. *Uranotaenia* will hold good if the character of 2-jointed palpi in ♂ and ♀ can be trusted.

After accounting for the above as good genera in Culicini there remains a very large number of species and groups of species, including *Culex* itself, which have little, if anything, taxonomically to separate them from one another except still vaguer palpal characters, all of admitted variability, the difficulty of unravelling the puzzle being increased by the limited information authors have been able to afford.

Scale characters I strongly resent being considered of generic value, and the continual shifting of species from one genus to another and of genera from the *Culex* to the *Aedes* group and *vice versa*, emphasises both their instability and the existing want of unity of opinion even amongst culicidologists themselves.

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[1] Mr. Edwards admits the ♀ claws are variable in at least one species—*Stegomyia simpsoni*, Theob. See *Howardina*, in List of Genera, p. 62.

[2] The *Aedes* group is considered separately further on, as being more convenient.

This bulky residuum consists, in the *Culex* group (the *Aedes* group being considered further on) of, firstly, nearly a dozen genera of which insufficient information is available to form any opinion, and secondly, *Culex* itself, *sensu lato*. Of this latter well distributed and extensive genus five subgenera may be regarded as fairly well founded: *Chaetocruiomyia*, on its spiny legs; *Culiciomyia* (*Pectinopalpus*) with its long outstanding scales on the 1st palpal joint; *Taeniorhynchus* on several rather indecisive characters which taken in the aggregate may justify subgeneric rank; *Finlaya* also on several minor characters, some of which would be better for further substantiation; and *Newsteadina*, on the long scaled basal joints of the antennae in both sexes.

Heptaphlebomyia, which Theobald almost decided was not a Culicid at all, is now recognized as " a slightly modified *Culex* "!

The so-called genera sunk in *Culex* in the present paper number no less than 77, including synonyms.

The diagnoses of the following do not allow of their satisfactory disposition: *Brevirhynchus*, *Duttonia*, *Orthopodomyia*, *Eumelanomyia*, *Gualteria*, *Cacomyia* and *Catageiomyia*.[1]

Such information as could be gleaned on these appears in the generic notes.

The genera in the Culicini are now considered in two groups, those round *Culex* and those round *Aedes*, the theoretical distinction being that of the palpi; because, having little or nothing on which to test generic validities beyond the descriptions I have been compelled to adopt this method, for want of any other.

Table of Genera in CULICINI.

A	The 2nd antennal joint normal.	
B	Scutellum normal.	
C	Legs with conspicuous outstanding scales.	
D	Posterior cross vein before the anterior cross vein.	
E	All the legs with outstanding scales	*Psorophora* R. Desv.
EE	Hind legs only so-scaled ..	*Janthinosoma*, Arrib.
DD	Posterior cross vein beyond the anterior cross vein ..	*Mucidus*, Theob.
CC	Body and legs without such conspicuous outstanding scales.	
F	Posterior cross vein beyond anterior cross vein ..	*Ekrinomyia*, Leices.
FF	Posterior cross vein before anterior cross vein.	

[1] Of this I have no knowledge beyond its simple inclusion in a table of genera (Theob. Monog., v, 115).

G	Antennae in ♂ fancifully ornamented	*Lophoceratomyia*, Theob.
GG	Antennae in both sexes without such fanciful ornamentation.	
H	Palpi in ♂ 5-jointed, in ♀ 4-jointed	*Stegomyia*, Theob.
HH	Palpi in ♂ 3-jointed, in ♀ 3—4-jointed	*Culex*, L.
HHH	Palpi in ♂ and ♀ 2-jointed ..	*Ludlowia*, Theob.
BB	Scutellum produced into a blunt spine (♂ unknown) ..	*Rachionotomyia*, Theob.
AA	The 2nd antennal joint many times longer than usual ..	*Deinocerites*, Theob.

N.B.—The above table is offered with some diffidence since several of the more striking genera are unknown to me and the remainder rest on the trustworthiness of the characters set up by their promoters.

Generic notes on the Culex group.

Psorophora, R. Desv.
Janthinosoma, Arrib.
Mucidus, Theob.

These three genera are sufficiently clearly characterized, providing always that the position of the posterior cross vein beyond the anterior cross vein holds constant in all the species. This is by no means certain in *M. alternans*, Westw. and *M. sudanensis*, Theob., for instance.

As regards the palpi, Theobald says *Psorophora* has them 4-jointed, admitting that Robineau Desvoidy and Arribalzaga claimed 5 joints for them, but in *Mucidus* although he describes six species in his monograph he does not mention any number in the ♀ palpi.[1] In his "genera of the *Mucidus* type," Col. Alcock includes *Mansonia*, *Mansonioides*, "*Etorilepidomyia*" (?=*Etorleptiomyia*), *Orthopodomyia*, *Aedimyia* and *Finlaya*.

Ekrinomyia, Leices. This genus is apparently sound, the posterior cross vein being beyond the anterior one, but the prominent outstanding scales on the legs being absent prevent it being confused with the first three genera.

Stegomyia, Theob.

Quasistegomyia, Theob.
Kingia, Theob.
Blanchardiomyia, Brun. (*Desvoidya*, Blanch.).
Scutomyia, Theob.

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[1] The continual recurrence of omissions like this render it almost impossible for a systematist to arrive at just conclusions.

The principal character of *Stegomyia* is the 5-jointed ♂ palpi, the ♀ having 4 joints, and the other genera added are said to be very near it. Theobald is silent as to the number of joints in the palpi in these, except that *Quasistegomyia* has 3 joints. This would presumably throw this "genus" back into *Culex*. Edwards ranks *Scutomyia* as a synonym of *Howardina*, which latter I cannot separate from *Culex*. Some discussion may be raised here as to the real preoccupation of Blanchard's name or not, on the ground of the spelling. Meade first used the name for a genus of Tachinid flies, spelling it *Desvoidia*, which is emended in the Palaearctic Catalogue to *Desvoidya*, that is to say subsequently to the use of the term by Blanchard, who spelt it *Desvoidea*. As the terms are obviously all used in commemoration of the French dipterologist Robineau-Desvoidy the exact spelling seems immaterial.

In any case, Blanchard's name, however it may or ought to be spelt, has no real weight, being proposed as a *nomen novum* for *Armigeres*, Th., under the assumption that the latter was preoccupied, which is really not the case, *Armiger*, Hartm. (in Moll. 1842), not being a true homonym. The original name *Armigeres*, Theob., should be therefore restored as a matter of principle though generic rank must be denied it. Theobald makes the extraordinary statement that "the wings have the 3rd long vein continued on, into and through the basal cell as a distinct unscaled line"!

Brevirhynchus, Theob. The validity seems doubtful, though the alleged 4-jointed ♂ palpi and the thick sinuous proboscis in the ♀ are good characters. No definite opinion can be offered here. The name, as a generic one, is in any case ill founded.

Mimomyia, Theob.

Ludlowia, Theob.	*Banksinella*, Theob.
Megaculex, Theob.	*Boycia*, Theob.
Radioculex, Theob.	*Conopomyia*, Leices.
Hispidimyia, Theob.	

This seems a definite, if not a very clearly limited genus, characterized by the 2-jointed clavate ♂ palpi, and the more or less different shape of the marginal cell, also less distinctly by the shorter fork cells and minor characters. Edwards admits *Banksinella* as distinct, on the fore and mid ungues in the ♀ being dentate, not simple. In *Conopomyia* the 2nd antennal joint is three times the usual length and as Leicester describes both sexes of the three species it may possibly be constant enough to form a sub-genus. "*Mimomyia*" is often regarded as intermediate between the *Culex* and *Aedes* groups, but Edwards has recently shown the type species (*splendens*) to be identical with the above group of genera, whilst the other species of the genus are quite distinct, and for these he has erected the genus *Ingramia*, and this latter genus I leave amongst those requiring confirmation.

Duttonia, Newstead. On this I can pronounce no opinion, the 4-jointed ♂ palpi being uncommon. The ♂ has the " anterior tarsi sub-chelate."

Eumelanomyia, Theob. This shows a little abnormality in the thickened 2-jointed ♀ palpi, and may be left as an uncertain quantity at present.

Orthopodomyia, Theob. This again has 4-jointed ♂ palpi, the ♀ having 5 joints, the last " minute but distinct." It remains in abeyance.

Lophoceratomyia, Theob. This ranks as a good genus on the strikingly fantastic adornment of the ♂ antennae ; the ♀ has 2-jointed palpi.

Rachionotomyia, Theob. Generically distinct by the scutellum being drawn out into a blunt spine. ♀ only known.

Cyathomyia, Meij. This is recently erected, near *Finlaya*, and must be left here in abeyance as I know nothing of it, but being established by a dipterologist and not by a culicidologist is at least presumptive evidence in favour of its validity.

Oculeomyia, Theob. From the original description of this, alleging contiguous eyes, " suggesting the family *Acroceridae*," and from Theobald's figure I was willing to accord it generic rank. *Molpemyia*, Theob., is evidently identical. Yet Mr. Edwards says it is founded on a misconception, many species with contiguous eyes existing both in Culicini and Metanotricha (= my Sabethini). It is, of course, a question of degree of contiguity. Blanchard's figures of *Taeniorhynchus taeniorhynchus*, W. (p. 291), *Culex fatigans*, W. (p. 353), and others show the eyes contiguous or sub-contiguous for a short space only, but in *Oculeomyia* they are shown by Theobald as sub-contiguous for half their length, and this seems to me sufficiently distinct from other genera to form a separate genus. I am disposed to leave the question open at present.

Deinocerites, Theob. (*Brachiomyia*, Theob.) The very long 2nd antennal joint makes this a good genus, the pilose ♂ antennae forming a second character. Theobald made a subfamily of this genus and *Dinomimetes*, Knab, together, but the latter belongs to the Sabethini and there is certainly nothing above generic rank in either.

Heptaphlebomyia, Theob. This has given rise to the most erratic views, Theobald, when first describing it, saying it " must undoubtedly be placed in a separate subfamily on account of there being 7, not 6, longitudinal scaled veins," [1] subsequently (Monog. iv, 531) even adding, " the strangeness of the venation might be thought sufficient to exclude them from the *Culicidae* altogether," (!) yet he admits on the same page that the vein is not, as a rule, scaled for its whole length, and finally Alcock defines the genus as " a somewhat modified *Culex*."

[1] Monog. iii, 336.

In describing what Theobald assumes (with a doubt) to be the ♂ of *H. simplex*, the type species, he says the 7th vein is *apparently not scaled*, and moreover his figure of the wing shows no 7th vein at all! In describing *H. argenteopunctata*, Ventr., he says "this species has a false nerve covered with a row of scales forming a 7th vein." A *row of scales* cannot constitute a *vein*, as his descriptions would lead one to suppose, but remains simply a row of scales. I have never seen *Heptaphlebomyia*, but suspect that the so-called 7th vein is merely the usual fold of the wing a little more distinct than usual, and bearing scales or not according to the species or perhaps, to sex also.[1] Mr. Edwards finally disposes of *H. simplex* and with it the "subfamily" by registering the ♂ as synonymous with *Culex decens*, Theob., and the ♀ with *C. univittatus*, Theob.

The genus Culex, L.

Sub-genera of CULEX.

The following five species or groups of species appear to have more or less claim to sub-generic rank in *Culex*.

Chaetocruiomyia, Theob. This is characterized by long spines on the fore tibiae and lesser, though conspicuous ones on the femora. Other supporting characters are claimed for it. Its generic validity is at least dubious.

Culiciomyia, Theob.
(*Pectinopalpus*, Theob.).

This is erected on a row of long outstanding scales on the ♂ palpi, a feature omitted from the original description. Edwards draws attention to this fact (Bull. Ent. Res. ii, 242) and *Pectinopalpus* becomes synonymous.

Taeniorhynchus, Arrib.
(*Pseudotaeniorhynchus*, Theob.;
Rhynchotaenia, Brethes).

In this the ♂ palpi are clavate, turned downwards at the tips, the ♀ palpi are said to be 5-jointed, the last very minute; the hind metatarsi distinctly shorter than the tibiae, differing thus from *Culex* proper, in which the ♂ palpi are not clavate and are turned upwards at the tip, the ♀ possessing only 3 or 4 joints, and the hind metatarsi are at least as long as the tibiae, generally longer. The distinctions *read* satisfactorily, all depends on the absence of intermediary forms. Edwards thinks *Coquillettidea* may be synonymous.

Finlaya, Theob. This is founded on the ♀ only and is recorded as possessing three abnormalities, a 15-jointed antenna, the two basal joints of which are scaly, and tufts of scales below the abdomen towards the tip.

[1] It is curious that Theobald himself in his 1st vol. (pp. 18, 19) calls attention to the *folds* in the wing, and advises caution not to misinterpret them as veins.

Theobald at first regarded it as intermediate between the Culicines and the Aedines, but later he placed it in the former section, whilst Edwards sinks it in *Ochlerotatus*.

Newsteadina, Theob. The alleged 4-jointed ♂ palpi and the long scales in both sexes on the basal antennal joints may separate this from *Culex* proper, but it must be noted that some species of *Culex* have the basal antennal joints more or less scaled. Its even subgeneric rank is very uncertain, as the supposed 4th palpal joint may be apparent only, due to a constriction.

Mr. Edwards (Bull. Ent. Res. iii, 14) definitely sinks in *Ochlerotatus*, the following genera as synonymous: *Acartomyia*, *Finlaya*, *Aedimorphus*, *Culicelsa*, *Culicada*, *Ecculex*, *Protoculex*, *Pseudoculex*, *Chrysoconops*, *Reedomyia*, *Pecomyia*, *Pseudograbhamia*, *Phagomyia*, *Polyleptiomyia*, *Lepidotomyia*, *Lepidoplatys*, *Pseudoskusea*, *Pseudohowardina*, *Protomacleaya*, *Duttonia*, *Mimeteculex*, *Geitonomyia*, *Myxosquamus*, *Neopecomyia*, *Stenoscutus*, *Bathosomyia*, and *Leslieomyia*. Also, with a doubt, *Gilesia*, *Gualteria*, *Danielsia*, *Cacomyia*, *Stegoconops*, *Molpemyia* and *Andersonia*.

Mr. Edwards separates *Ochlerotatus* from *Culex* (Bull. Ent. Res. ii, 242) partly by the last two joints of the ♂ palpi being thickened and more or less turned downwards at the tip, instead of being thin and turned upwards, as in the latter genus, but in his above list of synonyms are included *Lepidotomyia*, *Pecomyia*, *Reedomyia*, *Lepidoplatys*, *Culicada*, *Culicelsa* and *Culiseta*, and of these Theobald does not mention the ♂ palpi as clavate, although it is true this is merely negative evidence. He separates the two genera *Ochlerotatus* and *Culex*, in the females by ungual characters, and speaks very positively on this point, but I am not at present prepared to accord it such value.

It seems impossible to recognize *Ochlerotatus* simply on the strength of clavate ♂ palpi, there being so many genera admittedly with the ♂ palpi more or less swollen at the tip[1] and which would be annectant, and in addition there would be semi-intermediate forms, so to speak, to be found in those species which were slightly aberrant in this character, yet included either in the clavate palpi genera or the non-clavate palpi ones.

It has therefore seemed justifiable to sink in *Culex* all genera considered by Mr. Edwards as synonymous with *Ochlerotatus*, except *Finlaya* and *Duttonia*, the former of which ranks in the present paper as a sub-genus of *Culex* and the latter as a genus left in abeyance on account of the 4-jointed ♂ palpi.

Generic synonyms of CULEX.

Acartomyia, Theob.
Aedimorphus, Theob.
Andersonia, Strickland.
Aporoculex, Theob.
Bancroftia, Lutz.
Bathosomyia, Theob.

[1] These are *Macleaya*, *Gymnometopa*, *Theobaldia*, *Grabhamia*, *Pseudograbhamia* and *Mimeteculex*, with no doubt others.

Carrollia, Lutz in Theob.
Ceratocystia, Dyar and Knab.
Chrysoconops, Goeldi.
Culicada, Felt.
Culicella, Felt.
Culicelsa, Felt.
Culiseta, Felt.
Danielsia, Theob.
Diceromyia, Theob.
Ecculex, Felt.
Etorleptiomyia, Theob.
(**Etorilepidomyia**, Alcock, *em.*)
Feltidia, Dyar.
Geitonomyia, Leices.
Gilesia, Theob.
Gnophodeomyia, Theob.
Grabhamia, Theob.
Heptaphlebomyia, Theob.
Heteronycha, Arrib.
Howardina, Theob.
Hulecoeteomyia, Theob.
Jamesia, Christophers.
Lasioconops, Theob.
Leicesteria, Theob.
Lepidoplatys, Coq.
Lepidotomyia, I. Theob.
Lepidotomyia, II. Theob.
Leslieomyia, Christophers.
Leucomyia, Theob.
Lutzia, Theob.
Macleaya, Theob.
Maillotia, Theob.
Mansonia, Blanch.
Mansonioides, Theob.
Melanoconion, Theob.
Microculex, Theob.
Mimeteculex, Theob.
Mimeteomyia, Theob.
Mochlostyrax, Dyar and Knab.
Myxosquamus, Theob.
Neoculex, Dyar.
Neomacleaya, Theob.
Neomelanoconion, Theob. ♀.
Neopecomyia, Theob.
Ochlerotatus, Arrib.
O'Reillia, Ludlow.
Panoplites, Theob.
Pardomyia, Theob.
Pecomyia, Theob.
Phagomyia, Theob.
Pneumaculex, Dyar.
Polyleptiomyia, Theob.
Popea, Ludlow.
Protoculex, Felt.
Protomacleaya, Theob.
Protomelanoconion, Theob.
Pseudocarrollia, Theob.
Pseudoculex, Dyar.
Pseudograbhamia, Theob.
Pseudoheptaphlebomyia, Ventrillon.
Pseudohowardina, Theob.
Pseudoskusea, Theob.
Pseudotheobaldia, Theob.
Rachisoura, Theob.
Reedomyia, Ludlow.
? **Stegoconops**, Lutz.
Stenoscutus, Theob.
Theobaldia, Nev. Lem.
Theobaldinella, Blanch.
Theobaldiomyia, Brun., nom. nov. for *Leucomyia*, Theob., preocc.
Thomasina, Newstead and Carter.
Trichopronomyia, Theob.
Trichorhynchomyia, Brun., nom nov. for *Trichorhynchus*, Theob., preocc.

N.B.—Accepted synonyms of any so-called genera are included in the above list.

The majority of the above cannot be distinguished from *Culex* by any characters that would be recognized by a systematic dipterologist. Those which appear to show (from the generic descriptions) the greatest modifications are noted below.

Acartomyia has the 1st antennal joint thickened and scaly; *Aporoculex* is founded on some trifling difference in venation;

Bancroftia has two prominent tufts of hair-like scales, or scale-like hairs, on the scutellum; *Bathosomyia* has peculiar ♂ genitalia, and the "1st posterior cell almost uniform in breadth" (!); *Carrollia* has the abdominal segments in the ♂ deeply constricted at the base; *Ceratocystia* is synonymous with *Grabhamia* (*t.* Coq.); *Culicada* is said to have 4-jointed ♂ palpi, but fuller information on this is required; *Diceromyia* is synonymous with *Mansonioides* (*t.* Edwards); *Heptaphlebomyia* is dealt with elsewhere (see p. 41); *Howardina* was at first admitted by Edwards on claw characters, but in a later paper he abandons it; *Lasioconops* was founded on a misconception, through some lepidopterous scales adhering, accidentally to the type; *Leucomyia* is said to have 5-jointed ♂ palpi; *Mansonia* is reputed to have 4-jointed ♂ palpi; *Melanoconion* is a group of small black species with densely scaled wings; *Microculex* is a "small stout gnat totally different from any other member of the genus" (*Culex*); *Mimeteculex* has the two basal antennal joints scaled; *Mimeteomyia* has the 2nd and 3rd antennal joints rather enlarged; *Mochlostyrax* based on larval characters, is allied to *Melanoconion* in the adult stage; *Pardomyia* is supposed to possess a novel venation but differs only slightly from normal *Culex*; *Pecomyia* has unequal hind ungues in the ♂, said to be unique, also the ♂ genitalia very marked; *Phagomyia* is included here on account of Theobald associating it with other "genera" belonging here, though he says it is near *Stegomyia*; *Pneumaculex* was founded originally on larval characters only, but the adult is now known and is said to be near *Danielsia*, judging from the ♂ genitalia; *Polyleptiomyia* is included for the same reason as *Phagomyia*; *Pseudoskusea* has the mid-ungues of the ♂ equal in size, a character found only in this genus; *Rachisoura* has the plumosity of the ♂ antennae a little less dense than usual; *Reedomyia* has the ♂ genitalia "very marked"; *Theobaldia* forms for Theobald a natural group of five species with spotted wings, clubbed antennae and thick wing scales in ♂ and ♀, Edwards ranking it generically distinct on claw characters; *Thomasina* is supposed to have the ♂ palpi short and the ♀ palpi "relatively long"[1] and *Trichorhynchomyia* (*nom. nov.* for *Trichorhynchus*, preocc.) is said to be "very marked" and to be intermediate between the *Culex* and *Stegomyia* groups.

The AEDES group.

Coming to a closer examination of the *Aedes* group we find much difficulty in the ambiguous or actually negative information afforded us as regards the palpal joints, and the plumosity or pilosity

[1] The authors figure a ♂ head in which the palpi are *only a very little shorter* than the prosboscis, though their diagnosis reads "much shorter." This exaggeration of minute differences is the cause of the bulk of the trouble in understanding culicid writer's meanings. They then figure an *isolated* ♀ palpus, so there is no means of judging their idea of "relatively short." If they are drawn to the same scale both are of equal length.

of the ♂ antennae, both evidently uncertain quantities in many cases.

The following table attempts to elucidate the few genera that appear well founded, but their validity, of course, depends on the definite nature and constancy of the points tabulated, and it is seen that practically nothing but palpal characters can be used. The other recorded genera appear of uncertain validity.

Table of genera.

Proboscis not elbowed.
 Antennae 14-jointed in ♀ as usual.
  a. Palpi in ♂ 5-jointed, in ♀ 5-jointed *Haemagogus*, Will.
  b. ,, ,, 3 ,, ,, 3 ,, *Skusea*, Theob.
  c. ,, ,, 2 ,, ,, 4 ,, *Aedes*, Mg.
  d. ,, ,, 2 ,, ,, 2 ,, *Uranotaenia*, Arrib.
 Antennae 13-jointed in ♀, ♀ palpi 1-jointed: ♂ unknown .. .. *Hodgesia*, Theob.
Proboscis elbowed .. .. *Harpagomyia*, Meij.

Generic notes on the AEDES group.

Haemagogus, Will. By the 5-jointed palpi in ♂ and ♀ this should be a good genus, though the 1st and 5th joints are very small. *Colonemyia*, Leices., may be synonymous as it is also said (with a doubt) to possess 5-jointed palpi.

Zeugnomyia, Leices. Palpi in ♂ 3, in ♀ 4-jointed. On this it cannot be synonymous with either *Aedes* or *Skusea*. Its author says it is allied to *Colonemyia*, *Skeiromyia* and *Uranotaenia*, and through these to the *Wyeomyia* group. For my own part I leave its position in abeyance at present.

Skusea, Theob. Of its 3-jointed palpi in both sexes, the last is " small and ripple-like," and on this it is tentatively ranked as valid, at least *pro. tem.* There seems nothing to separate *Aioretomyia*, Leices., and *Acalleomyia*, Leices., from *Skusea*.

Aedes, Mg. Technically with 2-jointed ♂ and 4-jointed ♀ palpi, this genus is sufficiently distinct from *Culex*, but several others must be included as identical, as *Micraedes*, Coq., *Aedeomyia*, Theob., *Aedinus*, Lutz., and probably both *Leptosomatomyia*, Theob. (established on a unique ♂), and *Squamomyia*, Theob. (of which the ♀ is unknown).

Uranotaenia, Arrib. Apparently a natural group whether of generic rank or not, characterized by 2-jointed palpi in ♂ and ♀, a proboscis swollen at the tip, the usually quite small size and often brilliant blue colouring. *Pseudouranotaenia*, Theob., *Anisocheleomyia*, Theob., *Verrallina*, Theob. (in which trace of an additional basal palpal joint is spoken of in the ♀, the ♂ being unknown), and *Ficalbia*, Theob., are evidently synonyms.

Hodgesia, Theob. The ♂ is unknown, which is unsatisfactory. The ♀ antenna is reputed to have only 13-joints, which would be an abnormality, and the 1st joint is large and globular. The palpi is one-jointed only, which in itself would entitle it to generic rank, especially if a similar character exists in the ♂. From the one-jointed palpi attributed to *Skeiromyia*, Leices., this may be synonymous.

Harpagomyia, Meij. The short thick elbowed proboscis distinguishes this. *Grahamia*, Theob., is, on his own showing, synonymous, as, though it appeared first in print, the paper was for private circulation only. *Malaya*, Leices., is also synonymous. for Edwards has shown that though Leicester described the metanotum (" mesonotum," *lapsus*) as with scales, which would throw the genus in the Sabethini, it is probable these were accidentally attached, and in that case the genus falls here, and becomes synonymous with *Harpagomyia*. Moreover, the name *Malaya* is practically preoccupied by *Malaia*, Heller, in 1891.

However, if the genus *has* scales on the metanotum it in all probability will be synonymous with *Limatus*, Theob.

Topomyia, Leices. No palpal information is given by the author, though he describes nine species. The males are said to be very gossamer-like and the genus may quite likely prove a good one.

Genera of uncertain position.

The following genera are left in abeyance, simply in the section Culicini, as no exact position is at present assignable to them.

Cacomyia, Coq. A large cluster of outstanding blunt spines are found below the penultimate abdominal segment; the palpi are half as long as the proboscis, and some alleged slight differences of venation are urged in favour of this genus.

Theobald says *Gualteria* has similar characters, so the two may be identical, in which case the latter has precedence, but at the time of its erection it was said to be " near *Danielsia*," a genus of the *Culex* group. Theobald placed it with the Aedines, but it seems likely that with its ♂ palpi half as long as the proboscis it should be referred, and probably *Gualteria* also, to the *Culex* group.

Philodendromyia, Theob., and **Polylepidomyia**, Theob.

These two genera, once placed erroneously in the Sabethini group, are referred by Theobald as probably intermediate between the *Culex* and *Aedes* groups. Of the former the ♂ antennae are pilose, the ♀ being unknown. Of the latter the ♂ is unknown, and both palpi and proboscis are said to vary in almost every individual.

Ingramia, Edwards. (*Mimomyia*, Theob. *pt* ; *Dasymyia*, Leices., *preocc.*)

This genus is really a new name for the species recently placed in *Mimomyia*, except the type species, *splendens*. *Dasymyia* is synonymous with *Ingramia*, but is preoccupied.

Section IV. SABETHINI.

The genera comprised herein under this section are distributed finally by Theobald (Monog., v, 554 et seq.) in three sub-families: (1) *Trichoprosoponinae*, with *Runchomyia*, *Trichoprosopon*, *Joblotia* (wrongly admitted as a good genus), *Hyloconops*, *Goeldia* and *Eretmapodites*; (2) *Dendromyinae*, with *Sabethes*, *Phoniomyia*, *Wyeomyia*, *Menolepis*, *Bolbodeomyia*, *Sabethoides*, *Dendromyia* and *Prosopolepis*; *Limatus* forming his other sub-family. Two other genera *Philodendromyia* and *Polylepidomyia*, though included in his table are rightfully excluded in a footnote and referred to the *Uranotaenia* group, the metanotum being nude.

He places *Dinomimetes*, Knab., in the *Deinoceratinae*, a subfamily he characterizes by the very long 2nd antennal joint, and short palpi in both sexes, but the metanotum bearing setae is a stronger character than the abnormal length of the 2nd antennal joint, and the genus must come in the present section.

In separating the genera Theobald uses scale distribution, some points of venation and the length and shape of the proboscis as distinguishing characters.

On examining the genera systematically, two are seen to be individually specialized, *Dinomimetes* and *Runchomyia*, whilst in possessing the palpi always more than half as long as the proboscis, *Trichoposopon* ♂ ♀, *Eretmapodites* ♂ and *Hyloconops* ♂ are separated from the remainder, in which they are at most one-third as long as the proboscis.

Sabethes is easily recognized by the paddle-like scales on some of the legs, a feature absent in the other genera except in some species of *Eretmapodites* (*v.* tab. genera, *post*). This feature is by no means generic in itself, it is not dependent on sex and occurs in various genera in diptera, *Empis*, *Rhamphomyia*, etc.

The proboscis varies considerably in length, from half as long as to longer than the whole body, and may be dilated or swollen apically or not. No generic characters can be safely drawn from it in this section except to identify *Limatus*. The antennae are normally pilose in both sexes, a little denser in the ♂, and this character appears fairly constant, but it is subplumose or plumose in *Sabethes* and certainly plumose in *Hyloconops*.

Even of *Wyeomyia* I have seen no definite statement of the number of palpal joints in the ♂, whilst there seems an uncertainty of them being 3-jointed in the ♀.

The presence of chaetae only scales only or both together may all be regarded as of equal taxonomic value.

Table of genera in SABETHINI.

A 2nd antennal joint very long. (Metanotum with chaetae) .. *Dinomimetes*, Knab.

AA 2nd antennal joint normal.

B Palpi comparatively long, always more than half as long as proboscis.

C	Antennae pilose in ♂ as well as ♀.	
D	Metanotum with both chaetae and scales; palpi in ♂ 4-jointed, in ♀, 3-jointed.	*Trichoposopon*, Theob., ♂ ♀.
DD	Metanotum with chaetae only; palpi in ♂ 5-jointed, in ♀ 4-jointed. ..	*Eretmapodites*, Theob., ♂.
CC	Antennae plumose in ♂, pilose in ♀ (metanotum with chaetae and scales)	*Hyloconops*,[1] Lutz, ♂.
BB	Palpi comparatively short, or very short; at most one-third the length of the proboscis. (In *Goeldia* and some species in either sex in *Sabethes*, about $\frac{1}{3}$ as long as proboscis. Metanotum with chaetae only, scales only, or both).	
E	Frons with a protuberance between the eyes. (Proboscis longer than the whole body)	*Runchomyia*, Theob.
EE	Frons normal.	
F	Proboscis not elbowed.	
G	Legs with paddle-like scales. (Antennae in ♂ moderately or quite plumose, in ♀ pilose: metanotum with chaetae)	*Sabethes*, R. Desv.
GG	Legs without such scales. (Antennae pilose ♂ ♀).	
H	Palpi ostensibly 4-jointed. (Metanotum with chaetae only, scales only, or both)	*Wyeomyia*, Theob., (*s. latu*, *mihi*.)
	Metanotum with chaetae only or scales only; palpi in ♂ never so long as $\frac{1}{3}$ of the proboscis.	sub-genus *Wyeomyia*, Theob.
	Metanotum with both chaetae and scales; palpi in ♂ one-third as long as proboscis, in ♀ very short.	sub-genus *Goeldia*,[2] Theob.
HH	Palpi 2-jointed in ♂ and ♀. (Antennae in ♀ densely pilose) ..	*Sabethoides*,[3] Theob.
FF	Proboscis elbowed.	*Limatus*, Theob.

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[1] It is impossible to satisfactorily include *Hyloconops* ♀ in the present table, Theobald saying simply that the ♀ palpi are "short," the ♀ antennae being pilose, these definitions being insufficient for the purpose.

[2] Some doubt attaches to the alleged ♀ of this genus.

[3] *Sabethinus*, Lutz, may be synonymous with *Sabethoides*, according to Theo-

Generic notes in SABETHINI.

Dinomimetes, Knab. The very long 2nd antennal joint "14 times as long as wide" conspicuously separates this from all other genera in the family except *Deinocerites*, a genus of Culicini. The eyes are said by Theobald to be contiguous, and this is made a generic character but Edwards points out that this is no uncommon feature both in Culicini and Sabethini.

Trichoprosopon, Theob. A sufficiently distinct genus by the metanotal adornment coupled with palpal characters.

Joblotia, Blanch., is an absolute synonym, erected as a *nom. nov.* under the mistaken assumption that Theobald's name was preoccupied by *Trichoprosopus*, Macq., in Diptera.

Lutz would employ *Joblotia* as a separate genus, for *Trichoprosopon lunata*, Theob , characterized by the clypeus not being hairy.

Lestiocampa, Dyar and Knab. Firstly this is inadmissible, being founded on larval characters only. Theobald says that in the adult it differs from *Runchomyia* only in the absence of the conical frons, but he refers some of the species to *Trichoprosopon*, with which it may be considered synonymous.

Eretmapodites, Theob. This author claims generic rank for this on the thin hairless ♂ palpi, the ungues, and the greater length of the two last antennal joints (presumably in both sexes), but it is admitted here as valid on the metanotal [1] and palpal characters given in the table.

Some species, at least in the ♂, have paddle-like scales on the legs, in this respect resembling *Sabethes*. These species, in the ♂ ♂ are recognizable by the thin palpi, but I know of no method of distinguishing the ♀ ♀ with certainty.

Hyloconops, Lutz. Theobald professes to differentiate this genus from *Trichoprosopon* by the "swollen apex of the proboscis and the shorter ♂ palpi," but the latter is said to have the proboscis with "rather expanded apex." The plumose instead of pilose ♂ antennae, assuming no doubt on the matter, is a better distinction. As regards the ♀ *Hyloconops*, insufficient information is accorded to be able to identify it with certainty.

Chaetomyia, Leices. (renamed *Leicesteriomyia*, Brun.), must, on account of its metanotum bearing scales and chaetae, be removed from the Culicini to this section. In my table of genera it comes with *Hyloconops*, from which insufficient information as to the latter genus precludes my separating it. It may possibly be synonymous.

Runchomyia, Theob. (*Binotia*, Blanch.). The frontal prominence in this genus sufficiently distinguishes it. The proboscis

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bald; on the other hand it seems quite possible to be synonymous with *Wyeomyia* (*v.* generic notes, *post*).

[1] Newstead describing a new species from the Congo says no metanotal scales or chaetae are present. They may have been rubbed off, or perhaps the species is placed wrongly here.

being longer than the whole body is also a useful character, although it shares this distinction with at least *Phoniomyia*.

Sabethes, R. Desv. This genus, one of the oldest erected in the family, is well characterized by the paddle-like fringe of scales on the legs, a peculiarity shared only with some species of *Eretmapodites* (*v. ante*).

Wyeomyia, Theob. This appears, in the wide sense, a good genus, but it seems doubtful if it can be subdivided, at least any further than into *Wyeomyia s. str.* and *Goeldia*, Theob., and additional species may break down the apparent differences between these. The ♀ form attributed to *Goeldia* is not definitely known to belong here.

Phoniomyia, Theob.
Menolepis, Lutz.
Bolbodeomyia, Theob.
Dendromyia, Theob. (*Heinzmannia*, Ludl.).
Prosopolepis, Lutz.

There seems no justification for recognizing any of these as good genera. Theobald would found *Phoniomyia* on the proboscis being " longer than the whole body " but in one species *P. indica*, it is only " nearly as long " as the whole body, and some species of *Wyeomyia* probably possess it nearly as long as in *P. indica*. The white scaled metanotum in *Menolepis*, the " complex ♂ genitalia " forming a " very marked genus" in *Bolbodeomyia*, and the scaled clypeus in *Prosopolepis* are all indefinite or quite minor characters, and all these must sink in *Wyeomyia*, *sensu lato*.

Sabethoides, Theob. The alleged 2-jointed palpi afford the only grounds on which to establish this.

As regards *Sabethinus*, Lutz., Theobald admits that " apart from any marked genitalic diversity " (he notes the genitalia as very marked) this genus only differs from *Sabethoides* by the swollen tip of the proboscis.

In Theobald's description of *Sabethinus* he mentions no number of joints to the palpi, but as *Sabethoides* is only admitted in this paper as a good genus on the strength of its alleged 2-jointed palpi, both of these genera become synonymous with *Wyeomyia* if their palpi prove 4-jointed as in the latter. If they have 3-jointed palpi they might, united, form a separate genus, or an unpaddled legged section of *Sabethes*, the recorded variation of the antennae and proboscis being of a minor nature.

Limatus, Theob. (*Simondella*, Laveran). The elbowed proboscis seems sufficient on which to erect this genus.

Genera of uncertain position in CULICIDAE.

The following genera are regarded by Theobald as of uncertain position in the family. I have no further information of them.

Isostomyia,[1] Coq.
Lepidosia, Coq. Science xxiii, 314 (1906).
Tinoletes Coq. Proc. Ent. Soc. Wash. vii, 185 (1906).

The sub-family CORETHRINAE.

There is nothing to be criticized in this group the few admitted genera being well founded, *Corethra*,[2] Mg., *Chaoborus*, Lichtenstein (*Sayomia* Coq.), and *Ramcia*,[3] Annandale.

The question of the synonymy of the first two genera was fully discussed by me recently.[4]

Mr. W. S. Dallas, F.L.S., has given [5] a translation of a paper by Prof. Meinert on *Corethra*, in which the latter accepted *plumicornis*, F., as the type species simply because it figured as such in popular manuals.

Prof. Meinert, however, added, "Strictly speaking, the generic name *Corethra* should be retained for *Tipula culiciformis*, DeGeer, and when other species such as *C. plumicornis* and *pallida* were afterwards proved to belong to a different genus from the first named species a new generic name ought to have been selected for them." He, however, refrained from making the transposition, and concluded, "If such a change is eventually to be made, it had better remain over for some future monographer of the group."

The conclusions reached substantiate the synonymy as worked out by me, though at the time I had no knowledge of Meinert's paper.

Some controversy has of late years arisen by the mosquito workers desiring to exclude the *Corethrinae* from the *Culicidae*, on the absence of a biting mouth and scales, or because they do not appear to have any economic value, perhaps. This cannot be done. The two groups have been accepted without dispute in a single family for a century by dipterologists, who, when all is said and done, must remain the ultimate judges of systematic questions.

In spite of attempts to prove the contrary, the most recent researches have proved the biological affinity of the two groups, Alcock asserting this most emphatically, and the new genus *Ramcia*, set up by Dr. Annandale,[6] though decidely more corethrine than culicine, is distinctly intermediate in nature.

Dr. Adolf Eysell in his paper "Sind die Culiciden eine Familie"[7] desires to separate the corethrines and would also form a separate family of the anophelines, but both suggestions are dipterologically incorrect.

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[1] I can find no reference to the description of this genus.

[2] I have shown *Mochlonyx*, Lw. to be synonymous with *Corethra*. (Rec. Ind. Mus. iv, 317).

[3] Edwards has adopted the term *Chaoborinae* for this subfamily, but the antiquity of *Corethrinae* must preserve it from alteration.

[4] Rec. Ind. Mus. iv, 317 and vi, 227

[5] Ann. Mag. Nat. His. (5) xii, 374 (1883).

[6] Rec Ind. Mus. iv, 505.

[7] Archiv. fur Schiffs. und Tropen Hygiene ix, 51–55 (1905).

SYSTEMATIC CATALOGUE OF VALID GENERA IN CULICIDAE.

Sub-family. I. *CULICINAE.*

Sect. I. ANOPHELINI.

1 **Anopheles**, Mg.[1]
2 **Chagasia**, Cruz.
3 **Calvertina**, Ludl.
4 **Bironella**, Theob.
5 **Dactylomyia**, Newst. and Carter.

Sect. II. MEGARHINI.

6 **Megarhinus**, R. Desv.
Lynchiella, Lahille.
7 **Ankylorhynchus**, Lutz.
8 **Toxorhynchites**, Theob.
Worcesteria, Banks.
Teromyia, Leices.

Sect. III. CULICINI.

CULEX GROUP.

9 **Psorophora**, R. Desv.
10 **Janthinosoma**, Arrib.
11 **Mucidus**, Theob.
12 **Ekrinomyia**, Leices.
13 **Lophoceratomyia**, Theob.
14 **Stegomyia**, Theob.
Quasistegomyia, Theob.
Kingia, Theob.
Armigeres, Theob.
Desvoidya, Blanch.
Blanchardiomyia, Brun.
Scutomyia, Theob.
Gymnometopa, Coq.
15 **Mimomyia**, Theob.
Ludlowia, Theob.
Megaculex, Theob.
Radioculex, Theob.
Banksinella, Theob.
Boycia, Newstead.
Hispidomyia, Theob.
Conopomyia, Leices.
16 **Culex**, L.[2]
Sub-genera—
I *Chaetocruiomyia*, Theob.

Culex, L. (*contd.*)
II *Culiciomyia*, Theob.
Pectinopalpus, Theob.
Neomelanoconion, Theob. ♂ only.
III *Taeniorhynchus*, Arrib.
Pseudotaeniorhynchus, Theob.
Rhynchotaenia, Brethes.
? *Coquillettidea*, Dyar.
IV *Finlaya*, Theob.
V *Newsteadina*, Theob.
17 **Rachionotomyia**, Theob.
18 **Deinocerites**, Theob.
Brachiomyia, Theob.
19 ? **Cyathomyia**, Meij.

Genera requiring confirmation.

1 *Brevirhynchus*, Theob.
2 *Duttonia*, Newstead.
3 *Eumelanomyia*, Theob.
4 *Orthopodomyia*, Theob.
5 *Oculeomyia*, Theob.
? *Molpemyia*, Theob.

AEDES GROUP.

20 **Haemagogus**, Will
? *Colonemyia*, Leices.
21 **Skusea**, Theob.
Aioretomyia, Leices.
Acalleomyia, Leices.
22 **Aedes**, Mg.
Micraedes, Coq.
Aedeomyia, Theob.
Aedinus, Lutz.
? *Leptosomatomyia*, Theob.
? *Squamomyia*, Theob.
23 **Uranotaenia**, Arrib.
Pseudouranotaenia, Theob.
Anisocheleomyia, Theob.
Verrallina, Theob.
Ficalbia, Theob.
24 **Hodgesia**, Theob.
? *Skeiromyia*, Leices.

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[1] For list of synonyms, see p. 34.

[2] For list of synonyms, see p. 43.

25 **Harpagomyia**, Meij.
Grahamia, Theob.
Malaya, Leices.

Genera requiring confirmation.

1 *Zeugnomyia*, Leices.
2 *Topomyia*, Leices.
3 *Ingramia*, Edw.
Dasymyia, Leices.
Mimomyia, Theob.
4 *Pseudograhamia*, Th.[1]

Genera requiring confirmation belonging to Section CULICINI.

(Uncertain whether to *Culex* or *Aedes* group.)

1 *Philodendromyia*, Theob.
2 *Polylepidomyia*, Theob.
3 *Cacomyia*, Coq.
4 *Gualteria*, Lutz.

Sect. IV. SABETHINI.

26 **Dinomimetes**, Knab.
Trichoprosopon, Theob.
Joblotia, Blanch.
Lestiocampa, Dyar and Knab.
27 **Eretmapodites**, Theob.
28 **Hyloconops**, Lutz.
Leicesteriomyia, Brun.
(*Chaetomyia*, Leices.)
29 **Runchomyia**, Theob.
Binotia, Blanch.
30 **Sabethes**, R. Desv.
31 **Wyeomyia**, Theob.
Sub-genera—
I *Wyeomyia*, Theob.
II *Goeldia*, Theob.
(Syns. *Wyeomyia*, *s. lato*).
Phoniomyia, Theob.
Menolepis, Lutz.
Bolbodeomyia, Theob.
Dendromyia, Theob.
(*Heinzmannia*, Ludl.)
Prosopolepis, Lutz.
32 **Sabethoides**, Theob.
Sabethinus, Lutz.
33 **Limatus**, Theob.
Simondella, Laveran.

Sub-fam. II. *CORETHRINAE*.

34 **Corethra**, Mg.
Mochlonyx, Lw.
35 **Chaoborus**, Lichtenstein.
Sayomyia, Coq.
36 **Ramcia**, Annandale.

INDEX OF PUBLISHED GENERA IN CULICIDAE.[2]

Acalleomyia, Leices., Cul. Mal. 194 (1908).
Type, *A. obscurus*, Leices., sp. nov., ♂ ♀, *l.c.*, the only species. =*Skusea*, Theob.

Acartomyia, Theob., Monog. iii, 251 (1913).
Type, *A. zammitii*, Theob., sp. nov., ♂ ♀, *l.c.* 252, the only species. =*Culex*, L.

Aedeomyia, Theob., Monog. ii, 218 (1901) (sp. allotted); Jour. Trop. Med. iv, 235 (July 15, 1901), (nom. nud.)
Aedomyia, Edwards, emend. Bull. Ent. Res. iii, 24.
Type, *Aedes squamipennis*, Arrib., ♂ ♀, the first species, by present designation. =*Aedes*, Mg.

[1] Nothing sufficiently definite about this to estimate its generic validity.
[2] In the present index, "Monog." refers to Theobald's "Monograph of the Culicidae of the World," and Leices. "Cul. Mal." to a long paper by Dr. Leicester published in the "Studies from the Institute of Medical Research," Kuala Lumpur, vol. iii (1908).

Aedes, Mg., Syst. Besch. i, 13 (1818).
Type, *Aedes cinereus*, Mg., by original designation.
A valid genus.

Aedimorphus, Theob., Monog. iii, 290 (1903).
Type, *Uranotaenia domestica*, Theob., *l.c.*, ii, 253, ♀, the only species at the erection of the genus. =*Culex*, L.

Aedinus, Lutz., in Peryassu, Os Culic. do Bras. 36 (1908).
Type, *A. amazonensis*, Lutz., sp. nov., by original designation. =*Aedes*, Mg.

Aioretomyia, Leices., Cul. Mal. 185 (1908).
Type, *A. varietas*, Leices., sp. nov., ♂ ♀, *l.c.*, the first of the six species, by present designation. =*Skusea*, Theob.

Aldrichia, Theob., Monog. iii, 353, App. (1903).
Aldrichinella, Theob. emend.; *loc. cit.*, v, 77 (1910). *Aldrichia*, preocc. Coq., 1894, in Bombylidae.
Type, *A. error*, Theob., *l.c.*, iii, 353, ♀, by original designation. =*Anopheles*, Mg.

Andersonia, Strickland, Entom. (1911), p. 250.
Type, *A. tasmaniensis*, Strick., sp. nov., *l.c.*, by original designation. =*Culex*, L.

Anisocheleomyia, Theob., Entom. xxxviii, 52 (1905); Monog., iv, 570.
Type, *A. nivipes*, Theob., sp. nov. (the first of the four species given in his Monog., iv, 570) by present designation.
=*Uranotaenia*, Arrib.

Ankylorhynchus, Lutz., in Bourroul's Mosq. Bras. 3 (1904).
Type, *Culex violaceus*, Hgg., in Wied. by present designation[1] as the earliest described of the three species referred to this genus by Theobald. (Monog. iv, 127). A valid genus.

Anopheles, Mg., Syst. Besch. i, 10 (1818).
Type, *A. maculipennis*, Mg., by customary european acceptance.[2]
N.B.—Coquillett quotes *bifurcatus*, L., as the type species, but *A. maculipennis* is I think usually regarded in Europe as the type. A valid genus.

Aporoculex, Theob., Monog. iv, 316 (1907).
Type, *A. punctipes*, Theob., sp. nov., ♀, the only species.
=*Culex*, L.

Armigeres, Theob., Monog. i, 322 (1901).
Type, *Culex obturbans*, Walk., the only species at time of erection.
N.B.—*Armigeres* is *not* preoccupied, *Armiger*, Hartm., in Moll., 1842, not being a homonym, and this name should be res-

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1 Lutz's work is not accessible, and Theobald does not note any type species having been selected.

2 Prof. Kertesz's Catalogue adopts the name *claviger*, F., for this well-known species. The alteration, after a century, is quite inadmissible.

tored in place of *Desvoidya*, Blanch., if the genus is ever considered valid. =*Stegomyia*, Theob.

Arribalzagia, Theob., Monog. iii, 81 (1903).
Type, *Arribalzagia maculipes*, Theob., sp. nov. ♀, *l.c.*, by original designation. Coquillett ranks it synonymous with *Cellia*, Theob. =*Anopheles*, Mg.

Bancroftia, Lutz., in Bourroul's Mosq. Bras 40 (? 59) (1904).
Type, *B. albicosta*, Lutz., sp. nov., ♀, the only species. =*Culex*, L.

Banksinella, Theob., Monog. iv, 468 (1907).
Banksiella, Brun., Rec. Ind. Mus. iv, 477, *lapsus*.
Type, *Culex luteolateralis*, Theob., ♂ ♀, by original designation. =*Mimomyia*, Theob.

Bathosomyia, Theob., Monog. v, 267 (1910).
Type, *B. abnormalis*, Theob., sp. nov., *l.c.* 268, ♂ only, the only species =*Culex*, L.

Binotia, Blanch., Arch. Paras. viii, 478 (1904); Les Moust., 427.
N B.—Erected as a *nom. nov.* for *Runchomyia*, Theob., under the supposed preoccupation by *Rhynchomyia* R. Desv., in Muscinae. =*Runchomyia*, Theob.

Bironella, Theob., Ann. Mus. Hung. iii, 69 (1905).
Type, *B. gracilis*, Theob., ♂, sp. nov., *l.c.*, the only species. A valid genus.

Blanchardiomyia, Brun., Rec. Ind. Mus. iv, 440 (1912).
Nom. nov. for *Desvoidya*, Blanch., preoccupied by Meade in Muscidae (*Desvoidia*) =*Stegomyia*, Theob.

Bolbodeomyia, Theob., Rec. Ind. Mus. iv, 31 (1910).
Type, *B complex*, Theob., sp. nov., *l.c.*, ♂ ♀, by original designation. =*Wyeomyia*, Theob.

Boycia, Newstead, Ann. Trop Med. and Paras. i, No. 1, 33 (1907).
Type, *B. mimomyiaformis*, Newst., sp. nov., *l.c.* 34, ♂ ♀, fig. 7, wing, by original designation. =*Mimomyia*, Theob.

Brachiomyia, Theob., Monog. ii, 343, App. (1901).
Type, *B. magna*, Theob., sp. nov., ♀, *l.c.* 344, by original designation. Synonymous with *Deinocerites*, Theob. (*t.* Theob., *l.c.*, iii, 275).

Brevirhynchus, Theob., Rec. Ind. Mus. ii, 293 (1908).
Type, *B. magnus*, Theob., ♂ ♀, sp. nov., *l.c.*, ♂ ♀, by original designation. Of doubtful validity.

Cacomyia, Coq., U.S. Dep. Agric. Bull. Tech. Ser. ii, 16 (1906).
Type, *Haemagogus albomaculatus*, Theob., by designation of Coquillett. Of uncertain validity.

Calvertia, Ludl., Can. Ent. xli, 22 (1909); emended by Miss Ludlow to *Calvertina*, *loc. cit.*, xli, 234 (1909); *Calvertia*, preocc. by Warren in Lepidoptera.
Type, *Chagasia lineata*, Ludl., Can. Ent. xl, 50.
A valid genus.

Carrollia, Lutz in Theob., Monog. iv, 206 (1907).
Type, *C. iridescens*, Lutz (*irridescens*, lapsus), the original species. =*Culex*, L.

Catageiomyia, Theob., Monog. v, 115 (1910) *nom. nud.*
N.B.—I can obtain no further information respecting this genus.

Cellia, Theob., Jour. Trop. Med.[1] v, 183 (June 16, 1902); Monog. iii, 107 (1903).
Type, Theobald gives *Anopheles pulcherrimus*, Theob., as the first species in his Monograph, and apparently intended it as the genotype, but I have seen *A. pharoensis*, Theob., suggested in its place.

Ceratocystia, Dyar and Knab, Jour. N.Yk. Ent. So. xiv, 183 (1906).
Type, *Culex discolor*, Coq. Identical with *Grabhamia*, Theob., according to Coquillett. =*Culex*, L.

Chaetocruiomyia, Theob., Monog. v, 195 (1910).
Type, *C. sylvestris*, Theob., sp. nov., *l.c.*, ♀, the only species. =Subgen. *Culex*, *pro tem.*

Chaetomyia, Leices, Cul. Mal. 100 (1908).
Preocc. Brauer and Berg. in Tachininae (1892). Renamed *Leicesteriomyia*, Brun., Rec. Ind. Mus. iv, 452.
Type, *C. flava*, Leices., sp. nov., *l.c.*, 101, ♂ ♀, the only species. May be identical with *Hyloconops*, Lutz.

Chagasia, Cruz, Brasil Medico xx, 20, p. 199 (1906).
Type, *Pyretophorus fajardi*, Lutz, by original designation. A valid genus.

Chaoborus, Lichtenstein, Wied. Arch. Zool. i, 174 (1800).
Type, *Tipula crystallina*, Degeer (as *antisepticus*, sp. nov). Synonymous with *Sayomyia*, Coq. A valid genus.

C ristophersia, James, Rec. Ind. Mus. iv, 103 (1910); Paludism 33, *nom. nud.*
Type, *C. halli*, James, Paludism i, 33, by original designation. =*Anopheles*, Mg.

Christya, Theob., Rep. Sleep. Sick. Roy. So. 7, p. 34 (1903).
Chrystya, Giles, Revis. Anoph. 40 (1904).
Type, *Christya implexa*, Theob., sp. nov., *l.c.*, ♀. =*Anopheles*, Mg.

Chrysoconops, Goeldi., Os Mosq. do Para. 114 (1905).
N.B.—I have seen no type species stated; *Culex fulvus*, W., is the earliest described species of those now referred to it. =*Culex*, L.

Coelodiazesis, Dyar and Knab., Jour. N.Yk. Ent. So. xiv, 77 (1906).

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[1] This volume is inaccessible to me, perhaps only a *nom. nud.*

Type, *Anopheles barberi*, Coq., by original designation.
Erected on larval characters alone, therefore inadmissible.
In any case it=*Anopheles*, Mg.

Colonemyia, Leices., Cul. Mal. 233 (1908).
Type, *C. caeruleocephala*, Leices., sp. nov., *l.c.*, ♂ ♀, the 1st species, by present designation.
Probably=*Haemagogus*, Will.

Conchyliastes, Theob., in Howard's "Mosquitoes," p. 235 (1901).
Type, *Culex posticatus*, W. (as *musicus*, Say), the first species by Coquillett's designation, the latter author saying it is synonymous with *Arribalzagia*. =*Anopheles*, Mg.

Conopomyia, Leices., Cul. Mal. 113 (1908).
Type, *C. metallica*, Leices., sp. nov., *l.c.*, ♂ ♀, the first of the three species, by present designation. =*Mimomyia*, Theob.

Coquillettidia, Dyar, Proc. Ent. So. Wash. vii, 47 (1905).
Edwards sinks in *Taeniorhynchus*, Arrib.

Corethra, Mg., Illig. Mag. ii, 260 (1803).
Mochlonyx, Lw., 1844.
Type, *Tipula culiciformis*, Degeer, by original designation.
A valid genus.

Culex, L. Syst. Nat. Ed. x, 602 (1758).
Type, *C. pipiens*, L., by universal designation and by Latreille's, Consid. Gen. 442 (1810). A valid genus.

Culicada, Felt, N.Yk. State Mus. Bull. 79, Ent. 22, App. p. 391*b* (1904)
Type, *Culex canadensis*, Theob., by original designation, but Theob. says (Monog. iv, 319) that the type species should be *cantans*, Mg., giving no reason, but perhaps because it is the oldest known species referred to it. =*Culex*, L.

Culicella, Felt, N.Yk. State Mus. Bull. 79, Ent. 22, App. p. 391*c* (1904).
Type, *Culex dyari*, Coq., by original designation. = *Culex*, L.

Culicelsa, Felt., *loc. cit.*, p 391 (1904).
Type, *Culex taeniorhynchus*, W., by original designation.
=*Culex*, L.

Culiciomyia, Theob., Monog. iv, 227 (1907).
Type, *C. inornata*, Theob., sp. nov., *l.c.*, ♂ ♀, the first species, by present designation.
Admitted herein as a subgenus of *Culex*.

Culiseta, Felt., N.Yk. State Mus. Bull. 79, Ent. 22, App. p. 391*e* (1904).
Type, *Culex absobrinus*, Felt., by original designation.
=*Culex*, L.

Cyathomyia, Meij., Ann. Jard. bot. Buitenzorg 3rd supp., p. 922 (1910).
Type, *C. jenseni*, Meij., sp. nov., *l.c.*, by original designation.
Admitted herein as valid, *pro. tem.*

Cycloleppteron, Theob., Monog. ii, 312 (1901); *id.*, Jour. Trop. Med iv, 234 (1901) *nom. nud.* ; *Cyclolepidopteron*, Blanch., em.
Type, Anopheles grabhami, Theob., by original designation.
=*Anopheles*, Mg.

Dactylomyia, Newstead and Carter, Ann. Trop. Med. iv, 377 (1910).
Type, D. ceylonica, Newst. and Cart., sp. nov., *l.c.*, by original designation. Type in Liverpool School of Tropical Medicine. Mr. Edwards thinks may = *Anopheles deceptor*, Don., and *Myzomyia thorntoni*, Ludl. Apparently a valid genus.

Danielsia, Theob., Entom. xxxvii, 78 (1904).
Type, D. albotaeniata, Theob., *l.c.*, p 111, ♂ ♀, by original designation. =*Culex*, L.

Dasymyia, Leices., Cul. Mal. 102 (1908).
Type, D. fusca, Leices., sp. nov., ♂ ♀, *l.c.*, the only species.
Dasymyia, preocc., Egg. 1858 in Syrphidae (=*Pocota*, St. Farg. and Serv.) ; renamed *Ingramia*, Edw.

Deinocerites, Theob., Monog. ii, 215 (1901) ; Jour. Trop. Med. iv, 235 (1901), *nom. nud* ; *Brachiosoma*, Theob., July 15, 1901, *Brachiomyia*, Theob., Nov. 23, 1901.
Type, D. cancer, Theob., sp nov., *l.c* , the only species.
A valid genus.

Dendromyia, Theob., Monog. iii, 313 (1903).
Type, D. ulocoma, Theob., sp. nov., *l.c.*, ♀, the first of the five species given, by present designation. =*Wyeomyia*, Theob.

Desvoidea, Blanch., Comp. rend. liii, 1043 (1901), *nom. nov.* for *Armigeres*, Theob., under presumed preoccupation by *Armiger* : *id.*, Moust., 265. *Desvoidya*, Theob., emend. Gen. Ins. Fasc., 26, 17.
Desvoidea, preoc. Meade, 1892, in Tachininae (*Desvoidia*) ; see p. 40 ? . =*Stegomyia*, Theob.

Diceromyia, Theob., 4th Rep. Wellc. Lab. Vol. B. 151 (1911).
Type, unknown to me. =*Culex*, L.

Dinomimetes, Knab, Jour. N Yk. Ent. So. xv, 120 (1907).
Type, D. ulocoma, Theob., sp. nov., ♀, *l.c.*, by Coquillett's designation. A valid genus.

Duttonia, Newstead, Ann. Trop. Med. and Paras. i, No. 1, 17 (1907).
Type, D. tarsalis, Newst., sp. nov., *l.c.* 18, ♂ ♀, fig. 2, wing, the only species ; in Liverpool School of Tropical Medicine.
Of doubtful validity.

Ecculex, Felt., N.Yk. State Mus. Bull. 79, Ent. 22, App. p. 391*c* (1904).
Type, Culex sylvestris, Theob., by original designation.
=*Culex*, L.

Ekrinomyia, Leices., Cul. Mal. 71 (1908).
Type, *E. aureostriata*, Leices., sp. nov., *l.c.*, ♂ ♀, the only species. Possibly a valid genus.

Eretmapodites, Theob., Monog. i, 280 (1901).
Type, *E. 5-vittatus*, Theob., sp. nov., *l.c.*, by original designation. A valid genus.

Etorleptiomyia, Theob., 1st Rep. Wellc. Lab. 71 (1904); Gen. Ins. Fasc. 26, 44; Monog. iv, 505 (*Etiorleptiomyia*). *Etorilepidomyia*, Alcock, em. Ann. Mag. Nat. Hist. (8) viii, 249.
Type, *O'Reillia luzonensis*, Ludl., ♀. =*Culex*, L.

Eumelanomyia, Theob., Monog. v, 240 (1910).
Type, *E. inconspicuosa*, Theob., sp. nov., *l.c.*, ♂ ♀, the only species. Of uncertain validity.

Feltidia, Dyar, Proc. Ent. So Wash. vii, No. 1, 47 (1905).
Type, *Culex jamaicensis*, Theob., by original designation.
N.B.—This genus was erected on the identical species which formed the genotype of *Grabhamia* and is synonymous with that genus. =*Culex*, L.

Feltinella, Theob., Monog. iv, 56 (1907).
Type, *F. pallidopalpi*, Theob., sp. nov, *l.c.*, ♂, by original designation. =*Anopheles*, Mg.

Ficalbia, Theob., Monog. iii, 296 (1903).
Type, *Uranotaenia minima*, Theob., the first described of the four species now allotted to the genus, by present designation. =*Uranotaenia*, Arrib.

Finlaya, Theob., Monog. iii, 281 (1903).
Type *F. poicilia*, Theob., sp. nov., ♀, *l.c.* 283, by present designation. Admitted herein as a sub-genus of *Culex*, L.

Geitonomyia, Leices., Cul. Mal. 134 (1908).
Type, *Culex caecus*, Theob., by original designation. =*Culex*, L.

Gilesia, Theob., Monog. iii, 233 (1903).
Type, *G. aculeata*, Theob., sp. nov., *l.c.*, ♀, only, the only species. =*Culex*, L.

Gnophodeomyia, Theob., Jour. econ. Biol. i, No. 1, 21 (1905); Monog. iv, 251.
Type, *G. inornata*, Theob., sp. nov., ♀, the only species. =*Culex*, L.

Goeldia, Theob., Monog. iii, 330 (1903).
Type, *G. fluviatilis*, Theob., sp. nov., the original species. Admitted herein as a sub-genus of *Wyeomyia*, Theob.

Grabhamia, Theob., Monog. iii, 243 (1903).
Feltidia, Dyar; *Ceratocystia*, Dyar and Knab. See *Feltidia*.
Type, *Culex jamaicensis*, Theob., the original species. =*Culex*, L.

Grahamia, Theob., in Rept. on Dr. Graham's Collection,[1] and Monog. v, 497, footnote, and 548.

Type, *Grahamia trichorostris*, Theob., sp. nov., *l.c.*

N.B.—As Theobald's paper was not for sale, Meijere's genus *Harpagomyia*, with which *Grahamia* is synonymous, takes precedence. =*Harpagomyia*, Meij.

Grassia, Theob., Jour. Trop. Med. v, 181 (June 16, 1902).

Preocc. Fisch., 1885, in Protozoa; renamed *Myzomyia*, Blanch.

Type, *Anopheles rossii*, Giles. =*Anopheles*, Mg.

Gualteria, Lutz, in Bourroul's Mosq. Bras. 49 (? 54) (1904).

Type, *G. oswaldii*, Lutz, sp. nov., *l.c.*, the first of the two species, by present designation. Possibly identical with *Cacomyia*, Coq. Of doubtful validity.

Gymnometopa, Coq., Proc. Ent. So. Wash. vii, 183 (1906).

Type, *Stegomyia mediovittata*, Coq., by original designation.

N.B.—Theobald says (Monog. iv, 209) the genus was founded on his (Theobald's) *Stegomyia* 6-*lineata*, and that it is probably synonymous with *Macleaya*. Coquillett himself appointed *mediovittata* as the type species and added 6-*lineata* also to his genus. The question of its identity or otherwise with *Macleaya* is another one. Coquillett and Theobald place *Gymnometopa* near *Stegomyia*, and I follow Edwards in ranking it synonymous, but I have seen no reference to the palpi. =*Stegomyia*, Theob.

Haemagogus, Will., Trans. Ent. So. Lond. (1896) 271.

Type, *H. splendens*, Will., by original designation.

A valid genus.

Harpagomyia, Meij., Tijd. v. Ent. lii, 165 (1909).

Grahamia, Theob., Report on Dr. Graham's collection. This Report not on sale and therefore technically not "published."

Type, *H. splendens*, Meij., sp. nov., *l.c.*, by original designation. A valid genus.

Heinzmannia, Ludl., Can. Ent. xxxvii, 130 (1905) (*Heizmannia*, lapsus); emend., Banks, Phil. Jour. Sci. i, 99. Absolutely synonymous with *Dendromyia*, Theob.

Type, *Heinzmannia scintillans*, Ludl., sp. nov., Can. Ent. xxxvii, 130. =*Wyeomyia*, Theob.

Heptaphlebomyia, Theob., Monog. iii, 336 (1903).

Type, *H. simplex*, Theob., sp. nov., ♀, *l.c.*, the original species. =*Culex*, L.

Heteronycha, Arrib., Rev. Mus. la Plata I, 397 (1891).

Type, *Culex aestuans*, W. (as *dolosa*, sp. nov.) the only species, but *aestuans* is considered synonymous with *fatigans*. =*Culex*, L.

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[1] The full title of this paper is "Descriptions of new Mosquitoes collected by Dr. Graham in Ashanti," Colonial Office Report, Miscellaneous, No. 237 (May 23, 1909).

Hispidimyia, Theob., Monog. v, 245 (1910).
Type, H. hispida, Theob., sp. nov., ♂ ♀, *l.c.*, the only species. =*Mimomyia,* Theob.

Hodgesia, Theob., Jour. Trop. Med. vii, 17 (Jan. 15, 1904); Monog. iv, 579.
Type, H. sanguinae, Theob., sp. nov., ♀, *l.c.*, by original designation. A valid genus.

Howardia, Theob., Jour. Trop. Med. v, 181 (1902)
Renamed *Pyretophorus,* Blanch; (*Howardia,* preocc. Dalla Torre 1897 in Insecta).
Type, unknown to me. =*Anopheles,* Mg.

Howardina, Theob., Monog. iii, 287 (1903).
Type, Culex walkeri, Theob., by designation of Dyar (Proc. Ent. So. Wash. vii, 49 (1905).
N.B.—Edwards sinks *Howardina* in *Stegomyia,* saying the ♀ claws are variable. (Bull. Ent. Res. iii, 11). =*Culex,* L.

Hulecoeteomyia, Theob., Entom. xxxvii, 163 (1904); Monog. iv, 219 (1907).
Type, H. trilineata, Leices., in Theob., sp. nov., ♂ ♀, *l.c.*, by present designation.
N.B.—Is Alcock's *Hylecoetomyia* (Ann. Mag. Nat. Hist. (8) viii, 248), an emendation? =*Culex,* L.

Hyloconops, Lutz, in Bourroul's Mosq. Bras. 49 (? 55) (1904).
Type, H. pallidiventer, Lutz, apparently the original species, as *longipalpis*; the only other species was not described till 1907 (Monog. iv, 588). A valid genus.

Ingramia, Edwards, Bull. Ent, Res. iii, 43 (May 1912).
Mimomyia, Theob., Monog. iii, 304 pt.; *Dasymyia,* Leices., (preocc.) pt.
Type, Mimomyia malfeyti, Newstead, by original designation. Of uncertain validity.

Isostomyia, Coq.
Type, Aedes perturbans, Will., the original species. Of uncertain validity and position.

Jamesia, Christophers, Sci. Mem. Med. Off. Ind. (n. s.) xxv, 12 (1906).
Type, Major Christophers quotes *Culex concolor* and *tigripes* as belonging to his genus, without specifying either as a definite type. In any case as *Jamesia* is erected on larval characters it has no *locus standi*, and, in any case again, it is only a *Culex* =*Culex, L.*

Janthinosoma, Arrib., Rev. Mus. la Plata I, 394 (1891).
Conchyliastes, Theob.
Type, Culex discrucians, Walk. A valid genus.

Joblotia, Blanch., Comp. rend. So. biol. Paris liii, 1046 (Dec. 6, 1901), *nom. nov.* for *Trichoprosopon*, Theob., under the assumed preoccupation by *Trichoprosopus*, Macq.
=*Trichoprosopon*, Theob.

Kerteszia, Theob., Ann. Mus. Hung. iii, 66 (1905) ; Monog iv, 117.
Type, *K. boliviensis*, Theob., sp. nov., ♀ , *l.c.*, by original designation. =*Anopheles*, Mg

Kingia, Theob , Monog. v, 135 (1910).
Type, *Stegomyia luteocephala*, Newstead, by original designation. =*Stegomyia*, Theob

Lasioconops, Theob., Monog. iii, 235 (1903). (*Lacioconops*, lapsus, v, 4 4).
Type, *L. poicilipes*, Theob., sp. nov., *l c.*, the only species.
=*Culex*, L.

Laverania, Theob., Jour. Trop. Med. v, 181 (June 16, 1902), preocc Billet 1895 in Protozoa, and again by Grassi and Filetti in 1900. Renamed *Nyssorhynchus*, Blanch.
Type, *Anopheles argyritarsis*, R. Desv. =*Anopheles*, Mg.

Leicesteria, Theob., Entom. xxxvii, 211 (Aug. 1904); Monog. iv, 201 (1907).
Type, *L. longipalpis*, Leices , *l.c.*, the original species.
=*Culex*, L.

Leicesteriomyia, Brun., Rec. Ind. Mus. iv, 452 (1912) ; *nom. nov.* for *Chaetomyia*, Leices., preocc. Brauer and Berg in Tachininae.
Possibly = *Hyloconops*, Lutz.

Lepidoplatys, Coq., Science xxiii, 314 (1906).
Type, *Culex squamiger*, Coq. =*Culex*, L

Lepidosia, Coq., Sciene xxiii, 314 (1906).
Type, *Culex cyanescens*, Coq.
Of uncertain validity and position.

Lepidotomyia I., Theob., Ann. Mus. Hung. iii, 80 (1905). Synonymous with *Reedomyia*, Ludl.
Type, *L. alboscutellata*, Theob., sp. nov., *l.c.*, by original designation. =*Culex*, L.

Lepidotomyia II., Theob., Gen. Ins. Fasc. 26, 22 (1905) ; Monog. v, 249; *non Lepidotomyia*, Theob., Ann. Mus. Hung., iii.
Type, *L. magna*, Theob., sp. nov., ♂ ♀ , the only species.
=*Culex*, L.

Leptosomatomyia, Theob., Ann. Mus. Hung iii, 110 (1905) ; Monog. iv, 548.
Type, *L. lateralis*, Theob., sp. nov., ♂ only, by original designation. Probably=*Aedes*, Mg.

Leslieomyia, Christophers, Paludism No. 2, p. 68 (1911).
Type, *L. taeniorhynchoides*, sp. nov., *l.c.* ♂ ♀ , by original designation. =*Culex*, L.

Lestiocampa, Dyar and Knab, Jour. N.Yk. Ent. So. xiv, 226 (1906)
Type, *Wyeomyia lunata*, Theob.

N.B.—Inadmissible, being founded on larval characters only. It is however synonymous with *Trichoprosopon*, Theob.

Leucomyia, Theob., Monog. iv, 372 (1907).
Preocc. Brauer and Berg. 1892 in Sarcophaginae, renamed *Theobaldiomyia*, Brun.
Type, *Culex gelidus*, Theob., by original designation.
=*Culex*, L.

Limatus, Theob., Monog. ii, 349 App. (1901).
Simondella, Laveran.
Type, *L. durhamii*, Theob., by original designation.
A valid genus.

Lophoceratomyia, Theob., Ann Mus Hung. iii, 93 (1905). Monog. iv, 471.
Type, *L. fraudatrix*, Theob., sp. nov. ♂ ♀, *l.c.*, by present designation, the first of the two species. A valid genus.

Lophoscelomyia, Theob., Entom. xxxvii, 12 (Jan. 1904).
Lophocelomyia. Theob., Gen. Ins. Fasc. 26, 10 (*lapsus*).
Lophomyia, Giles, Jour. Trop. Med. vii, 366 (1904).
Type, *Lophoscelomyia asiatica*, Theob., sp. nov., *l.c.*, 13.
=*Anopheles*, Mg.

Ludlowia, Theob., Monog. iv, 193 (1907).
Type, *Mimomyia chamberlaini*, Ludl., the original species.
=*Mimomyia*, Theob

Lutzia, Theob., Monog., iii, 155 (1903).
Type, *Culex bigotii*, Bell., ♂ ♀, the original species.
=*Culex*, L.

Lynchiella, Lahille in Peryassu, Os Culic. do Bras. 125 (1905).
Type, unknown to me. =*Megarhinus*, R. Desv.

Macleaya, Theob., Entom. xxxvi, 154 (1903); Monog. iv, 203.
Type, *M. tremula*, Theob., nov. sp., *l.c.*, the only species.
=*Culex*, L.

Maillotia, Theob., Monog. iv, 274 (1907).
Type, *M. pilifera*, Theob., sp. nov., ♀, *l.c.*, the only species.
=*Culex*, L.

Malaya, Leices., Cul. Mal. 258 (1908).
Type, *M. genurostris*, Leices., sp. nov., ♂, *l.c.*
N.B.—The name is practically preoccupied by *Malaia*, Heller (1891). =*Harpagomyia*, Meij.

Manguinhosia, Cruz in Peryassu, Os Culic. do Bras. 112 (1908).
Type, *M. lutzi*, Cruz, *l.c.*, the only species. =*Anopheles*, Mg.

Mansonia, Blanch., Comp. rend. liii, No. 37, 1046 (1901); Moust. 375; *nom. nov.* for *Panoplites*, Theob., preocc. Gould, 1853, in Aves.
Type, *Culex titillans*, Walk. =*Culex*, L.

Mansonioides, Theob., Monog. iv, 498 (1907).
Type, *M. 7-guttata*, Theob., sp. nov., ♀, *l.c.*, the original species. =*Culex*, L.

Megaculex, Theob., Monog. iv, 282 (1907).
Type, Culex albitarsis, Theob., *l.c.*, ii, 267, ♂; iii, 186, ♀, the only species. =*Mimomyia*. Theob.

Megarhinus, R. Desv, Essai Culic. in Mem. So. Nat. Hist. Paris, iii, 412 (1827); *Megarrhinus, Megarhina, Megarrhina*, Auctt., *Lynchiella*, Lahille.
Type, Culex haemorrhoidalis, F.
N.B.—*Megarhina*, was used by St. Farg. and Serv. in Diptera, and *Megarhinus* proposed again by Schonh. 1836 in Coleoptera. A valid genus.

Melanoconion, Theob., Monog. iii, 238 (1903).
Mochlostyrax, Dyar and Knab.
Type, Culex atratus, Theob., by Dyar's designation (Proc. Ent. So. Wash. vii, 49). =*Culex*, L.

Menolepis, Lutz in Peryassu, Os Culic. do Bras. 38 (1908).
Type, M. leucostigma, Lutz, sp nov., *l.c.*, the only species. =*Wyeomyia*, Theob.

Micraedes, Coq., Proc. Ent. So Wash. vii, 185 (1906).
Type, M. bisulcatus, Coq., by original designation. =*Aedes*, Mg.

Microculex, Theob., Monog. iv, 461 (1907).
Type, M. argenteoumbrosus, Theob., sp. nov., ♀ *l.c.*, the only species. =*Culex*, L.

Mimeteculex, Theob., 3rd Rep. Wellc Res. Lab. Gordon College, 258 (1908); Monog. v, 408.
Type, M. kingii, Theob., sp. nov., ♂ ♀, *l.c.*, the only species. =*Culex*, L.

Mimeteomyia, Theob., Monog. v, 210 (1910).
Type, M. apicotriangulata, Theob., sp. nov., *l.c*, the only species. =*Culex*, L.

Mimomyia, Theob., Monog. iii, 304 (1903).
Type, M. splendens, Theob., sp. nov., ♀, *l.c.*, the original species. Admitted on Edward's testimony as a valid genus.
N.B.—All the species except the genotype are now removed to *Ingramia*.

Mochlonyx, Loew., Stett. Ent. Zeit. v, 121 (1844).
Type, Corethra velutina, Ruthe, by original designation. =*Corethra*, Mg.

Mochlostyrax, Dyar and Knab, Jour. N.Yk. Ent. So. xiv, 223 (Ap. 15, 1906).
Type, M. caudelli, Dyar and Knab, by original designation.
N.B.—Technically inadmissible, founded on larval characters only, but from the adults subsequently discovered or bred, it is said to be allied to *Melanoconion*. =*Culex*, L

Molpemyia, Theob., Monog. v, 479 (1910).
Type, M. purpurea, Theob., sp. nov., ♀, *l.c.*, the only species.
N.B.—Probably synonymous with *Oculeomyia*, which Mr. Edwards sinks in *Culex*.

Mucidus, Theob., Monog. i, 268 (1901).

No type species was appointed by Theobald, so out of the five species included by that author at the erection of the genus I propose *alternans*, Westw., as being (apart from *laniger*, W., which Theobald at that time had not seen) the oldest described one (1835). Both sexes were present before him, and the "type" (Theobald does not say which sex) is in the Hope collection at Oxford. A valid genus.

Myxosquamus, Theob., Monog. v, 225 (1910).

Type, *M. confusus*, Theob., sp. nov., ♀, *l.c.*, by original designation. =*Culex*, L.

Myzomia, Blanch., Comp. rend, liv, 795 (July 4, 1902).

Type, *Anopheles rossii*, Giles, by original designation.

N.B.—Theobald suggests (Monog. iii, 12) altering the type to *funesta*, Giles, but this of course is inadmissible. James apparently desires to erect a new genus *Nyssomyzomyia* [1] on *rossii*, but this is impossible, as the latter must remain the type of *Myzomyia*. =*Anopheles*, Mg.

Myzorhynchella, Theob., Monog. iv, 78 (1907).

Type, *M. nigra*, Theob. =*Anopheles*, Mg.

Myzorhynchus, Blanch., Comp. rend. liv, 795 (1902).

Type, *Anopheles sinensis*, W., by original designation. =*Anopheles*, Mg.

N.B.—Major James suggests *barbirostris*, Wulp, as the type species which is quite impossible in the face of Blanchard's definite selection of a type.

Neocellia, Theob., Monog. iv, 111 (1907).

Type, *N. indica*, Theob., sp. nov., ♂ ♀, *l.c.*, the first species. =*Anopheles*, Mg.

Neoculex, Dyar, Proc. Ent. So. Wash. vii, 47 (1905).

Type, *Culex territans*, Walk. =*Culex*, L.

Neomacleaya, Theob., Monog. iv, 238 (1907).

Type, *N. indica*, Theob., sp. nov., ♀, *l.c.*, the original species. =*Culex*, L.

Neomelanoconion, Theob., Monog. iv, 514 (1907).

Type, *Culex rima*, Theob., Rep. Liverp. Sch. Trop. Med. App. p. xi (1901), by original designation, (iv, 514).

N.B.—*Neomelanoconion* ♂ = *Culiciomyia*, Theob., according to Edwards. =*Culex*, L.

Neomyzomyia, Theob., Monog. v, 29 (1910).

Type, *Anopheles elegans*, James in Theob., by original designation. =*Anopheles*, Mg.

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[1] Rec. Ind. Mus. iv, 106. In this paper Major James desires to make *culicifacies*, Giles, the type of *Myzomyia*, which is impossible since *rossii* was definitely selected as such by Blanchard. These attempts to alter genotypes are zoologically unpardonable.

Neopecomyia, Theob., Monog. v, 261 (1910).
Type, N. uniannulata, Theob., sp. nov., ♀, *l.c.*, the only species.
=*Culex*, L.

Neostethopheles, James, Rec. Ind. Mus. iv, 98 (1910).
Type, N. aitkeni, James, by original designation.
=*Anopheles*, Mg.

Newsteadina, Theob., Ann. Trop. Med. Paras. II, No. 4, 297 (1909); Monog. v, 474.
Type, Culex arboricollis, D'Emm de Char. *loc. cit.*, 257, ♂ ♀.
Admitted herein *pro tem* as subgenus *Culex*, L.

Nototricha, Coq.
Type, Cyclolepppteron mediopunctatus, Theob., by original designation, the only species.
N.B.—Theobald (Monog. v, 33) spells the genus *Notonotricha*.
=*Anopheles*, Mg.

Nyssomyzomyia, James, Rec. Ind. Mus. iv, 101 (1910).
Type, Anopheles rossii, Giles, according to James, but this is impossible, as this species was the chosen type of *Myzomyia* at its erection by Blanchard. =*Anopheles*, Mg.

Nyssorhynchus, Blanch., Comp. rend., liv, 795 (1902). *Nom. nov.* for *Laverania*, Theob., preocc.
N.B.—Blanchard desired to make *Anopheles albimanus*, W., the type, but as his name is simply a *nomen novum* the original type of *Laverania*, *argyritarsis*, R. Desv., must remain as the type of *Nyssorhynchus*. Theobald suggests (Monog. iii, 14) *maculatus*, Theob., as type, and James (Rec. Ind. Mus. iv, 100) would follow him, but, as Edwards has pointed out (Bull. Ent Res. ii, 141) this is not permissible. =*Anopheles*, Mg.

Ochlerotatus, Arrib., Rev. Mus. la Plata i, 385 (1891).
Type, Coquillett designated *O. confirmatus*, Arrib., sp. nov. as type, but Edwards says *Culex albifasciatus*, Macq. was so appointed, which, as these were apparently the only two species admitted by Arribalzaga, seems the more likely.
N.B.—Mr. Edwards believes strongly in the validity of this genus. =*Culex* L.

Oculeomyia, Theob., Monog. iv, 515 (1907).
Type, O sarawaki, Theob., sp. nov., *l.c.*, the original species.
Of uncertain validity.

O'Reillia, Ludl., Can. Ent. xxxvii, 101 (1905).
Type, O. luzonens, Ludl., sp. nov., *l.c.*, the original species.
Synonymous with *Etorleptiomyia*, Theob. =*Culex*, L.

Orthopodomyia, Theob., Entom. xxxvii, 236 (1904). Monog. iv. 527.
Type, O. albipes, Leices. in Theob., sp. nov., *l.c.* 237, the original species. Of uncertain validity.

Panoplites, Theob., Rep. Coll. Mosq. Brit. Mus. 5 (1900) ; Monog. ii, 173 (1901).

Renamed *Mansonia*, Blanch., *Panoplites*, preocc.

Type, *Culex titillans*, Walk., as *Taeniorhynchus taeniorhynchus*, Arrib., by designation of Neveu Lemaire (Mem. So. Zool. xiv, 214). =*Culex*, L.

Pardomyia, Theob., Monog. iv, 280 (1910).

Type, *P. aurantia*, Theob., sp. nov., ♀, *l.c.*, the original species. =*Culex*, L.

Patagiamyia, James, Rec. Ind. Mus. iv, 98 (1910).

Type, *Anopheles gigas*, Giles, by original designation. =*Anopheles*, Mg.

Pecomyia, Theob., Jour. econ. biol. I, No. 1, 24 (1905) ; Monog. iv, 265.

Type, *P. maculata*, Theob., sp. nov., the original species. =*Culex*, L.

Pectinopalpus, Theob., Monog. v, 416 (1910).

Type, *P. fuscus*, Theob., sp nov., *l.c.*, the only species. Synonymous with *Culiciomyia*, Theob., which is regarded herein as a subgenus of *Culex*.

Phagomyia, Theob., Gen. Ins. Fasc. 26, 21 (1905). Monog. iv, 223.

Either *P.* (*Stegomyia*) *gubernatoris*, Giles (Entom. 1901, p. 194), or *P. irritans*, Theob. (Rep Liverp. Sch. Trop. Med. App 3, 1901), must be the generic type, but I cannot tell which has priority. =*Culex*, L.

Philodendromyia, Theob., Monog. iv, 623 (1907).

Type, *P. barkerii*, Theob., sp. nov., ♂, *l.c.*, the original species. Of uncertain validity.

Phoniomyia, Theob., Monog. iii, 311 (1903).

Type, *Wyeomyia longirostris*, Theob., by designation of Dyar, Proc. Ent. So. Wash. vii, 49. =*Wyeomyia*, Theob.

Pneumaculex, Theob., Monog. iv, 523 (1907). Dyar Proc. Ent. So. Wash. vii, No. 1, *nom. nud.*

Type, *Culex signifer*, Coq., Can. Ent. xxviii, 43 (1896).

N.B.—The genus must stand to Theobald's credit, as he apparently first described it, Dyar's reference being merely a *nomen nudum*. Founded originally on larval characters and therefore inadmissible but the adult has since been obtained. =*Culex*, L

Polyleptiomyia, Theob., Gen Ins. Fasc. 26, 21 (1905) ; Monog. iv, 223 (1907)

Type, *P. albocephala*, Theob. (Monog. iii, 140), the only species, a unique ♂. =*Culex*, L.

Polylepidomyia, Theob., Ann. Mus. Hung. iii, 118 (1905). Monog. iv, 625.

Type, *P. argenteiventris*, Theob., sp. nov., ♀, *l.c.*, the only species. Of uncertain validity.

Popea, Ludl., Can. Ent. xxxvii, 95 (1905).
Type, P. lutea, Ludl., sp. nov., ♂ *l.c.*, the only species.
=*Culex*, L.

Prosopolepis, Lutz in Peryassu, Os Culic. do Braz. 38 (1908). Theob. Monog. v, 594.
Type, P. confusus, Lutz., sp. nov., the original species.
=*Wyeomyia*, Theob.

Protoculex, Felt, N.Yk. State Mus. Bull. 79, Ent. 22, p. 391*d*, App. (1904).
Type, Culex serratus, Theob., by original designation.
=*Culex*, L.

Protomacleaya, Theob., Monog. iv, 253 (1907).
Type, Culex triseriatus, Say. =*Culex*, L.

Protomelanoconion, Theob., Monog. v, 462 (1910).
Type, P. fusca, Theob., sp. nov., *l.c.*, 463. =*Culex*, L.

Pseudocarrollia, Theob., Rec. Ind. Mus. iv, 12 (1910). Monog. v, 186.
Type, P. lophoventralis, Theob., sp. nov., ♀, *l.c.*, the only species. =*Culex*, L.

Pseudoculex, Dyar, Proc. Ent. So. Wash. vii, 45 (1905).
Type, Culex aurifer, Coq. =*Culex*, L.

Pseudoficalbia, Theob., Trans. Linn. So. Lond. xvi, 89 (1912); U. South. Afr. Dept. Agric. 1st Rep. Vet. Res. *nom. nud.* 272 (1911). =*Uranotaenia*, Arrib.

Pseudograbhamia, Theob., J. Bomb. N. H. So. xvi, 244 (1905). Monog. iv, 314.
Type, P. maculata, Theob., sp. nov., *l.c.*, the only species.
=*Culex*, L.

Pseudograhamia, Theob., Rec. Ind. Mus. iv, 26 (1910). Monog. v, 551.
Type, P. aureoventer, Theob., sp. nov., ♀, *l.c.*, 27, the original species. Of doubtful validity.

Pseudoheptaphlebomyia, Ventr., Bull. Mus. Paris xi, 427 (1905) *nom. nud.*
Type, not allotted. =*Culex*, L.

Pseudohowardina, Theob., Monog. iv, 223 (1907).
Type, Culex trivittata, Coq., by original designation.
=*Culex*, L.

Pseudoskusea, Theob., Monog. iv (1907).
Type, Skusea multiplex, Theob., by present designation, as the only species mentioned at the erection of the genus.
=*Culex*, L.

Pseudostegomyia, Ludl., Can. Ent. xxxvii, 99 (1905) (lapsus calami for *Quasistegomyia*; (t. Ludl. in Theob. Monog. v, 135).

Pseudotaeniorhynchus, Theob., Novae Culicidae i, 19 (1911).
Type, Taeniorhynchus fasciolatus, Arrib. Mr. Edwards says this is certainly synonymous with *Taeniorhynchus*, which is herein ranked as a subgenus of *Culex*.

Pseudotheobaldia, Theob., Monog. iv, 217 (1907).
Type, *P. niveitaeniata*, Theob., sp. nov., ♂, *l.c.* =*Culex*, L.

Pseudouranotaenia, Theob., Jour. econ. biol. i, 33 (1905); Monog. iv, 566 (1907).
Type, *P. rowlandii*, Theob., sp. nov., *l.c.*, the original species. =*Uranotaenia*, Arrib.

Psorophora, R. Desv., Essai Culic. (1827).
Type, *Culex ciliata*, F., the oldest described species at the institution of the genus. A valid genus.

Pyretophorus, Blanch., Comp. rend. xxiii, 795 (1902).
Type, *Anopheles costalis*, Lw., by original designation.[1] =*Anopheles*, Mg.

Quasistegomyia, Theob., 2nd Rep. Gord. College Wellc. Labor., 69 (1906).
Type, *Q. unilineata*, Theob., sp. nov., the original species. =*Stegomyia*, Theob.

Rachionotomyia, Theob., Jour. Bomb. Nat. Hist. So. xvi, 248 (1905). Monog. iv, 518.
Type, *R. ceylonensis*, Theob., sp. nov., ♀, *l.c.*, the original species. A valid genus.

Rachisoura, Theob., Monog. v, 207 (1910).
Type, *R. sylvestris*, Theob., sp. nov., *l.c.*, 208 the only species. =*Culex*, L.

Radioculex, Theob., Rec. Ind. Mus., ii, 295 (1908); Monog. v, 192.
Type, *R. clavipalpis*, Theob., sp. nov., *l.c.*, the original species. =*Mimomyia*, Theob.

Ramcia, Annandale, Spol. Zeyl. vii, 187 (1911).
Type, *R. inepta*, Annand., sp. nov., ♂, *l.c.*, the only species. A valid genus.

Reedomyia, Ludl., Can. Ent. xxxvii, 94 (1905).
Type, *R. pampangensis*, Ludl., sp. nov., ♀, *l.c.*, the original species. =*Culex*, L.

Rhynchotaenia, Brethes, Ann. Mus. Buen. Ayres xx, 470 (1910), *nom. nov.* for *Taeniorhynchus*, Theob.

Rossia, Theob., Jour. Trop. Med. v, 181 (1902).
Preocc. by Owen 1838 in Mollusca, and Bonap., 1838, in Aves; renamed *Myzorhynchus*, Blanch.
No type species ever set up, and as *Rossia* is displaced by *Myzorhynchus*, which itself sinks in *Anopheles*, nothing is to be gained by selecting one now. =*Anopheles*, Mg.

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[1] Major James' suggestion (Rec. Ind. Mus. iv, 99) to set up *palestinensis*, Theob., as the "type example" of the genus (whatever he may mean by that as distinct from "type of the genus") is unpardonable. *A. costalis*, Lw., was definitely selected by Blanchard as the type and must remain so.

Runchomyia, Theob., Monog. iii, 319 (1903).
Binotia, Blanch., *nom. nov.* on alleged preoccupation by *Rhynchomyia*, R. Desv. (1830), in Muscinae.
Type, *R. frontosa*, Theob., sp. nov., ♀, *l.c.*, by original designation. A valid genus.

Sabethes, R. Desv., Essai Culic. 411 (1827).
Sabettus, Scudd., emend. (1882).
Type, *Culex longipes*, F., so far as I can ascertain. Coquillett gives *C. cyaneus*, F., " as *locuples*, sp. nov." ; the Kertesz Catalogue makes *locuples* a synonym of *longipes*, F., which has another synonym in *remipes*, W. (this latter being given as genotype by Theobald). *Cyaneus*. F., is a separate species under *Culex* in the Kertesz Cat. and even if it should prove synonymous with *longipes*, F., the latter takes bare precedence by being described on the previous page.
A valid genus.

Sabethinus, Lutz., in Bourroul, Mosq. Bras. 48 (? 57), (1904).
Sabettinus, Blanch., Moust. 634, emend.
Type, *S. intermedius*, Lutz, the first species described, by present designation. Theobald says the genus may be synonymous with *Sabethoides*, Theob., which is the view adopted herein.

Sabethoides, Theob., Monog. iii, 328 (1903).
Sabettoides, Blanch., emend., Moust. 423.
Sabethinus, Lutz.
Type, *S. confusus*, Theob. Admitted as valid *pro. tem.*

Sayomyia, Coq., Can. Ent. xxxv, 190 (1903).
Type, *Corethra punctipennis*, Say. =*Chaoborus*, Lichtenstein.

Scutomyia, Theob., Entom. xxxvii, 77 (1904).
Type, *Culex sugens*, W., by present designation, as the oldest described species included by Theobald at the erection of the genus. =*Stegomyia*, Theob.

Simondella, Laveran, Comp. rend. soc. biol. liv, 1158 (1902).
Type, *S. curvirostris*, Lav. =*Limatus*, Theob.

Skeiromyia, Leices., Cul. Mal. 248 (1908).
Type, *S. fusca*, sp. nov., ♂ ♀, *l.c.*, the only species.
Probably=*Hodgesia*, Theob.

Skusea, Theob., Monog. iii, 291 (1903).
Type, *S. funerea*, Theob., by original designation.
A valid genus.

Squamomyia, Theob., Rec. Ind. Mus iv, 28 (1910); Monog. v, 529.
Type, *S. inornata*, Theob., sp. nov. ♂, the original species.
Probably=*Aedes*, Mg.

Stegoconops, Lutz, Imprensa Medica (1906) (? *nom. nud.*); Peryassu, Os Culic. do Bras. 34 (1908).
Type, unknown to me. =*Culex*, L.

Stegomyia, Theob., in Howard's Mosquitoes p. 233 (Jan. 1, 1901); Monog. i, 283.
Type, *Culex fasciatus*, F., as *calopus*, Mg.
Apparently a valid genus.

Stenoscutus, Theob., Monog. v, 263 (1910).
Type, *S. africanus*, Theob., sp. nov., ♀, *l.c.* =*Culex*, L.

Stethomyia, Theob., Jour. Trop. Med. v, 181 (1902).
Type, *S. nimba*, Theob., sp. nov., *l.c.*, the original species.
=*Anopheles*, Mg.

Taeniorhynchus, Arrib., Rev. Mus. la Plata i, 389 (1891).
Restricted by Theobald, Monog. ii, 190 (1901).
Type, *Culex titillans*, Walk., as *C. taeniorhynchus*, W., technically.
N.B.—Theobald observes (Monog. iv, 483) the genus was technically founded on Wiedemann's *taeniorhynchus*, with which the author regarded *titillans* as synonymous, also adding two new species, *confinnis* and *fasciolatus*. Coquillett would adopt *titillans*, in place of *taeniorhynchus*, to avoid tautonomy, but the selected original type species must stand. Admitted herein as a sub-genus of *Culex* L.

Teromyia, Leices., Cul. Mal. 49 (1908).
Type, *T. acaudata*, Leices., sp. nov., ♂ ♀, the first species, by present designation. See p. 35 as to possible validity.
=*Toxorhynchites*, Theob.

Theobaldia, Neveu-Lemaire, Comp. rend. liv, 1331 (Nov. 29, 1902). *Theobaldinella*, Blanch., Moust. 390, *nom. nov.*, under supposed preoccupation by *Theobaldius*, Neville, in Mollusca.
Type, *Culex annulatus*, Schrk. =*Culex*, L.

Theobaldiomyia, Brun., Rec. Ind. Mus. iv, 462 (1912), *nom. nov.* for *Leucomyia*, Theob. preocc., Brauer and Berg., 1892 in Sarcophaginae.

Thomasina, Newstead and Carter, Ann. Trop. Med. Paras. iv, 553 fig. 1, head ♂ (1910–11).
Type, *Mansonia longipalpis*, (♀ only descr.) Newstead and Thomas, Ann. Trop. Med. Paras. iv, 145, ♀. =*Culex*, L.

Tinoletes, Coq., Proc. Ent. So. Wash. vii, 185 (1906).
Type, *T. latisquama*, Coq., by original designation.
Of uncertain validity and position.

Topomyia, Leices., Cul. Mal. 238 (1908).
Type, *T. minor*, Leices., sp. nov., ♂ ♀, *l.c.*, the first of the nine species, by present designation. Probably a valid genus.

Toxorhynchites, Theob., Monog. i, 244 (1901).
Type, *T. brevipalpis*, Theob., sp. nov., ♀, *l.c.*, by original designation. The attempt to make *Megarhinus mutilus* the type must fail, as stated by Mr. Edwards (Bull. Ent. Res. iii, 3). A valid genus.

Trichopronomyia, Theob., Ann. Mus. Hung. iii, 98 (1905); Monog. iv, 479.

Type, *T. annulata*, Theob., sp. nov., ♂, *l.c.*, the original species. =*Culex*, L.

Trichoprosopon, Theob., Monog. ii, 283 (1901); Jour. Trop. Med. iv, 235, July 15, 1901, *nom. nud.*

Type, *T. nivipes*, Theob., sp. nov. the original species.

A valid genus.

Trichorhynchomyia, Brun., Rec. Ind. Mus. iv, 477 (1912).

nom. nov. for *Trichorhynchus*, Theob., preocc.

Trichorhynchus, Theob., Jr. Bomb. Nat. Hist. Soc. xvi, 240 (1905); Monog. iv, 270.

Preoccuped by Balbiani 1887 in Protozoa; renamed *Trichorhynchymyia*, Brun.

Type, *T. fuscus*, Theob., by original designation. =*Culex* L

Uranotaenia, Arrib., Rev. Mus. la Plata i, 405 (1891).

Type, *U. pulcherrima*, Arrib., by designation of Neveu-Lemaire (Mem. So. Zool. Fran. xv, 21—1902).

Apparently a valid genus.

Verrallina, Theob., Monog. iii, 295 (1903).

Type, *Aedes butleri*, Theob., by Coquillett's designation.

=*Uranotaenia*, Arrib.

Worcesteria, Banks, Phil. Jour. Sci. i, 779 (1906).

Type, *W. grata*, Banks, sp. nov. the original species.

Some doubt attaches as to *grata* being distinct from *Toxorhynchites immisericors*. =*Toxorhynchites*, Theob.

Wyeomyia, Theob., Monog. ii, 267 (1901); Jour. Trop. Med. iv, 235, July 15, 1901, *nom. nov.*

Type, *W. grayii*, Theob., by designation of Neveu Lemaire, (Mem. So. Zool. Fran. xv, 223—1902).

A valid genus. ? p. 268.

Zeugnomyia, Leices., Cul. Mal. 231 (1908).

Type, *Z. gracilis*, Leices., sp. nov., ♂ ♀, *l.c.* 232, the only species. Of uncertain validity.

III. FURTHER RECORDS OF INDIAN BRACKISH WATER MYSIDAE WITH DESCRIPTIONS OF A NEW GENUS AND SPECIES.

By WALTER M. TATTERSALL, *D.Sc., Keeper of the Manchester Museum.*

(Plates xii–xiii.)

In 1908 I described two new species of Mysidae from brackish water, near Calcutta (*Rec. Ind. Mus.*, vol. ii, pt. 3, 1908). Since that time, Dr. Annandale and his staff have continued their exploration of the brackish waters of India and have sent to me, from time to time, samples of the Mysidae they found in their material, for identification. Most of the specimens sent me were found to belong to one or other of the two forms I had previously described. They have proved to be abundant and widely distributed on the east coast of India. Among the material sent me, however, I found a bottle of specimens from a brackish creek near Bombay, which proved to belong to an undescribed species requiring the formation of a new genus.

In the present paper, I give a description with figures of the new species and a complete list of all the records for the two previously described forms. These three species are, so far as I am aware, the only Mysidae known from the littoral of India. Many purely marine species must still await discovery and it seems probable that further work in the brackish waters of the west coast will bring to light undescribed forms.

I am much indebted to Dr. Annandale for the opportunity of examining the material here dealt with and to Mr. S. W. Kemp for valuable notes on the occurrence of the species and for a complete list of known localities. To both these gentlemen I desire to express my best thanks.

Macropsis orientalis, Tattersall.

M. orientalis, Tattersall, *Rec. Ind. Mus.*, vol. ii, pt. 3, 1908.

Complete list of localities.

(1). Chittagong town, brackish ponds near river. (*N. Annandale* and *S. W. Kemp.*)

(2). Dhappa, near Calcutta, brackish ponds (*N. Annandale*). Type locality.

Found since in abundance in the same district, in water with 5·09–7·41 g. NaCl per litre.

(3). Port Canning, Lower Bengal, brackish ponds (*N. Annandale*).

(4). Zoological Gardens, Calcutta, fresh water (*S. W. Kemp*). (The pond in which Mr. Kemp took the specimens is filled periodically from a creek of the R. Hughli. *N. A.*)

(5). Belgachia, Calcutta, brackish water canal. (*S. W. Kemp*.)

(6). Garia, Lower Bengal, brackish ponds (*N. Annandale* and *S. W. Kemp*).

(7). Nalbano, L. Chilka, Puri district, brackish water (*J. T. Jenkins*).

(8). S. end of L. Chilka (inland), brackish water (*N. Annandale*).

(9). Barkul, Chilka Lake, in water with 4·09 g. NaCl per litre (*F. H. Gravely*).

(10). Rambha, Ganjam district, brackish ponds (*N. Annandale*).

(11). Vizagapatam backwater, Vizagapatam, salt water (*S. W. Kemp*).

(12). Sar Lake, nr. Puri, Orissa, fresh water (*N. Annandale*).

(13). Madpur, Bengal (*R. A. Hodgart*).

(14). Edge of the Mahanadi River, Cuttack, Orissa (*N. Annandale*).

I am indebted to Mr. Kemp for the above list of records for this species and for samples of specimens from nearly all the localities, from which I have been able to confirm Mr. Kemp's determinations. When forwarding the list of captures, Mr. Kemp kindly gave me the following note on the general occurrence of this species. "The species usually occurs in enormous numbers swimming in shoals. In one instance, when a strong breeze was blowing, it was noticed that the shoal kept to the windward side of the pond. In the neighbourhood of Calcutta, it seems to prefer ponds and canals, of slowly moving water, which are brackish, but does not occur in the salt lakes proper. None the less, as shown in the records given above, it is sometimes found in water almost or fully as salt as the sea and the fresh water record from a pond in the Zoological Gardens at Calcutta, cannot be questioned."

Since writing the above, Mr. Kemp forwarded to me specimens from Madpur, in the Midnapore district from absolutely fresh water, "at least thirty miles away from the nearest possible source of saline contamination"

The species was taken in abundance at all the above localities.

We may therefore summarise our knowledge of the distribution of this species by saying that it is an abundant form at the head of the Bay of Bengal and on the east coast of India, from Chittagong and the delta of the Ganges to Vizagapatam, usually found in brackish water or in fresh water not far distant from the influence of brackish tidal streams, but occasionally found in absolutely fresh water, beyond suspicion of saline contamination as at Madpur or in the Zoological Gardens at Calcutta, or in water almost as salt as the sea as at L. Chilka.

I have seen no specimens at all from the west coast of India.

Potamomysis assimilis, Tattersall.

P. assimilis, Tattersall, *loc. cit.*

(Plate xiii, fig. 14.)

Complete list of localities.

(1). Chittagong town, brackish ponds near river (*N. Annandale* and *S. W. Kemp*).

(2). Dhappa, near Calcutta, brackish ponds (*N. Annandale*). Type locality.

(3). Garia, Lower Bengal, brackish ponds (*N. Annandale* and *S. W. Kemp*).

(4). Sar Lake, near Puri, Orissa, fresh water (*N. Annandale*).

(5). Edge of the Mahanadi River, Cuttack, Orissa, fresh water (*N. Annandale*).

I have seen specimens from all these localities. This species has a general distribution very closely agreeing with that of *Macropsis orientalis*. It is generally found in company with the latter, but is apparently as a rule not nearly so abundant. Moreover, it seems to prefer brackish water, since it has not yet been taken in water as salt as the sea and only twice has it been found in fresh water. It has not yet been found on the west coast of India.

The additional material that I have been able to examine of this species has enabled me to supplement my original description. I find that in mature males, 6 mm. in length, there is a prominent hirsute lobe on the antennules, similar in form to but shorter than the same appendage in *Macropsis orientalis*. At the time of describing the species, my largest male specimen measured only 4 mm. and in specimens of that size, the appendage is just beginning to show itself as a small hirsute tubercle.

The female has two pairs of incubatory lamellae.

In the specimens from the Mahanadi River, I find that the small spines arming the truncate apex of the telson show a tendency to an arrangement in series of shorter spines with a longer spine between each series (see plate xiii, fig. 14). This arrangement was shown to a much less extent in the type specimens but is probably characteristic of the species.

Most of the specimens have a row of black chromatophores on the inner margin of the outer uropod.

Genus **Indomysis**, nov.

Form of the body comparatively slender.

Eyes well developed.

Carapace not produced in the form of a rostral plate ; lateral corners acutely produced.

Superior antennae of the usual structure but wanting the hirsute appendage in the male.

Antennal scale narrowly oval in shape, setose all round, unjointed.

Telson short, entire, quadrangular in shape, lateral margins armed with a few short spines; apex truncate, armed with a row of small teeth.

First, second and third pairs of pleopods in the male, as in the female. Fourth pair distinctly biramous, inner ramus quite small and bearing only a few delicate setae, outer ramus considerably elongate, extending beyond the posterior margin of the last segment of the pleon, consisting of a single elongate joint terminated by a long slender spiniform seta. Fifth pair elongate, extending beyond the posterior margin of the last segment of the pleon, consisting of a single linear joint armed with setae.

It is possible that the characters of the mandibular palp and the terminal joints of the sixth, seventh and eighth thoracic limbs, as given in the description of the type species below may be found to be of generic significance when further species of the genus are discovered.

This new genus is distinguished by the combination of characters afforded by the unjointed antennal scale, the short entire quadrangular telson and the form of the pleopods in the male. It resembles the genus *Potamomysis* in the form of the telson, but the latter genus has the antennal scale jointed and the pleopods of the male quite different, the fifth pleopod resembling the first, second and third, and the fourth of entirely distinct form. I know of no other genus with which it can be confused. Only one species, the type of the genus, *Indomysis annandalei*, is as yet known.

Indomysis annandalei, gen. et sp. nov.

(Plate xii, figs. 1–5 and pl. xiii, figs. 6–13.)

Form (fig. 1) of the body moderately slender, thorax more than half as long as the pleon.

Carapace leaving the last segment of the thorax fully exposed ; anterior margin not produced in the form of a rostral plate but almost regularly and evenly round and slightly upturned ; antero-lateral corners produced into acute spiniform projections ; a small obtuse frontal spine visible below the anterior margin of the carapace.

Eyes well developed and almost completely uncovered by the carapace ; form nearly cylindrical, one and a half times as long as wide, cornea occupying rather less than the distal half of the eye, hardly at all expanded, pigment black.

Superior antenna (fig. 2) somewhat slender, proximal joint of the peduncle longer than the distal two combined, the latter each armed on their inner distal corners with a single very long and stout plumose seta; hirsute appendage apparently lacking in male specimens.

Inferior antenna with the peduncle about one half as long as the scale, last two joints subequal.

Antennal scale (fig. 3) about four and a half times as long as broad in its widest part, extending considerably beyond the distal end of the antennular peduncle, narrowly oval or lanceolate in shape, setose all round, without a second joint; basal joint from which the scale springs with the outer distal corner acutely produced.

Mandible with a well developed molar process; second joint of the palp linear, not expanded and unarmed; third joint of the palp comparatively short.

First and second thoracic legs (figs. 4–5) of normal form and structure, the masticatory lobes of the first pair well developed.

Third pair of thoracic legs (fig. 6) long and slender; tarsus slightly longer than the merus, three jointed, the first joint the longest; nail well developed.

Fourth and fifth pairs of thoracic legs (figs. 7–8) similar in form to the third pair but having the tarsus shorter and only two jointed; the tarsus of the fifth pair shorter than the tarsus of the fourth.

Sixth and seventh pairs of legs (fig. 9) peculiarly modified; ischial joint long and slender longer than the meral joint; tarsus short and robust, two jointed, second joint quite short; nail well developed and rather robust, having on its inside a strong toothed spine; on the lower distal corner of the first joint of the tarsus there is a long and strong slightly curved spine, which, with the dactylus gives the appearance of a chelate termination to the limbs.

Eighth thoracic legs (fig. 10) long and slender; merus longer than the same joint in the sixth and seventh legs and more slender; tarsus reduced to a single quite short joint, expanded distally, terminating in a short curved nail; the expanded distal end of the tarsal joint forms a sort of palmar edge on which the dactylus can inpinge and is armed with a row of six or seven short spines.

First five segments of the pleon roughly subequal in length; sixth segment about one and three quarters as long as the fifth.

Telson (fig. 13) shorter than the last segment of the pleon, one third as long again as broad at the base and almost three times as long as broad at the apex; latter squarely truncate, armed at each angle with a single spine between which is a row of small teeth, extending entirely across the whole apex of the telson, some of the teeth longer than the others; lateral margins of the telson armed proximally with four to seven short spines, the distal portion of the lateral margins unarmed. In the example figured, the left margin of the telson bears only four spines while the right margin bears seven

Inner uropods one and three quarters as long as the telson, without spines on its inner margins; otocyst rather large.

Outer uropods twice as long as the telson

First, second and third pleopods in the male similar to those of the female; fourth pleopods (fig. 11) distinctly biramous, inner ramus quite small and armed with a few slender setae; outer ramus extending beyond the posterior end of the last segment of the pleon, consisting of a single joint terminated by a very long stout spiniform seta; fifth pleopods (fig. 12) elongate, reaching backwards as far as the outer ramus of the fourth pair, consisting of a single joint armed at the distal end with about four very long and slender setae.

Marsupial pouch of the female, composed of two pairs of lamellae

Locality. Brackish creek at Panvel, near Bombay, February, 1911 (*J. Caunter*). About two hundred specimens up to 7 mm. in length.

I dedicate the species to Dr. Annandale, the Superintendent of the Indian Museum, who has done so much to elucidate the brackish water fauna of India. I have not seen any specimens from any other locality in India

This species differs from all other members of the sub-family Mysinae in the form of the pleopods of the male and the elongate form of the fifth pleopods necessitates a modification of the definition of the sub-family in order that this species may be included. The pseudochelate appearance of the sixth and seventh thoracic limbs, and the peculiar form of the extremity of the eighth thoracic limbs are quite characteristic and unknown to me in any other species.

EXPLANATION OF PLATE XII.

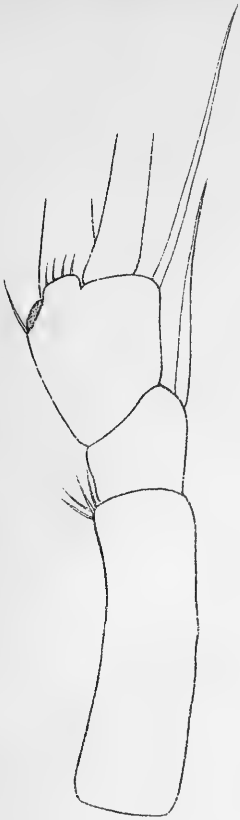
FIG 1.—*Indomysis annandalei*, adult female.

,, 2.— ,, ,, , antennular peduncle.

,, 3.— ,, ,, , antennal scale.

,, 4.— ,, ,, , endopod of the first thoracic limb.

,, 5.— ,, ,, , endopod of the second thoracic limb.



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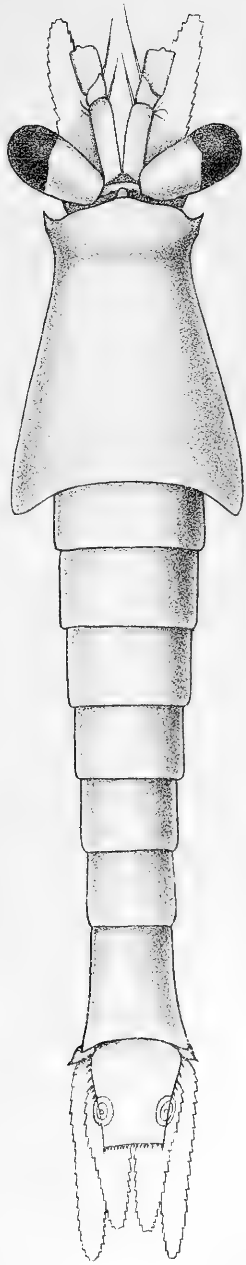

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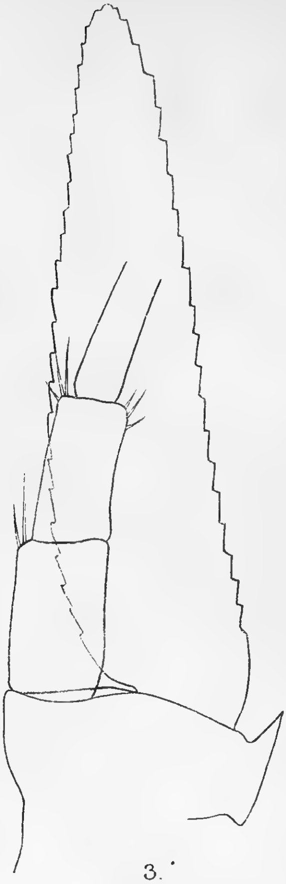

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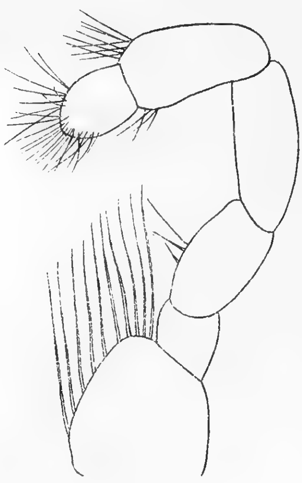

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W.M.T. del.

A.C.Chowdhary, lith.

INDOMYSIS ANNANDALEI, gen. nov., sp. nov.

EXPLANATION OF PLATE XIII.

FIG. 6.—*Indomysis annandalei*, endopod of the third thoracic limb.

,, 7.— ,, ,, , tarsus of the fourth thoracic limb.

,, 8.— ,, ,, , tarsus of the fifth thoracic limb.

,, 9— ,, ,, , endopod of the seventh thoracic limb.

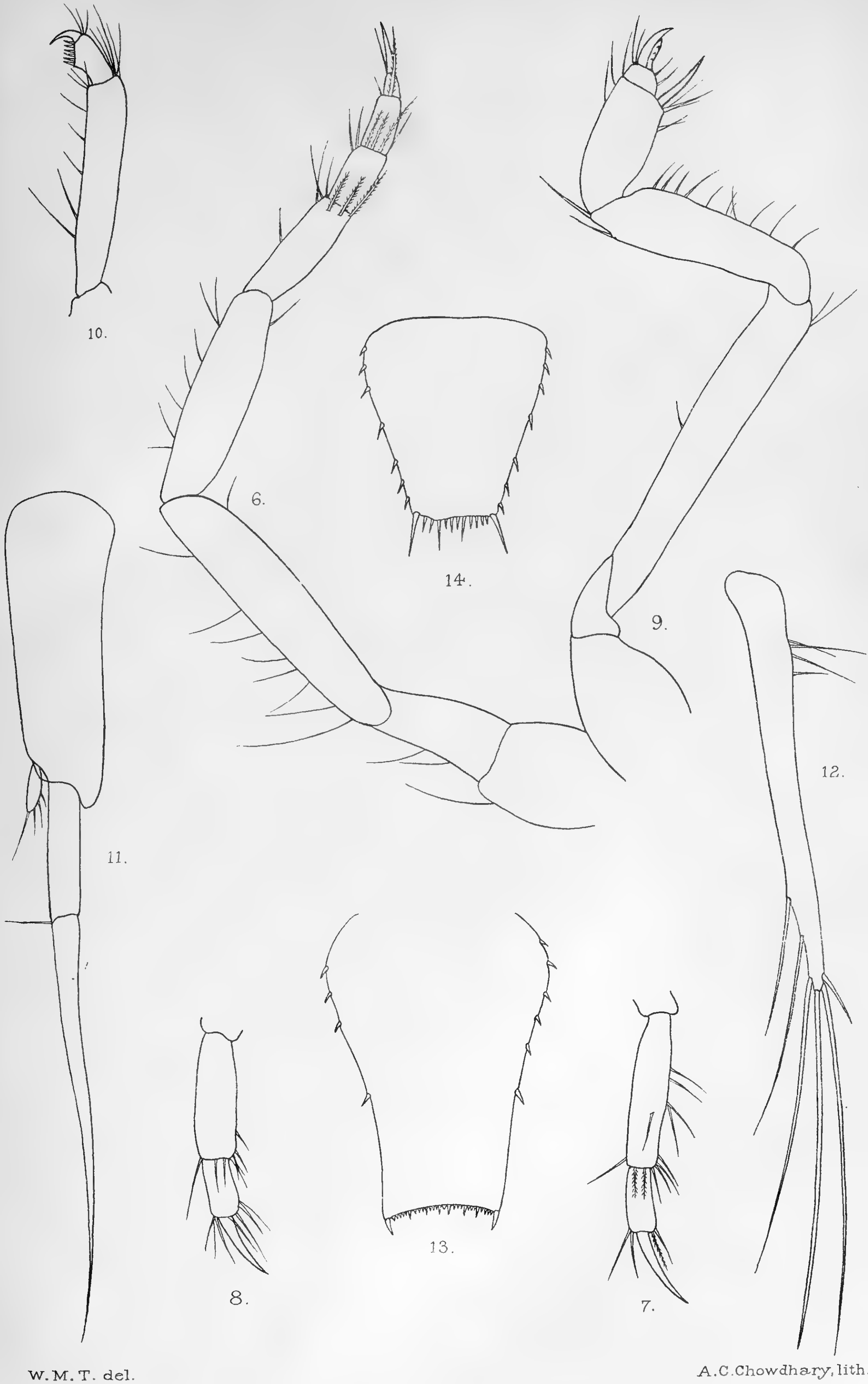
,, 10.— ,, ,, ; tarsus of the eighth thoracic limb.

,, 11.— ,, ,, , fourth pleopod of the male

,, 12.— ,, ,, , fifth pleopod of the male.

,, 13.— ,, ,, , telson.

,, 14.—*Potamomysis assimilis*, telson.



W. M. T. del. A. C. Chowdhary, lith.

Figs. 1-13. INDOMYSIS ANNANDALEI, gen. nov., sp. nov.
Fig: 14. POTAMOMYSIS ASSIMILIS, Tattersall.

IV. NOTES ON CRUSTACEA DECAPODA IN THE INDIAN MUSEUM.

V.—HIPPOLYTIDAE.

By STANLEY KEMP, *B.A., Assistant Superintendent, Indian Museum.*

(Plates I–VII.)

With the exception of a few more or less isolated records little has hitherto been written on the Hippolytidae occurring in Indian waters. The family is well represented in the Indian Museum, but there can be no doubt that many new and unrecorded forms remain to be discovered.

On a recent visit to the coasts of S. India in the vicinity of Rameswaram Island, made in company with Dr. J. R. Henderson of the Madras Museum, several species hitherto unknown from Indian coasts were obtained and there is little doubt that collections from other localities would prove equally interesting. Hippolytidae seem, for the most part, to prefer shallow water and a weedy bottom; it was at any rate in such situations that all the species found in S. India were obtained. Our collection was made in February and at this season the majority of the females were found bearing eggs.

The family Hippolytidae is one of somewhat unusual interest on account of the great diversity of form found in the different genera and of the different modes in which the secondary sexual characters may find expression.

Several genera such as *Leontocaris*, *Cryptocheles*, *Tozeuma* and *Gelastocaris* exhibit structural modifications of the most bizarre character; this specialization is presumably correlated with some unusual form of livelihood, but the reasons for the peculiar adaptations have not as yet been definitely ascertained.

In many of the genera no conspicuous secondary sexual characters are developed, but in others they form a most noticeable feature. In some, such as *Latreutes* and to a less marked extent in *Saron*, the sexes may be distinguished by the development of the upper antennular flagellum, that of the male being longer and stouter than that of the female. Young males of *Saron* in other respects bear a close resemblance to females, but in large individuals of the former sex the third maxillipedes and first peraeopods may attain a monstrous development, being often proportionately twice as long as those of the female. This condition, which is also found in the genus *Alope*, has been discussed at length by Coutière; he considers it to be a case of 'dimorphism', but his application of the term to the phenomena found in these genera is open to question.

In *Thor*, on the other hand, it is the third peraeopods which are affected. In males of this genus the third leg is proportionately much longer than in the female and bears a different type of spinulation.

If my results be accepted, the sexual modifications in one species of *Latreutes* (*L. mucronatus*) are of a very far-reaching nature, the whole form of the animal being different, while distinctions of the most striking character are found in the form of the rostrum.

The normal variation found in the species of certain genera is astonishingly great, especially as regards the form and armature of the rostrum, and it is unfortunate that almost implicit reliance was placed on this character by many of the older authors. As a consequence, a very large number of species stand in need of re-definition and considerable difficulties have been met with in identification, more particularly in the genera *Latreutes* and *Hippolysmata*.

In examining the Indian forms I have described three new species and one variety, while two fresh genera are proposed, both based on forms already described. Out of a total of twenty-two genera, the number now known from the Indo-pacific region[1] is fifteen, of which twelve have been found on the coasts of British India.

A sound basis for the classification of the genera was outlined by Calman in 1906[2] on characters derived from the branchial formula and the development of the mandible. The Indo-pacific genera may be distinguished by the use of the following key, which is adapted and expanded from that given by Calman. The genera *Ogyris*, Stimpson, and *Pterocaris*, Heller, are regarded as members of the Alpheidae and are not included therein. I have not seen examples of the genera *Nauticaris*, *Ligur* and *Mimocaris*.

KEY TO THE INDO-PACIFIC GENERA OF HIPPOLYTIDAE.

A. Arthrobranchiae present at base of first four pairs of peraeopods [mandible with three-segmented palp; many segments in carpus of second peraeopods].

I. A movable tooth at base of uropods.

- A. Mandible with incisor-process ... ... *Saron.*
- B. Mandible without incisor-process ... ... *Nauticaris.*

II. No movable tooth at base of uropods.

- A. Mandible with incisor-process; last three peraeopods not abnormally slender ... ... *Merhippolyte.*

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[1] Under this term I include the area extending from the Red Sea and Delagoa Bay to New Zealand, Oceania, the Hawaiian Is. and Japan.

[2] Calman, Ann. Mag. Nat. Hist. (7), XVII, p. 29.

B. Mandible without incisor-process; last three peraeopods abnormally slender ... ... *Ligur* (= *Parhippolyte*).

B. No arthrobranchiae at base of peraeopods.

I. Mandible with palp [carpus of second peraeopods composed of six to eight segments].

A. Mandibular palp three-segmented; supra-orbital spines of carapace very large [incisor-process of mandible present or absent] ... ... *Alope.*

B. Mandibular palp two-segmented; supra-orbital spines of carapace, if present, not very large [mandible with incisor-process] ... ... *Spirontocaris.*

II. Mandible without palp.

A. Mandible with incisor-process.

I. Carpus of second peraeopods composed of six or seven segments; ultimate segment of antennular peduncle with movable distal plate ... ... *Thor.*

II. Carpus of second peraeopods composed of only three segments; ultimate segment of antennular peduncle without movable plate (normal) ... *Hippolyte.*

B. Mandible without incisor-process.

I. Carpus of second peraeopods composed of three segments.

a. No post-ocular spine on carapace; carpus and chela of first peraeopods short and stout, dactyli of last three pairs normal.

1. Form of body stout; lateral process of basal antennular segment anteriorly rounded; third maxillipede with exopod; epipods at base of first three or four peraeopods ... *Latreutes.*

2. Form of body very slender; lateral process of basal antennular segment anteriorly pointed; third maxillipede without exopod; no epipods at base of peraeopods ... ... *Tozeuma.*

b. A post-ocular spine on carapace; carpus and chela of first peraeopods slender; dactylus of last three pairs composed of a short basal portion bearing a cluster of large teeth [third maxillipede without exopod; epipods at base of first four peraeopods] ... ... *Gelastocaris.*

II. Carpus of second peraeopods composed of many segments.

a. Abdomen bearing argespines dorsally and ventrally; carapace with longitudinal lateral carinae [exopod of third maxillipede present ?] ... *Mimocaris.*

b. Abdomen without large spines; carapace without lateral carinae.

1. Third maxillipede with exopod; epipods at base of first four peraeopods, ultimate segment of antennal peduncle not abnormal in size.

α. Upper antennular flagellum unequally biramous ... ... *Lysmata.*

β. Upper antennular flagellum uniramous ... *Hippolysmata.*

2. Third maxillipede without exopod; no epipods at base of first four peraeopods, ultimate segment of antennal peduncle abnormal in size ... ... *Merguia.*

As the literature dealing with the family is much scattered, I have given, at the end of this paper, a list of the Indo-pacific species with references.

Genus **Saron**, Thallwitz.

Saron marmoratus (Olivier).

1869. *Hippolyte kraussi*, Bianconi, Spec. Zool. Mossambic., XVII, in Mem. Acad. Sci. Bologna (2), IX, p. 209, pl. i, fig. 2*a*.
1878. *Hippolyte kraussi*, Hilgendorf, Monatsb. Akad. Wiss. Berlin, p. 836.
1898. *Saron marmoratus*, Borradaile, Proc. Zool. Soc. London, p. 1009.
1902. *Saron marmoratus*, Borradaile, in Willey's Zool. Results, p. 413.
1903. *Saron gibberosus*, de Man, Abhandl. Senck. nat. Ges., XXV, p. 852, pl. xxvi, fig. 57.
1905. *Nauticaris grandirostris*, Pearson, Ceylon Pearl Oyster Rep., IV, p. 79, pl. i, fig. 6.
1906. *Spirontocaris marmorata*, Rathbun, Bull. U.S. Fish. Comm. for 1903, p. 913.
1906. *Saron gibberosus*, Nobili, Ann. Sci. nat. Zool. (9), IV, p. 40.
1906. *Saron gibberosus*, Nobili, Bull. sci. France et Belg., XL, p. 35.
1910. *Saron gibberosus*, Coutière, Bull. Soc. philomath. Paris (10), II, p. 71, text-figs.

Most of the earlier synonymy of this species is given in full by Borradaile (*loc. cit.*, 1898). It should however be noticed that de Man (*loc. cit.*, 1902) has referred Ortmann's Japanese specimens [1] and some of those recorded by himself both in 1888 [2] and 1897 [3] to a new and very closely allied species, *Saron neglectus*, which is recorded in the present paper from the Andaman Is.

Among the male specimens of *S. marmoratus* preserved in the Indian Museum the variation in the proportional lengths of the third maxillipedes and first pair of peraeopods is enormous; in twenty individuals of this sex from a single locality the third maxillipedes vary from 35 to 77% and the first peraeopods from 30 to 88% of the total length. It is this great variation that has led to the confusion that exists in the taxonomy and has induced earlier authors to describe the species under two separate names, *marmoratus* and *gibberosus*. Thanks to the work of Borradaile and de Man this confusion no longer exists, but there is still, I believe, a certain amount of misconception regarding the occurrence of dimorphism in the genus.

Borradaile, while including *gibberosus* as a synonym of *marmoratus*, notes that in his specimens "the males can be sharply divided into two groups having the *marmoratus* and *gibberosus*-characteristics respectively" and suggests the possibility that the males of the species are dimorphic. This view is upheld by Coutière in a most interesting paper entitled "Les crevettes à mâles dimorphes du genre *Saron*" (*loc. cit.*, 1910); but an examination of the material at my disposal leads me to believe that this supposed dimorphism has no foundation in fact.

The variation shown in the relative lengths of the third maxillipedes and first peraeopods is, as shown in the table on page 85, of enormous extent. In some males these two appendages

[1] Zool. Jahrb., Syst., V, p. 497 (1890).
[2] Arch. f. Naturgesch., p. 533.
[3] Zool. Jahrb., Syst., IX, p. 761.

attain a monstrous size, while in others they are small and approximate more or less closely to those of the female. But this alone is, in my opinion, insufficient to prove the existence of dimorphism: it is essential that the specimens should fall into two well-defined groups and that their measurements, when plotted, should yield a bimodal curve. Measurements of our specimens show no indication of this. The greatest proportional size of the limbs is found in large specimens, but the figures, when plotted, give little other information of interest; there is no trace of a bimodal curve and even on casual examination of the specimens, it is evident that for all practical purposes the series is a graded one.

MEASUREMENTS OF MALE *Saron marmoratus*.

Locality.	Total length.	Length of		Percentage of total length.	
		3rd mxpde.	1st prpd.	3rd mxpde.	1st prpd.
	mm.	mm.	mm.		
Karachi	42	16·5	14	39·3	33·3
	43·5	19·5	17·5	44·8	40·2
	44	19	17	43·2	38·6
	44	19	16·4	43·2	37·3
	46	22·5	21·5	48·9	46·7
	48	25	25	52·1	52·1
	49·5	23·5	22·3	47·5	45
	49·5	23·5	22·5	47·5	45·4
	51	24·2	22	47·4	43·1
	53	25·5	24	48·1	45·3
	53	28	26·7	52·3	50·4
	53	29	30·5	54·7	57·5
	53·5	26·5	26·5	49·5	49·5
	55	30	29	54·5	52·7
	56	32	—	57·1	—
	58	33	34·5	55·2	59·5
	58	44·5	51	76·7	87·9
	61	37	42	60·6	68·8
	61·5	—	45·5	—	72·3
Andamans	33	11·7	10	35·4	30·3
	43	19	15·2	44·2	35·3
Port Canning ...	41	15	12·8	36·6	31·2
	43·5	16	14	36·8	32·2
	46	19	16·5	41·3	35·9
	49	21	16·7	42·8	34·1
	52	—	21·7	—	41·7
	61·5	27·7	25·5	45	41·5

In the measurements taken my specimens seem to agree with those examined by Coutière who has nowhere stated that they can be sharply divided into two groups. They are, however, directly at variance with the results obtained by Borradaile and for this I am unable to offer any adequate explanation.

Judging from the Indian examples the variation in the males of *Saron marmoratus* is closely similar to that found in certain freshwater prawns of the family Palaemonidae. In a number of species of this family the second peraeopods of some males are found to have attained a huge size, while in other individuals of the same sex and species they resemble those of the female: if sufficiently large numbers are examined it is found that the specimens fall into a more or less well-graded series and that it is impossible to separate them into two or more groups. Coutière considers that dimorphism also occurs in the Palaemonidae; but his detailed study of its occurrence in *Palaemon* (*Eupalaemon*) *lar*,[1] although of great interest, does not convince me that this is the case.[2]

Smith defines high and low dimorphism in the following terms[3]:—"It consists essentially in the existence among the males of any species of a graduated series, as regards size and the development of the secondary sexual characters, such that the smaller males have relatively poorly developed secondary sexual characters while the larger males attain to a much greater relative development of those characters. The smaller males are then termed 'low,' and the larger males "high": when there is a more or less abrupt transition in point of numbers from high to low males we may most properly speak of a high and low dimorphism existing in the males of that species, but we also apply the term more loosely to those cases in which no such abrupt transition is proved to occur."

If the last sentence in this paragraph be accepted, the phenomena found in these Caridea may correctly be described as dimorphism, but to do so would, in my opinion, only tend to obscure the real nature of the case. In *Saron*, *Palaemon*, and certain other genera it appears that the male may become sexually mature at a period when, in its secondary sexual characters, it shows but little external difference from the female; but that it gradually assumes the more striking features of its sex in the course of subsequent moults, just as the male parr in which the milt may be ripe gradually assumes the appearance of the adult milt salmon. In Caridea, therefore, the case is one of gradual transition rather than of true dimorphism, by which is implied either a

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[1] Coutière, Ann. Sci. nat. Zool. (8), XII, p. 292 (1901).

[2] Henderson and Matthai in their account of the freshwater Palaemonidae of Southern India (Rec. Ind. Mus., V, 1910, p. 280) have advanced certain facts which seem to indicate that *Palaemon scabriculus*, *P. dolichodactylus* and *P. dubius*, belong in reality to a single species. This suggestion is a most interesting one and, if it be proved, trimorphism in the males of Palaemonidae will be established. The case, however, is on an entirely different footing from that cited above, for the three forms, all founded on males of large size, differ from one another in well-marked characters drawn from the proportional lengths of the individual segments of the second peraeopods.

[3] Smith, Mitth. zool. Stat. Neapel, XVII, p. 312 (1906).

discontinuity in the development of the individual or a marked dichotomy of evolution within the limits of a species.

Coutière at the close of his paper on the males of the genus *Saron* gives an account of certain investigations which he has made on the condition of the testes in *S. marmoratus* and *neglectus*. In those specimens in which the third maxillipedes and first peraeopods were very large he found that the testes were reduced. The suggestion that he makes to account for the condition of the individuals that he examined is a most interesting one, namely that the production of very large limbs is the result of senility. This suggestion should form the basis of further investigation, but the fact that Coutière does not state whether all or any of his specimens, which came from widely separated localities, were killed during the breeding season, makes it impossible to accept his views without further evidence and this, unfortunately, my own material does not provide.

The specimens of *Saron marmoratus* in the Indian Museum were obtained at the following localities:—

$\frac{8103}{9}$	Queensland, Australia.	Queensland Museum.	One, 44 mm.
$\frac{248}{7}$, $\frac{2455}{10}$, $\frac{6403}{10}$	Andaman Is.	A. R. Anderson, J. Wood-Mason.	Six, 33–44 mm.
$\frac{6400}{10}$	Port Canning, Ganges delta.	J. Wood-Mason.	Six, 41–61·5 mm.
$\frac{8456}{10}$	Kilakarai, Ramnad Dist., S. India. From coral reef.	S. Kemp.	One, 44 mm.
$\frac{8454-5}{10}$	Pamban, Ramnad Dist., S. India. From coral reef.	S. Kemp.	Twenty-four, 10–43 mm.
1637, $\frac{3186}{5}$, $\frac{3169-77}{7}$	Karachi, M. of R. Indus.	Karachi Museum.	Forty-eight, 36–65 mm.
$\frac{6401}{10}$	Kubbar I. reef, Persian Gulf.	'Investigator.'	Two, 34 and 59 mm.
$\frac{1460}{7}$	Mauritius.	(Purchased.)	One, 50 mm.

The Pamban specimens were collected in February, 1913. All the larger individuals are ovigerous females and many of them bear coarse tufts of hairs on the rostrum, carapace and abdomen much as in *Hippolyte varians* form *fascigera*.

Saron marmoratus has been recorded from Australia (Milne-Edwards) from the Hawaiian Is. (Randall), and from many localities in Oceania and in the Malay Archipelago (Dana, Heller, de Man, Borradaile, etc.). It is also known from Ceylon (Pearson), Mozambique (Bianconi, Hilgendorf), Zanzibar (Ortmann), the Arabian coast (Nobili), and from the Red Sea (Heller, Nobili).

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1903. *Alope palpalis*, Thomson, Trans. Linn. Soc., Zool. (2), VIII, p. 440, pl. xxviii, figs. 3-12.
1903. *Merhippolyte spinifrons*, Thomson, *ibid.*, p. 444.
1909. *Alope palpalis*, McCulloch, Rec. Australian Mus., VII, p. 313, text-figs. 2, 3.
1906. *Merhippolyte spinifrons* = ? *Alope palpalis*, Calman, Ann. Mag. Nat. Hist. (7), XVII, p. 32.

Dr. Calman has suggested that *Hippolyte spinifrons*, Milne-Edwards, is probably a species of *Alope* and with this view I am in entire agreement. It seems likely that the phrase "les épines suborbitaires" in Milne-Edwards' description is a clerical error for "les épines supra-orbitaires"; this hypothesis explains the italicization of the whole passage and appears to me more probable than the view advanced by Bate[1] that the words refer to the lateral process of the antennular peduncle. In other respects the description agrees well enough with *Alope palpalis*; but until the matter has been placed beyond all doubt it is, in my opinion, not advisable to change the name of this well-known form.

Several subsequent authors have recorded both *Alope palpalis* and *Hippolyte spinifrons* from the New Zealand coast; but it does not appear that any of them, with the possible exception of Filhol, examined both forms. Filhol's *Hippolyte spinifrons*, as is shown by the figure, is undoubtedly synonymous with White's *Alope palpalis*; he refers to the supra-orbital spines as "épines sus-orbitaires" following Milne-Edwards' mistake in terminology. He gives no description of his *Alope palpalis* and it is possible that he has supplied records of its occurrence without examining specimens; his work, as a whole, is not such as to inspire confidence.

Thomson, under the name *Merhippolyte spinifrons*, merely quotes Filhol's account, and the examples subsequently recorded by Chilton[2] under this name from the Kermadec Is. are, as I have been able to determine by examination of specimens kindly sent me by the author, to be referred to the genus *Lysmata* (see p. 110). It is, I believe, most improbable that Milne-Edwards' description was based on this species.

Alope palpalis is represented in the Indian Museum by a single ovigerous female which differs rather markedly from Thomson's description and figures (*loc. cit.*). In the second pair of peraeopods the ischium and merus on the right side are composed of two segments and the carpus of seven (fig. 2). On the left side the ischium is two–, the merus three– and the carpus eight–segmented (fig. 1). The processes on the thoracic sternum bear little resemblance to Thomson's figure and are closely similar in form to those of the allied species, *A. australis* (see pl. I, fig. 5).

Thomson does not refer in any definite way to the great development of the third maxillipedes and first peraeopods in

[1] Bate, Rep. 'Challenger' Macrura, pp. 621, 622 (1888).
[2] Chilton, Trans. N. Zealand Inst., XLIII, p. 547 (1911).

large males of this species, but from Mier's figure (1874, *loc. cit.*) it is evident that this is sometimes a conspicuous feature.

8457/10 New Zealand. Canterbury Mus. exch. One, 39 mm.

Alope palpalis appears to be restricted to the coasts of New Zealand and the neighbouring islands, the records of its occurrence in Australian waters refer to the following species.

Alope australis, Baker.

(Plate I, figs. 3-5.)

1882. *Alope palpalis*, Haswell, Cat. Australian Crust., p. 193.
1898. *Alope palpalis*, Stead, Zoologist (4), II, p. 211.
1904. *Alope australis*, Baker, Trans. Roy. Soc. S. Australia, XXVIII, p. 154, pl. xxx, figs. 1-7.
1909. *Alope australis*, McCulloch, Rec. Australian Mus., VII, p. 313, text-fig. 1.

The chief distinctions between this species and *A. palpalis*, White, are as follows :—

A. australis.	*A. palpalis.*
Rostrum not reaching as far forwards as basal segment of antennular peduncle.	Rostrum reaching as far forwards as basal segment of antennular peduncle.
Supra-orbital spines scarcely reaching beyond base of eye-stalks.	Supra-orbital spines reaching to tips of eyes.
Lateral process of basal segment of antennular peduncle extending little, if at all, beyond end of segment.	Lateral process of basal segment of antennular peduncle extending far in advance of basal segment.
Mandible without incisor-process.	Mandible with incisor-process.

The five Burmese specimens examined differ from Baker's description and figures in a few particulars. The antennular peduncle reaches beyond the middle of the antennal scale, the second segment is longer than the third and is longer than broad ; the lateral process of the basal segment extends at most to the distal end of the segment, usually falling far short of it (fig. 3).

Baker states that *A. australis* differs from *A. palpalis* " in the less divided state of the second pereiopods—except the carpus " and in his figure the merus and ischium of this limb are not segmented. In four of the Indian examples the ischium and merus of this pair are each divided into two segments, while the carpus is composed of seven. In the fifth specimen, a large male, the left leg is similarly segmented, but the right, which is abnormally short, shows traces of subdivision into two and three segments in the ischium and merus and the carpus consists of ten segments, two of these, however, being only feebly indicated (fig. 4).

Three of the specimens examined possess five dorsal teeth on the rostrum; in the other two there are only four.

The mandible agrees closely with Baker's figures; but the second segment of the palp is as broad as long. A small ridge at the base of the palp is all that remains of the incisor-process.

The processes on the thoracic sternum of the large male (fig. 5) consist of (i) a sharp upstanding keel between the third and fourth pairs of peraeopods, (ii) a pair of acute backwardly directed teeth between the fourth and fifth pairs, and (iii) a conspicuous plate, very deeply bifurcated anteriorly, behind the base of the last pair. In small males and in an ovigerous female the processes are similar, but the anterior bifurcation in the plate behind the fifth peraeopods is much less pronounced.

The endopod of the first pair of peraeopods is, in the male, unequally bifid at the apex; in the female it is simple and ends acutely.

In the large male example the third maxillipedes are as long as the entire length of the animal (measured from the tip of the rostrum to the apex of the telson), though in other males and in the female they are less than half the same proportional length. The five specimens yield the following measurements:—

Sex.	Total length.	Length of 3rd mxpde.	Ratio of 3rd mxpde. to total length.
	mm.	mm.	
♂	22	8·5	39
♂	25	11	44
♂	30	14	47
♂	44	44	100
♀	30	12·3	41

The phenomenon is doubtless precisely similar in nature to that already discussed in the case of *Saron marmoratus*. It is to be noted, however, that in males of *Saron* and also, according to Mier's figure, in those of *A. palpalis*, the first peraeopods grow *pari passu* with the outer maxillipedes, whereas in *A. australis* the latter alone appear to affect an extreme development. The point is one of some interest, but it cannot be decided until large collections of both species have been examined.

The specimens of *Alope australis* in the Indian Museum were all found at one locality.

$\frac{6398}{10}$ Arrakan coast, Lower Burma. W. Theobald. Five, 22-44 mm.

The species has hitherto been recorded only from the Australian Coast, from Port Jackson (Stead), Kangaroo I., Smith's Bay (Baker) and Sydney (McCulloch).

Genus **Spirontocaris**, Bate.

1860. *Hippolyte*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, pp. 33-35.
1906. *Spirontocaris*, Calman, Ann. Mag. Nat. Hist. (7), XVII, p. 32 (*ubi cet. syn.*)

Spirontocaris pandaloides (Stimpson).

1860. *Hippolyte pandaloides*, Stimpson, Proc. Acad. Sci. Philadelphia, p. 34.
1902. *Hippolyte pandaloides*, Doflein, Abhandl. bayerisch. Akad. Wiss., XXI, p. 637.
1907. *Spirontocaris pandaloides*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 418, pl. xxxii, figs. 47, 48.

The Indian specimens differ from the long description given by de Man only in respect of the length of the sixth abdominal somite which, in all the larger examples, is little, if at all, more than two-thirds the length of the preceding somite.

On comparison with examples collected at Yokohama by Dr. Haberer and received in exchange from the Munich Museum the only difference that I can find is that in the Japanese specimens the distal end of the third abdominal somite is rather more strongly produced: in the proportions of the last two abdominal somites there is close agreement.

The rostrum in the Indian specimens bears 8 to 12 (usually 9) teeth on the upper margin and 8 to 12 on the lower. The two posterior teeth of the dorsal series are always situated on the carapace behind the orbit.

$\frac{6399}{10}$	Karachi, mouth of R. Indus.	Karachi Museum.	Nine, 33-53 mm.
$\frac{7731}{10}$	Yokohama, Japan.	Munich Mus. exch.	Three, *ca.* 42-50 mm.

Spirontocaris pandaloides has hitherto been recorded only from Japan; from Hakodadi (Stimpson), Yokohama (Doflein) and the Inland Sea (de Man).

Genus **Thor**, Kingsley.

1878. *Thor*, Kingsley, Proc. Acad. Sci. Philadelphia, XXX, pp. 6, 94.
1899. *Thor*, Kingsley, American Naturalist, XXXI, pp. 714, 718.
1901. *Thor*, Rathbun, Bull. U. S. Fish Comm. for 1900, II, p. 116.
1905. *Paschocaris*, Nobili, Bull. Mus. d'Hist. nat., Paris, p. 394.
1906. *Paschocaris*, Nobili, Ann. Sci. nat. Zool., Paris (9), IV, p. 37.

The genus *Thor* is very closely related to *Hippolyte*, but differs from *H. varians*, the type species of the latter genus, in the greater number of segments in the carpus of the second peraeopods and in the absence of supra-orbital and pterygostomian spines from the carapace. It is also distinguished by the presence of a curious movable triangular plate situated dorsally at the end of the ultimate segment of the antennular peduncle.

Thor paschalis (Heller).

Plate I, figs. 6-10.

1861. *Hippolyte paschalis*, Heller. Sitz-ber. Akad. Wiss. Wien, XLIV, p. 276, pl. iii, fig. 24.
1878. *Thor floridanus*, Kingsley, Bull. Essex Inst., X, p. 64.
1878. *Thor floridanus*, Kingsley, Proc. Acad. Sci. Philadelph., pp. 7, 95.
1879. *Thor floridanus*, Kingsley, *ibid.*, p. 421, pl. xiv, fig. 6.
1887. *Hippolyte paschalis*, de Man, Arch. f. Naturgesch., LIII, i, p. 534.
1887. *Hippolyte amboinensis*, de Man, *ibid.*, p. 535.
1901. *Thor floridanus*, Rathbun, Bull. U. S. Fish Comm. for 1900, II, p. 116.
1901-3. *Thor floridanus*, Verrill, Trans. Conn. Acad., XI, p. 19.
1905. *Hippolyte paschalis*, Lenz, Abh. Senck. naturf. Ges. Frankfurt, XXVII, p. 382.
1905. *Paschocaris paschalis*, Nobili, Bull. Mus. d'Hist. nat., Paris, p. 394.
1906. *Paschocaris paschalis*, Nobili, Ann. Sci. nat. Zool., Paris (9), IV, p. 38, pl. iii, fig. 1.

The synonymy shown above is given with confidence. Not only is it at once evident from comparison between Nobili's description of *Paschocaris* (1906) and that of *Thor*, as given by Miss Rathbun, that the two genera are identical, but I have been able to compare American examples, received under the name of *Thor floridanus* from the United States National Museum, with specimens from S. India which unquestionably belong to the form described by Nobili as *Paschocaris paschalis*.

The identity of the two forms is complete, unless it be that any importance can be attributed to the slightly stouter and more gibbous form of the S. Indian specimens: microscopic examination of the appendages fails to yield evidence for the recognition even of a subspecies in the case of the American form. The fact is one of considerable interest, for, among littoral Decapoda, it is most unusual to find a species inhabiting both the Atlantic and the Pacific without exhibiting any distinct structural differences.[1]

It is scarcely necessary to describe the species in detail for good accounts have already been given by Heller, de Man, Rathbun and Nobili.

In the examples from S. India the rostrum is bifid at the apex (in one specimen trifid) and bears three or four (very rarely two) teeth on its dorsal margin; one of the dorsal teeth is usually situated on the carapace behind the orbital notch. In the American examples the apex is bifid in four specimens, trifid in a fifth, and there are four dorsal teeth.

[1] Faxon (Mem. Mus. Comp. Zool. Harvard, 1895, XVII, p. 235, footnote) gives a list of Decapoda which have been recorded both from the Gulf of Panama and from the West Indian side of America: the identity of the species of *Alpheus* mentioned in this list is, as he remarks, doubtful. Excluding free-swimming forms such as *Pasiphaë sivado* and those having a circumpolar distribution, the only littoral Decapoda Natantia that I can call to mind which inhabit both the Atlantic and the Indo-pacific are *Peneus caramote, Stenopus hispidus, Processa canaliculata* and *Athanas nitescens,* and some of these cases require further investigation.

The carpus of the second peraeopod is composed of six, less commonly of seven, segments. It is described by Miss Rathbun as "five annulate", and six segments are distinct in the American examples which I have examined. The two proximal articulations are much less clearly marked than the remaining three, and the fact that in one specimen (fig. 9) there is a further subdivision, making three short proximal segments, indicates that the character is subject to some variation. In the normal 6-segmented carpus the proportional lengths of the segments differ somewhat from Miss Rathbun's description, but agree closely with the account given by Nobili. Comparison of fig. 7, which represents the carpus and chela of a specimen from Florida, with fig. 8, in which the same segments of a S. Indian individual are shown, will indicate the almost exact similarity in segmentation.

A feature of the species which seems to have escaped notice hitherto is the great development of the third peraeopod in the male. In the female (fig. 6) this limb is closely similar to those of the two succeeding pairs, but in males, both from Florida and from S. India, it is very much longer (fig. 10), reaching beyond the apex of the antennal scale by the dactylus and about one-half of the propodus. The propodus, moreover, is broadened towards its ultimate end and the inferior margin is, for rather more than its distal third, thickly beset with slender spines. The dactylar spines of the limb are also far more numerous.

As regards the spinulation of the merus in the last three pairs of legs there is considerable variation. In one example (from America) it bears five spines, in others two, three, or none at all. The telson bears three pairs of dorsal spinules: in some specimens four on one side and three on the other. The spinulation of the apex of the telson agrees with Nobili's description.

The following specimens have been examined :—

$\frac{8462-3}{10}$	Kilakarai, Ramnad Dist., S. India.	S. Kemp.	Seventeen, 7-12 mm.
$\frac{8464}{10}$	Pamban, Ramnad Dist., S. India.	S. Kemp.	One, 12 mm.
$\frac{7977}{10}$	Punta Rassa, Florida.	Smiths. Inst.	Five, 10-14 mm.

The specimens from Kilakarai and Pamban were found among weeds in water only a few feet deep. They were caught in February, 1913, and all, with the exception of two, are ovigerous females.

Thor paschalis has been recorded from Amboina (de Man), the Red Sea (Heller, Nobili) and from Zanzibar (Lenz). In the Atlantic it is known from the West Indies, the Bermudas, Florida, Yucatan and neighbouring localities (Kingsley, Rathbun, Verrill).

Genus **Hippolyte**, Leach.

1860. *Virbius*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 35.

Hippolyte ventricosus, H. Milne-Edwards.

Plate II, figs. 1-3.

1837. *Hippolyte ventricosus,* H. Milne-Edwards, Hist. nat. Crust., II, p. 371.
1878. *Virbius mossambicus,* Hilgendorf, Monatsb. Akad. Wiss. Berlin, p. 836, pl. iv, fig. 1.

This species is very closely related to *Hippolyte varians,* Leach, and should perhaps be regarded merely as a subspecies. The two forms may be distinguished by the following characters :—

H. ventricosus.	*H. varians.*
Rostrum rather more slender; armed with one or two dorsal teeth in its proximal third; apex acuminate (fig. 1).	Rostrum less slender, armed (usually) with only a single dorsal tooth in its basal third; a small dorsal tooth nearly always present close to apex, giving it a bidentate appearance.
Antennal scale not more than three times as long as broad (fig. 2).	Antennal scale three and a quarter to three and a half times as long as broad (fig. 4).
Thoracic appendages proportionately stouter; middle carpal segment of second peraeopods as broad as long (fig. 3).	Thoracic appendages proportionately more slender; middle carpal segment of second peraeopods nearly twice longer than broad (fig. 5).
Sixth abdominal somite about one and a half times as deep as long.	Sixth abdominal somite twice as deep as long.
Size smaller, ovigerous females not exceeding 20 mm. in length.	Size larger, ovigerous females sometimes 31 mm. in length.

Apart from the characters afforded by the rostrum, which, owing to the enormous range of variation that exists in both species, must necessarily be somewhat inconclusive, the principal difference between the two forms rests in the stouter build of that found in the Indo-pacific region. Structural distinctions of this nature are found in almost every part of the body, but in most cases they are so slight that it is scarcely possible to demonstrate them mathematically. They are, however, clearly shown in the proportions of the last abdominal somite and carpal segments of the second peraeopods and find less well-marked expression in the form of the antennal scale. The three segments composing the carpus of the second peraeopods have the same longitudinal proportions as in *H. varians.* The mouth parts of the two species are in closest agreement (the mandibles are nearly identical in structure) and no noteworthy differences are to be found in the arrangement of the gills and epipods or in the spinulation of the telson-tip and of the dactyli of the last three pairs of peraeopods.

Milne-Edwards' description of *Hippolyte ventricosus* is extremely brief and runs as follows:—

"Espèce extrêmement voisine de l'H. variable, mais dont le rostre ne porte en dessus qu'une seule dent située près de sa base, et dont les prolongemens latéraux des trois premiers anneaux de l'abdomen présentent des dimensions très-considerables. Longuer environ 4 lignes."

"Trouvée par M. Dussumier dans les mers d'Asie. (C. M.)"

The species does not seem to have been recorded—as *H. ventricosus*—since Milne-Edwards' time; but I believe that *Virbius mossambicus*, a name given by Hilgendorf in 1879 to a species found off the mouth of the Zambesi, is synonymous.

Milne-Edwards' reference to the abdominal segments is perplexing, for no definite differences are to be found in this respect between the Indian specimens and English examples of *Hippolyte varians*. The description of the rostrum seems, however, to leave little doubt of the identity of the species, more especially as, with the exception of *V. mossambicus*, no form closely resembling *H. varians* has yet been found in Asiatic waters.

The species appears to be very nearly related to *H. orientalis*, Heller[1], and it is possible that this name must be included in the synonymy of *H. ventricosus*. South Indian specimens agree well with Heller's description except that it is extremely rare to find among them an example with four teeth on the inferior margin of the rostrum.

Nobili[2] considers Paulson's *H. proteus*[3] a synonym of Heller's *H. orientalis*; but according to Czerniavsky[4] Paulson has confounded under the former name several known species, viz. *H. brullei*, Guérin, (=*H. prideauxiana*, Bell), *H. gracilis*, Heller, and *H. leptocerus*, Heller. Czerniavsky may be right, in part; but on general grounds it appears to me very unlikely that *H. prideauxiana* and *H. gracilis* occur in the Red Sea. It is probable that *H. ventricosus* does so, but it is impossible to speak with any certainty until further information is available. Indian specimens of *H. ventricosus* differ from *H. proteus*, as figured by Paulson, in the shorter antennular peduncle and in the carpal segmentation of the second peraeopods.

The specimens of *H. ventricosus* in the Indian Museum are registered thus:—

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1 Heller, Sitzber. math.-naturw. Klasse d. Kais. Acad. Wiss. Wien, XLIII, p. 277 (1861).

2 Nobili, Ann. Sci. nat. Zool. (9), IV, p. 33 (1906).

3 Paulson, Red Sea Crustacea, Kiew, p. 109, pl. xvi, figs. 2-5; pl. xviii, fig. 1 (1875).

4 Czerniavsky, Crustacea Decapoda Pontica Littoralia, p. 13 (1884).

$\frac{8458-60}{10}$ Kilakarai and Apa I., Ramnad Dist., S. India, 0-2 fms.	S. Kemp.	Many, 7-20 mm.
$\frac{8461}{10}$ Pamban, Ramnad Dist., S. India, 0-2 fms.		

The species was found in abundance at both the above localities, living among Zostera and other weeds inside the coral reef at depths ranging from low water to two fathoms. The specimens were obtained in an environment closely similar to that in which *H. varians* abounds on the English and Irish coasts and, at the time of capture, it was thought they must certainly belong to that species.

In colour the majority were of a brilliant green; but very many other types, each having its counterpart in home waters, were observed. The collection, which was made in February, 1913, contains a high proportion of ovigerous females.

Hippolyte australiensis (Stimpson).

Plate II, fig. 6.

1860. *Virbius australiensis* Stimpson, Proc. Acad. Sci. Philadelphia, p. 35.
1882. *Virbius australiensis*, Haswell, Cat. Australian Crust., p. 186.

Specimens of this species received in exchange from the Australian Museum differ from those of the preceding form in possessing no teeth on the dorsal margin of the rostrum and in having from four to six teeth (rarely three) ventrally. The ultimate segments of the antennular peduncle are shorter and broader, the second being broader than long, the antennal scale (in an ovigerous female) is three and a third times as long as broad and the last segment of the third maxillipede is scarcely twice the length of the penultimate. The proportions of the segments in the carpus of the second peraeopods are also different (fig. 6). The middle segment, as in *H. varians* and *H. ventricosus*, is much the shortest, but the third is decidedly longer than the first. The last three pairs of legs are stout. In an ovigerous female the propodus of the fifth pair is only five and a half times as long as broad and is little more than twice the length of the dactylus (spines included).

$\frac{7634-9}{10}$ New South Wales Coast.	Australian Mus. exch.	Twelve, 13-22 mm.

Hippolyte australiensis is known only from the Australian coast.

Genus **Latreutes**, Stimpson.

1906. *Latreutes*, Calman, Ann. Mag. Nat. Hist. (7), XVII, p. 33 (*ubi syn.*)

Carapace without supra-orbital, but with antennal spine; a series of small spines on antero-lateral margin. Basal process of antennular peduncle anteriorly rounded; upper antennular flagellum uniramous. Mandible without incisor-process or palp.

Third maxillipede with exopod. No arthrobranchs at base of peraeopods; epipods present on at least first three pairs. Carpus of second peraeopods composed of three segments.

Nearly all the species of this genus stand in need of re-definition. They are for the most part based on the character of the rostrum which, in this genus, is subject to even greater variation than in *Spirontocaris* or *Hippolyte.*

The three species known from the Indian coasts may be separated thus:—

I. Dactyli of last three pairs of peraeopods with conspicuous spines on margin.
  A. Form very slender, basal segment of antennular peduncle three times as long as wide, antennal scale more than six times as long as wide; legs short, second pair not reaching to end of eyes ... ... *L. pygmaeus.*
  B. Form stouter, basal segment of antennular peduncle twice as long as wide, antennal scale not more than four and a half times as long as wide (less in adults); legs longer, second pair reaching beyond end of antennular peduncle ... ... *L. mucronatus.*

II. Dactyli of last three pairs of peraeopods simple claws, without spines on margin ... ... *L. anoplonyx.*

I have seen no specimens of the very curious *Latreutes ceylonensis* described by Pearson from the Ceylon pearl banks.[1] The species differs from all other members of the genus with which I am acquainted in the peculiar spinulation of the carapace and antennal scale and in the armature of the dactyli of the last three peraeopods. In many respects it appears to be allied to Nobili's *Latreutes paronae* which is here regarded as the type of a new genus, *Gelastocaris.*

Latreutes pygmaeus, Nobili.

Plate II, figs. 7, 8; Plate III, figs. 1-7.

1904. *Latreutes pygmaeus,* Nobili, Bull. Mus. d'hist. Nat., Paris, p. 230.
1906. *Latreutes pygmaeus,* Nobili, Bull. sci. France Belg., XL, p. 37, pl. iii, figs, 4, a-h.
1906. *Latreutes pygmaeus,* Nobili, Ann. Sci. nat. Zool. (9), IV, p. 41.

Large series of specimens obtained at Kilakarai and Pamban in S. India may undoubtedly be referred to this species, which is a very close ally of the Atlantic *L. ensifer.*

Nobili's account may be supplemented as follows:—

The small dorsal spine on the carapace behind the orbit is movable, as in *L. ensifer,* and not fixed as in certain other species of the genus. The rostrum is sometimes wholly unarmed, but more usually bears from 1 to 3 dorsal teeth and 1 to 3 ventral teeth, all situated in the distal third. The apex may be acute or bluntly rounded (pl. II, figs. 7, 8; pl. III, figs. 1-3).

Close to the cornea on the inner and superior aspect of the stalk the eye bears a small conical process similar to that described by Nobili in allied species.

[1] Ceylon Pearl Oyster Rep., IV, p. 81, pl. ii, figs. 7, 7 *a—e.*

The antennular peduncle reaches to less than half the length of the antennal scale. Its basal segment is elongate (pl. III, fig. 4), about three times as long as broad, and its lateral process is anteriorly rounded and feebly bilobed. The second segment is, in the female, longer than broad. The antennal scale (pl. III, fig. 5) is very sharply pointed anteriorly and is more than six times as long as broad.

The third maxillipedes reach to the base of the antennal scale, the peraeopods of the second pair to the middle of the eye, those of the fifth pair extending scarcely further forwards. Of the three segments composing the carpus of the second peraeopods the middle one is the longest and the third the shortest. The middle segment is about one and a half times the length of the first and the first is one and a third, or rather more than one and a third times the length of the third: there is a little variation in the precise measurement of these segments. The dactyli of the last three peraeopods terminate in sharp curved spines: there are a few other spines on the posterior margin, the ultimate being large and placed close to the terminal spine, giving the apex a biunguiculate appearance (pl. III, fig. 6). Epipods are present at the base of the first four pairs of legs.

The sixth abdominal somite is fully one and three quarters the length of the fifth. The telson in S. Indian specimens bears only two pairs of dorso-lateral spinules in addition to those at the apex, not three as Nobili has stated.

The male is very different in appearance to the female. It is much more slender in build and the rostrum seldom bears more than one tooth on either margin near the apex. The antennular peduncle is shorter than in the other sex, but the upper flagellum is stouter and very much longer. In the female the flagellum does not nearly reach the apex of the antennal scale, whereas in the male it extends beyond that point by almost half its length.

The colour of living specimens is very variable. As a rule they are of a uniform dull green, but olive, brown and brownish red specimens are frequent.

Latreutes pygmaeus has exceedingly close affinities with *L. ensifer*, Milne Edwards, the type species of the genus. I have compared South Indian specimens of the former species with examples of the latter obtained in the Sargasso Sea. The Atlantic form is slightly more robust in build, the rostrum is more strongly concave above and the teeth are more closely restricted to the apex. The legs are a little longer, the second pair reaching the ends of the eyes, the antennal scale is proportionately a trifle broader and the sixth abdominal somite is shorter and a little less slender. The second segment of the antennular peduncle is about as broad as long in the female Probably the best distinction between the two forms rests in the number of epipods at the base of the legs; in *L. pygmaeus* they are found on the first four pairs, while in *L. ensifer* they occur only on the first three.

$\frac{8474-6}{10}$	Kilakarai, Ramnad Dist., S. India.	S. Kemp.	Many, 9-20 mm.
$\frac{8477-8}{10}$	Pamban, Ramnad Dist., S. India.		

Latreutes pygmaeus was common at both of the above localities living among weeds in a few feet of water; in life the species bore a close general resemblance to the British *Hippolyte prideauxiana*. The collection, made in the month of February, includes a large proportion of ovigerous females.

The species has been recorded by Nobili from the S. E. coast of Arabia and the Red Sea.

Latreutes mucronatus (Stimpson).

Plate III, figs. 8-15; plate IV, figs 1, 2.

1860. *Rhynchocyclus mucronatus*, Stimpson, Proc. Acad. Sci. Philadelphia, p. 28.
1902. *Latreutes mucronatus*, Doflein, Abhandl. bayerisch. Akad. Wiss., XXI, p. 638, pl. v, fig. 6.
1904. *Latreutes gravieri*, Nobili, Bull. Mus. Hist. nat., p. 231.
1906. *Latreutes gravieri*, Nobili, Bull. sci. France et Belg., XL, p. 39, pl. iii, figs. 4-44.
1906. *Latreutes gravieri*, Nobili, Ann. Sci. nat. Zool. (9), IV, p. 41.
1906. *Latreutes mucronatus* var. *multidens*, Nobili, *ibid.* p. 41, pl. ii, fig. 3.

Examination of a series of specimens from S. India suggests that *L. gravieri* must be regarded as a synonym of *L. mucronatus* and that there is no foundation for the retention of the varietal name *multidens*.

The series comprises twenty-nine examples, and of these eighteen were immediately separated from the rest on account of their stout and gibbous form and more or less circular rostrum (pl. III, figs. 8, 9; pl. IV, fig. 1). They were at once referred to *L. mucronatus* and examination of their rostral formulae indicated that the type specimen of *L. mucronatus* with a formula of $\frac{6}{6}$ and those referred by Nobili to his var. *multidens*, with formulae ranging from $\frac{2-15\ 1}{8-21\ 1}$, are only terms in a series exhibiting continuous variation. The formulae which the S. Indian specimens yield are as follows[1]:—

$\frac{1)15}{15}$ $\frac{1)13}{13}$ $\frac{1)12}{13}$ $\frac{1)11}{12}$ $\frac{1)10}{11}$ $\frac{1)11}{9}$ $\frac{1)9}{8}$ $\frac{1)7}{8}$ $\frac{1)12}{7}$ $\frac{1)9}{7}$

$\frac{1)8}{7}$ $\frac{1)8}{7}$ $\frac{1)8}{7}$ $\frac{1)7}{7}$ $\frac{3)10}{6}$ $\frac{3)9}{6}$ $\frac{1)8}{6}$ $\frac{4)13}{4}$

The remaining specimens characterized by their more slender form and narrower rostrum (pl. III, figs. 10, 11; pl. IV, fig. 2) afforded a more difficult problem. Not only did the rostrum exhibit a most remarkable diversity of form, but the proportions

[1] The figure on the left, separated by a bracket, represents the number of teeth on the carapace in the median line.

of the antennal scale and the spinulation of the antero-lateral margin of the carapace also showed extensive variation. A single specimen, however, the only one which possessed two teeth on the carapace (pl. III, fig. 11) was referred without difficulty to to *L. gravieri*, and by an attentive study of the remainder the conclusion that they also must belong to that species was reached.

It was only when these preliminary results were obtained that it was noticed that all the examples referred to *L. mucronatus* were female, while all referred to *L. gravieri* were male. The fact that both forms were found together at each of the two localities where specimens were obtained, suggested that the conclusions derived from the form of the animal and the characters of the rostrum were fallacious and a renewed study of the proportional measurements of the appendages and comparison with the sexual distinctions found in *L. pygmaeus* led to the conclusions outlined in the above synonymy.

In the female specimens (pl. IV, fig. 1) the rostrum reaches almost to or a little beyond the end of the antennal scale. At its base it is inferiorly excavate for the accommodation of the eye and in lateral view the length from the back of the orbit to the apex is less than twice, often not more than one and a half times the greatest height. Anteriorly the rostrum is sometimes almost circular in outline, but more often it is distinctly pointed. The dorsal and ventral teeth are borne only in its distal half.

The carapace is strongly arched dorsally. It is not carinate in the median line but bears, as a rule, a single stout fixed tooth behind the base of the rostrum: in rare instances three or four teeth (pl. III, fig. 8) are found in this position. There is a sharp antennal tooth and a series of small spines, usually 11—14, on the antero-lateral margin.

The eyestalk is a trifle wider than the cornea and bears a conspicuous pointed process on its inner distal aspect. The antennular peduncle reaches a little beyond the middle of the antennal scale and has the proportions shown in pl. III, fig. 12. The antennal scale (pl. III, fig. 13) is about three times as long as wide.

The outer maxillipede reaches a little beyond the antennal peduncle.

The second peraeopods reach about to the apex of the rostrum. The carpus is divided into three segments, of which the first and third are approximately equal, each being about half the length of the middle segment. The palm is a little longer than the last carpal segment and is decidedly longer than the dactylus.

The dactylus of the last three pairs of peraeopods, as in *L. pygmaeus*, terminates in two stout claws and bears three or four small spines on the posterior margin. In the fifth pair the carpus is a little more than two-thirds the length of the propodus. The dactylus is rather more than one-third the length of the propodus.

The last abdominal somite is about twice the length of the fifth. The telson bears two pairs of dorsal spinules and terminates in a narrow pointed process flanked by a pair of spines on either side. The innermost of these is more than twice the length of the outer and is often nearly twice as long as the median process. The outer uropod is shorter than the inner and is about three and a half times as long as broad.

In the male the whole form of the animal is far more slender, as will be seen on comparing figs. 1 and 2, plate IV. The rostrum is longer and much narrower in lateral view; it extends well beyond the apex of the antennal scale and exhibits the following spine formulae —

$$\frac{1)7}{9} \quad \frac{1)7}{9} \quad \frac{1)7}{7} \quad \frac{1)8}{6} \quad \frac{1)5}{6} \quad \frac{1)5}{6}$$

$$\frac{1)4}{6} \quad \frac{1)4}{6} \quad \frac{1)5}{4} \quad \frac{1)6}{1} \quad \frac{2)5}{0}$$

It seems that, as in *L. pygmaeus*, the teeth are on the whole less well-developed in males than in females; some of the males, however, are of very small size and may not have developed the full complement. Seen laterally the greatest length of the rostrum from the back of the orbit to the apex varies from two and a half to four times its greatest height: proportions strikingly variable and different from those found in the female (*cf.* pl. III, figs. 10, 11, pl. IV, fig. 2, and pl III, figs. 8, 9, pl. IV, fig. 1).

The carapace is not arched in lateral view. It bears a single dorsal fixed spine in ten of the specimens examined, while in the eleventh, which in this respect resembles the type of *L. gravieri*, there are two. It will be noticed that one, three, or four spines have been found in this situation in females.

The differences in other respects between the two sexes are less striking. There may be only six or seven spines on the antero-lateral margin of the carapace. The upper antennular ramus is stouter and very considerably longer than in the female; this feature affording the readiest distinction between the two sexes. The antennal scale may be four and a half times as long as broad in young males (pl. III, fig. 14); in older specimens the length is usually about three and a half times the breadth. In one individual the outer margin is very definitely concave (pl. III, fig. 15).

The third maxillipede scarcely reaches beyond the antennular peduncle. The second peraeopods in large specimens reach beyond the middle of the antennal scale, but are shorter in small examples. They agree precisely with those of the female in the proportional length of the segments.

The dactylus of the last three pairs agrees with that of the female and is a little more than one third the length of the propodus. The propodus of the fifth leg is usually shorter than in the female and is not quite so long as the merus.

According to Miss Rathbun[1] Stimpson's *Rhynchocyclus mucronatus* is synonymous with *Latreutes planirostris* (De Haan); but no reasons are advanced for this view and Stimpson appears to have had both species before him when writing in 1860. The Indian specimens differ widely from *L. planirostris* as figured and described by De Haan.[2]

$\frac{8472}{10}$	Kilakarai, Ramnad Dist., S. India.	S. Kemp.	Twenty nine,
$\frac{8473}{10}$	Pamban, Ramnad Dist., S. India.		9-13·5 mm.

The specimens were obtained in February, 1913, among weeds in water only a few feet deep; the females are ovigerous.

Latreutes mucronatus has been recorded from Sagami Bay, Japan (Doflein), Hongkong (Stimpson), Java (Nobili, *sub* var. *multidens*), the S. E. coast of Arabia and the Red Sea (Nobili, *sub* var. *multidens* and *L. gravieri*).

Latreutes anoplonyx, sp. nov.

Plate IV, figs. 3—5.

This species, founded on a single adult female, is readily distinguished from the two preceding by the simple claw-like dactyli of the last three peraeopods.

The specimen is robust in build. The carapace is not carinate mid-dorsally, but bears a single prominent fixed tooth in the middle of its anterior third. The antennal spine is strong and there is a series of eleven small spines on either antero-lateral angle (fig. 3).

The rostrum is triangular in shape; it reaches beyond the apex of the antennal scale and is rather more than three-quarters the length of the carapace; its greatest height in lateral view is rather more than one-third its extreme length from the back of the orbit. The dorsal margin is concave (the apex being directed obliquely upwards) and bears thirteen teeth in the distal two-thirds of its length; the inferior margin is evenly curved and is furnished with nine teeth in its distal half. The extreme apex is broken off and on it one or two additional teeth may have been situated.

On the eyestalk there is a lobe similar to that found in the preceding species, but much less conspicuous.

The antennular peduncle is very short, reaching to little more than one-third the length of the antennal scale. The lateral process is rounded and the second segment is broader than long. The stout upper antennular ramus reaches (in the female) almost to the end of the scale. The antennal scale (fig. 4) is pointed anteriorly and is about four times as long as wide.

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1 Proc. U.S. Nat. Mus., XXVI, p. 46 (1902).

2 In Siebold's Fauna Japonica, Crust., p. 175, and atlas, pl. xlv, fig. 7 (1843-9).

The oral appendages do not differ noticeably from those of the two preceding species. The third maxillipedes reach beyond the end of the antennular peduncle; the ultimate segment is less than twice the length of the antepenultimate.

In the chela of the first peraeopods the finger is about as long as the palm. The second peraeopod reaches to the middle of the rostrum. Of the three segments composing the carpus, the first is scarcely half the length of the second and is a little longer than the third; the chela is as long as the middle segment and the dactylus is shorter than the palm.

The third peraeopods reach forward a little beyond the end of the second and the fifth extend to the end of the eyes. The dactylus in each of the last three legs consists of a strong curved claw about one third the length of the propodus; it may bear a few microscopic spinules, but is otherwise wholly unarmed.

Large epipods are present at the base of the first four pairs of peraeopods.

The sixth abdominal somite is more than one and a half times the length of the fifth. The outer uropod is two and two-thirds times as long as broad. The telson bears two pairs of dorsal spinules and terminates in a narrow apex composed of a short median process with two spines on either side; the inner spine is longer than the median process and nearly twice the length of the outer (fig. 5).

In the absence, in the majority of cases, of any information regarding the spinulation of the dactyli of the last three legs, it is difficult to make suggestions regarding the affinities of the species described above. It appears to be most nearly related to Ortmann's *L. laminirostris*, but differs from that, and apparently from all other known species of the genus, in the form of the rostrum.

Bombay.	Bombay Nat. Hist. Soc.	One, ovigerous female, 39 mm. TYPE.

For the opportunity of examining the single known example of this species I am indebted to the Secretary of the Bombay Natural History Society.

Genus **Tozeuma**[1], Stimpson.

1860. *Tozeuma,* Stimpson, Proc. Acad. Sci. Philadelphia, p. 26.
1863. *Angasia,* Bate, Proc. Zool. Soc. London, p. 498.

Form extremely slender. Carapace without supra-orbital, but with antennal spine; a single spine at antero-lateral (pterygostomian) angle. Lateral process of antennular peduncle sharply pointed anteriorly. Upper antennular flagellum uniramous. Mandible without incisor-process or palp. Third maxillipede without exopod.

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[1] Stimpson informs us that this name is derived from the Greek Τόξευμα, but, if the spelling is emended, the name is preoccupied by Walker for a genus of Hymenoptera.

No arthrobranchs or epipods at base of peraeopods. Carpus of second peraeopods composed of three segments.

Tozeuma armatum, Paulson.

1875. *Tozeuma armatum*, Paulson, Red Sea Crustacea, Kiew, p. 99, pl. xv, figs. 2, *a-o*.
1893. *Angasia stimpsoni*, Henderson, Trans. Linn. Soc., Zool., V, p. 437, pl. xl, figs. 18-20.
1906. *Angasia armata*, Nobili, Ann. Sci. nat. Zool., Paris (9), IV, p. 42.

The specimens agree well with the published descriptions and figures. In two perfect individuals there are respectively twenty and twenty-four teeth on the inferior margin of the rostrum. Of the segments composing the carpus of the second peraeopods the first is the longest and the second the shortest, the third being only a little longer than the second. The dactyli of the last three pairs of legs bear several spines much as in Paulson's figure, but in an ovigerous female only two are found in this position.

All the examples bear a sharp inferior spine on either side of the sixth abdominal somite near its distal end. The lateral spine on the posterior edge of the fifth somite is present in all the specimens and in one individual there is a second large spine on this margin placed lower down: the difference is not correlated with sex.

The only male individual is badly damaged, but in the proportions of the upper antennular flagellum does not differ from the female.

$\frac{8599}{6}$	Off Cinque I., Andamans, 36 fms.	'Investigator.'	One, imperfect.
$\frac{8479}{10}$	S. E. of Ceylon; 6° 2′ 30″ N., 81° 29′ E., 52-68 fms.	'Investigator.'	Three, the largest an ovigerous female, 77 mm.

Tozeuma armatum has been recorded from the Gulf of Martaban, Burma (Henderson) and from the Red Sea (Paulson and Nobili).

Genus **Gelastocaris**, nov.

Carapace without supra-orbital spine and without spine or spinules on antero-lateral margin. Post-orbital and antennal spines present, the latter strong and flanked by a well-marked carina. Rostrum triangular in dorsal view, forming eaves which conceal the eyestalks. Basal segment of antennule terminating in an upstanding process which protects the eyes anteriorly; its lateral process large and subquadrate. Upper antennular flagellum uniramous. Outer margin of antennal scale furnished with spinules. Mandible without incisor-process or palp. Third maxillipede without exopod. Carpus and chela of first peraeopods elongate; chela smaller than that of second peraeopods and furnished with peculiar interlocking spines at apex. Carpus of second peraeopods composed of three segments. Dactylus of last three pairs consisting of a very short basal portion bearing four large spines two of which are lateral in position. No arthrobranchs at base of peraeopods, epipods present on first four pairs.

This genus is instituted to receive the very peculiar species described by Nobili under the name of *Latreutes paronae*. In the absence of the exopod on the third maxillipede and in the presence of epipods at the base of the peraeopods the genus is intermediate in position between *Latreutes* and *Tozeuma*, but differs from both in the extraordinary structure of the first peraeopods and in several other characters mentioned in the above diagnosis; it is most improbable that it has any close genetic relationship with either of these genera. The structure of the second maxillipede is peculiar; the ultimate segment of the exopod articulates terminally with the penultimate, resembling that found in the primitive families of Caridea.

Gelastocaris, like several other genera of Hippolytidae, shows an extraordinary degree of specialization and, except for the fact that it belongs to the Latreutid section of the family, its affinities are obscure. Judging from its peculiar structure it seems probable that the genus is specially adapted to some unusual mode of life; but inasmuch as only three specimens are known, regarding none of which are any biological data available, this must remain a matter of conjecture.

Gelastocaris paronae (Nobili).

Plate V, figs. 1—11.

1905. *Latreutes paronae*, Nobili, Boll. Mus. Torino, XX, No. 506, p. 2, text-fig.

The species is of a very robust build; the carapace, rostrum and abdomen are beset with minute papillae, while on many of the appendages there are delicate feathery setae.

The carapace (fig. 1) is not definitely carinate above, but there is a rounded mid-dorsal prominence a little behind the middle and anteriorly, a huge blunt ridge which is highest above the orbital notch and thence rapidly declines to the smooth non-carinate surface of the rostrum. There is no supra-orbital spine, but the anterior margin is produced to a sharp point defining the lower limit of the orbit and immediately below this point, above the insertion of the antennae, is a sharp outstanding post-orbital spine. The antennal spine is very strong and is flanked by a sharp carina which extends backwards to the middle of the carapace. The antero-lateral portion beneath this carina is flexed inwards on either side, enclosing the first two pairs of maxillipedes. The antero-lateral angle is obtusely rounded; it is not provided with a spine, or, as in *Latreutes*, with a series of spinules. In lateral view the inferior margin of the carapace is seen to be excavate posteriorly, leaving the apices of the last four pleurobranchs exposed.

The rostrum is triangular in dorsal view and its breadth at the base is fully two-thirds its length. In transverse section it would be T-shaped as in *Tozeuma*, for the inferior part of the blade is well developed, the dorsal part is flat or only a trifle convex, and there is a sharp ridge on either side running to the back of the orbit. This lateral ridge is produced in the vicinity of the eye and forms an eave which conceals the greater part of the eyestalk. In lateral view the dorsal line of the rostrum is straight and greatly depressed, forming an angle of nearly 45° with the mid-dorsal line of the carapace. The total length of the rostrum is about half that of the carapace; it extends a little beyond the apex of the antennal scale and terminates in a sharp upwardly directed point. On the dorsal surface, close behind the apex, there is a conspicuous movable spine. The greatest depth of the inferior blade is nearly one-half the total length. It is strongly curved in lateral view, excavated at the base for the accommodation of the eyes, and is devoid of spines.

The corneal part of the eyes is well pigmented and is a little narrower than the stalk.

The antennular peduncle is peculiar. The basal segment appears as if moulded round the eye; in lateral view it is almost semicircular in shape and distally it projects upwards in front of the cornea in the form of a thin lamella. The lateral process is large, parallel-sided and apically truncate; it projects outwards at right angles from the segment and its distal portion, which is somewhat reflected upwards, is pressed closely against the eyes. The second and third segments are extremely short. The upper ramus is thickened and (in the female) reaches a little beyond the apex of the rostrum; the lower ramus is more slender and a trifle longer.

The antennal scale (fig. 2) is about twice as long as broad and is very strongly narrowed apically. It terminates in a stout spine and on its outer margin there is a series of small movable spinules, twenty to twenty-two in number Its dorsal surface is covered with small papillae similar to those found on the carapace; the ventral surface is beset with very long finely plumose setae (fig. 3), a few occurring on the upper surface also.

The mandible is furnished neither with incisor-process nor palp. The second maxillipedes (fig. 4) are peculiar in that the ultimate segment of the endopod is not applied as a strip along the whole length of the penultimate, as in the more typical Caridea, but is terminal in position resembling that found in the more primitive families, the Pasiphaeidae and Bresiliidae. The epipod is entire and not partially divided into branchial plumes as in many Hippolytidae.

The third maxillipedes reach a little beyond the rostrum and possess an epipod but no exopod. The basal segments are very broad and the ultimate, which is about twice the length of the penultimate, bears a series of eight spines on its margins (fig. 5).

The first peraeopods (fig. 6) differ from those found in most Hippolytidae in being slender; they reach a little beyond the eyes. The ischium is short and the merus, which is rather strongly curved, is one and a half times the length of the carpus. The carpus is four times, and the chela, which is a little longer, is four and a half times as long as broad. The length of the dactylus, excluding its spines, is contained nearly two and a half times in that of the palm. The armature of the chela is, I believe, unique. The fingers (fig. 7) bear no teeth on their inner margins, but the apex of each is truncate. At the end of the fixed finger there are three large blunt spines, curved near the tip, arranged side by side in a transverse row; the dactylus is similarly armed, but bears only two spines which, when the claw is closed, fit into the interstices between those of the opposing segment. All the spines are movable. At their base, on either side both of the dactylus and of the fixed finger, there is a tuft of long setae which are shortly plumose; two of these setae, situated alongside the dactylar spines but on a slightly lower level, are stouter than the rest and probably assist in grasping.

The second peraeopods (fig. 8) are more normal in structure. They reach to the apex of the rostrum and are stouter than those of the first pair. The merus, the middle of the three segments composing the carpus, and the chela are approximately equal in length. The first carpal segment is equal to the third and the two combined are a little longer than the median segment. The dactylus is about two-thirds the length of the palm. There are no teeth on the inner edges of the claw, but the fixed finger has an angulate prominence a little behind its middle point. The limb bears scattered plumose setae.

The last three pairs of legs are similar; the third reaches to the end of the antennal scale and the fifth to the anterior third of the carapace; all are densely beset with long plumose setae. In the third pair (fig. 9) the merus is about four times as long as wide; it bears a stout spine at the distal end of its inferior margin and movable spinules on its upper edge. The carpus is massive and the protuberance at the distal end, overhanging the articulation with the propodus (found in most Hippolytidae), is very strongly developed; the total length of the carpus is nearly three-quarters that of the propodus. In the fifth leg the merus is much broader, about twice as long as wide, but the proportions of the other segments are much the same. The dactylus is very peculiar. In the third and fourth pairs it consists of a very short basal portion to which four large teeth are attached. Two of these lie in the same plane (the normal plane of the dactylus), while the others, which are a little smaller, are attached one on each side. In the fifth pair the arrangement is similar, but the lateral teeth are, in one specimen, reduced to small conical processes.

The abdominal somites are obscurely furrowed transversely and their inferior margins bear short spines. These are most strongly developed on the fourth and fifth somites, where there are in one specimen five and seven respectively. The sixth somite is only a very little longer than the fifth.

The telson (fig. 10) is broad at the base and narrows rapidly towards the apex; it bears two pairs of dorsal spinules. The apex (fig. 11) consists of a slender median tooth with a pair of spines on either side, the inner nearly twice the length of the outer. The outer uropod is less than twice as long as broad.

The specimens examined are ovigerous females; the eggs measure from ·55 to ·65 and from ·45 to ·55 mm. in longer and shorter diameter.

The specimens described above agree well with Nobili's brief account. In the type, however, the carina from the antennal spine extends backwards nearly to the posterior end of the carapace and the ultimate carpal segment of the second peraeopods is said to bear a spine at its distal end.

There are two examples in the Indian Museum—

$\frac{8485}{10}$	3 miles N.N.W. of Pt. Pedro, Ceylon.	'Investigator'.	One, 15 mm.
$\frac{8496}{10}$	Ceylon Pearl banks.	T. Southwell.	One, 14 mm.

The type was found in shallow water at Zanzibar.

Genus **Lysmata**, Risso.

Carapace without supra-orbital, but with antennal spine; pterygostomian spine present or absent. Lateral process of antennular peduncle anteriorly pointed. Upper antennular flagellum biramous, the two rami fused at base. Third maxillipede with exopod. Epipods but no arthrobanchs at base of first four peraeopods. Carpus of second peraeopods composed of many segments.

Lysmata chiltoni, sp. nov.

Plate VI, fig. 1-4.

1911. *Merhippolyte spinifrons*, Chilton, Trans. N. Zealand Inst., XLIII, p. 549.

Owing to the doubt that exists regarding the identity of Milne-Edwards' *Hippolyte spinifrons*, a species referred to the genus *Merhippolyte* by subsequent authors, I asked Dr. Chilton if he would permit me to examine the specimens which he recorded under this name in 1911 from the Kermadec Is. He very kindly sent me two examples, which most unfortunately dried up in transit, and subsequently forwarded two others, all the material that remained at his disposal.

The question of the identity of Milne-Edwards' *H. spinifrons* is discussed above and the conclusion I have reached is the same as that advanced by Calman, namely that the species is in all probability synonymous with *Alope palpalis*. Dr. Chilton's examples do not agree at all closely with Milne-Edwards' description.

Examination shows that the mandible lacks both incisor-process and palp, that there are no arthrobranchs at the base of the peraeopods and that the inner antennular flagellum is conspicuously biramous. The species therefore belongs to the genus *Lysmata* and I believe has not hitherto been described.

The rostrum (fig. 1) commences as a median dorsal crest a little in front of the middle of the carapace; it is straight and extends only a trifle beyond the eyes. On its upper margin it bears five teeth, two of which are situated on the carapace behind the orbital notch, while the third is placed almost immediately above that point; the distance between the two posterior teeth is slightly greater than that between those placed further forwards. Inferiorly the rostrum bears two or three teeth very much smaller than those on the upper edge and placed close to the apex in advance of the anterior dorsal tooth.

The only spine on the carapace is the antennal, the pterygostomian angle is obtuse but not spinous.

The lateral process on the basal segment of the antennular peduncle (fig. 2) is sharply pointed anteriorly and reaches to the end of the segment; the second segment is about as broad as long. The inner antennular flagellum is biramous; but the two branches are fused basally for a distance equal to half the length of the shorter ramus. The fused portion is composed of from nine to twelve segments.

The antennal scale is a little less than three and a half times as long as wide and is not much narrowed distally. The outer margin is concave and terminates in a spine which scarcely extends beyond the lamellar portion.

The third maxillipedes reach beyond the antennal scale by one-half the length of the ultimate segment. The exopod is conspicuous.

The first peraeopods just fail to reach the apex of the scale. The carpus is a trifle shorter than the chela and the finger is about half the length of the palm. The second peraeopods, in the single perfect specimen examined, are a little unequal, the longer one extending beyond the antennal scale by the whole length of the carpus and chela. Both ischium and merus are annulate and there are 25 or 26 segments in the carpus. The last carpal segment is about as long as the palm, and the dactylus, which is decidedly longer than the fixed finger and bears two small teeth at its apex, is almost as long as the palm (fig. 4).

The third peraeopods reach beyond the antennal scale by the dactylus and three-quarters the length of the propodus; the fifth scarcely reach the apex of the scale. There are no spines on the ischium and merus, but there are four large teeth, increasing in size distally, on the dactylus.

The fifth abdominal somite, measured dorsally, is three quarters the length of the sixth and is about half as long as the telson. The telson is shorter than both inner and outer uropods. It bears two pairs of dorsal spinules and its convex lateral margins meet in a comparatively narrow setose apex, minutely pointed in the middle and with two pairs of spines on either side, the innermost much the longest.

Lysmata chiltoni[1] differs in many respects from the well-known *L. seticaudata*, Risso, the chief points being the length and dentition of the rostrum, the form of the pterygostomian angle and antennal scale, the length of the fused portion of the rami of the upper antennular flagellum and the number of segments in the carpus of the second peraeopods. *Lysmata intermedia* (Kingsley) may be distinguished by the much greater length of the fused portion of the antennule and by the comparatively short dactylus of the first peraeopods.

It is in Heller's *Lysmata pusilla* from the Red Sea that *L. chiltoni* seems to find its nearest ally; but in that species the thicker ramus of the upper antennular flagellum is fused proximally with its fellow for only one-third its length, there are only four dorsal teeth on the rostrum and the two situated on the ventral margin are more widely spaced. In the antennal scale, moreover, the distal spine projects beyond the apex of the lamella.

Four specimens were obtained at Meyer I. in the Kermadec group. The type specimen is 27 mm. in length and is preserved in the Canterbury Museum, New Zealand.

Genus **Hippolysmata**, Stimpson.

Carapace without supra-orbital, but with antennal spine; antero-lateral (pterygostomian) spine present, reduced, or absent. Lateral process of antennular peduncle anteriorly pointed. Upper antennular flagellum uniramous. Mandible without incisor-process or palp. Third maxillipede with exopod. Epipods (sometimes rudimentary), but no arthrobranchs at base of first four peraeopods. Carpus of second peraeopods composed of many (more than 10) segments.

The only difference between this genus and Risso's *Lysmata* is that in the latter the outer antennular flagellum is split and is composed of two unequal rami which are fused basally. In *Hippolysmata* the flagellum is simple. The character does not seem a very important one, but in my experience is reliable[2]; it is, however, not improbable that further investigation will reveal such a degree of gradation that two distinct genera can no longer be recognized, and in this case all the species must take rank under *Lysmata*.

In two West Indian species, *Hippolysmata moorei*, Rathbun[3] and *H. intermedia*,[3] Kingsley, the additional ramus is well developed and they must in consequence be transferred to Risso's genus.

Two new species are here described from material in the

[1] I have compared specimens with both *L. seticaudata* and *L. intermedia*.

[2] In addition to the species mentioned in this paper I have examined *Lysmata seticaudata*, Risso, *Lysmata intermedia* (Kingsley), *Hippolysmata californica*, Stimpson, and *Hippolysmata wurdemanni* (Gibbes).

[3] See Rathbun, Bull. U. S. Fish Comm. for 1900, XX, ii, pp. 115, 116 (1902).

Indian Museum. One of these, *H. ensirostris*, a peculiar form which shows but little affinity with any species hitherto known, is remarkable for its wide range of variation. It seems, indeed, that extensive variation exists throughout the genus in regard to the rostral armature, the proportional length of the legs and the number of segments in the carpus of the second pair; in consequence it is not advisable to found species on these characters alone. In the case of the Indian species the armature of the dactylus of the last three peraeopods, the development of the epipods and of the antero-lateral spine of the carapace and the form of the telson have proved of considerable value in systematic work. The colouration of at least some of the species is very striking and it is probable that they could be more easily recognized in the field than from preserved material.

The Indian species of *Hippolysmata* may be determined by the following characters:—

I. Rostrum shorter than carapace, without elevated basal crest; pterygostomian spine, if present, smaller than antennal: lateral margins of telson convex, apex blunt with a pair of spines.
  - A. Rostrum not reaching beyond second segment of antennular peduncle, inferior margin with 2-4 teeth; dactylus of last three peraeopods terminating in two large claw-like spines.
    - 1. A minute spine at antero-lateral angle of carapace; fingers of first peraeopods, when closed, meeting only at tips.
      - a. Second peraeopods symmetrical, carpus composed of 15-24 segments ... ... *H. vittata.*
      - b. Second peraeopods asymmetrical, carpus composed of 28-32 segments. ... . *H. vittata,* var.
    - 2. No spine at antero-lateral angle of carapace; fingers of first peraeopod, when closed, meeting throughout their length. .. .. *H. kükenthali.*
  - B. Rostrum reaching beyond antennular peduncle, inferior margin armed with 6-7 spines; dactylus of last three peraeopods simple. ... ... *H. dentata.*

II. Rostrum longer, usually very much longer than carapace, with an elevated dentate basal crest; pterygostomian spine as large as antennal; lateral margins of telson concave, apex acute and unarmed.
  - A. Carapace smooth or sparsely punctate laterally, depression between branchial and cardiac regions usually obscure; basal crest of rostrum with 7-12 teeth; fifth peraeopods not extending beyond antennal scale. ... *H. ensirostris.*
  - B. Carapace coarsely and closely punctate laterally, depression between branchial and cardiac regions distinct; basal crest of rostrum with 4-8 teeth; fifth peraeopods extending beyond antennal scale by at least length of dactylus. ... ... do. var. *punctata.*

Hippolysmata vittata, Stimpson.

Plate VI, figs. 6—10.

1901. *Hippolysmata vittata,* Lanchester, Proc. Zool. Soc., London, p. 563.
1906. *Hippolysmata vittata,* Nobili, Ann. Sci. nat. Zool. (9), IV, p. 46.
1907. *Hippolysmata vittata,* de Man, Trans. Linn. Soc., Zool. (2), IX, p. 423, pl. xxxiii, figs. 49, 50.

Under the last reference de Man quotes the earlier synonymy of this abundant species. To his detailed description I have little to add. I would, however, remark on the presence of a small (pterygostomian) spinule at the antero-lateral angles of the carapace (fig. 6) and to the gape at the base of the fingers of the chela of the first peraeopods when the claw is closed (fig. 7); it is only by attention to these seemingly trivial details that spirit specimens of *Hippolysmata vittata* can be distinguished from the allied *H. kükenthali*.

The rostrum in Indian examples of *H. vittata* bears six to nine dorsal teeth; the hindmost is situated just in front of the middle of the carapace and is always separated by a considerable interval from the next of the series. On the inferior margin there are from two to four very small teeth

The antennal scale, in adults, is a little less than three times as long as broad.

The second peraeopods are symmetrical and the distal end of the merus, which may be annulated, reaches to about one-third the length of the antennal scale. The carpus is composed of 15—19 segments. Stimpson in his original description gives 20, and subsequent authors 17—24. In the proportions of the last segment and of the chela the specimens agree closely with de Man's account. On the last three legs there are five or six dactylar spines which increase in size as they approach the apex (fig. 8)

The telson (fig. 9) has convex margins and a comparatively broad apex which is furnished with the two pairs of spines found in most members of the family.

The colour of living specimens is very striking The whole animal is practically transparent with narrow longitudinal stripes and streaks on the carapace and abdomen. At the anterior end of the first abdominal somite there is a complete transverse band and another is distinct at the anterior end of the fourth somite. The latter stops half way down on either side where it meets the uppermost of the three complete longitudinal stripes of the abdomen. There are other short longitudinal streaks on the carapace and abdomen, those on the anterior portion of the former being oblique. There is a median red stripe on the telson and on each inner uropod. The thoracic appendages are clear red and the eggs light green.

The following specimens are preserved in the Indian Museum :—

$\frac{6677}{10}$	Madras.	J. R. Henderson.	One, 31 mm.
$\frac{8451-3}{10}$	Kilakarai Ramnad Dist., S. India, 0—2 fms.	S. W. Kemp.	Many, 14—27 mm.
$\frac{8450}{10}$	N. Cheval Paar, Ceylon.	T. Southwell.	One, 21 mm.
$\frac{3187}{5}$, $\frac{3045-60}{7}$, $\frac{3193}{7}$	Karachi.	Karachi Museum.	Forty, 18—30 mm.
$\frac{6682}{10}$	Persian Gulf, 28° 59′ N., 50° 3′ E., 25 fms.	'Investigator.'	Three, 24—34 mm.

The examples from Kilakarai were found among weeds in only a few feet of water; many of them are ovigerous females.

The Persian Gulf specimens differ from others in the collection in having the teeth on the inferior margin of the rostrum (4 or 5 in number) larger, though still smaller than those on the upper edge. The rostrum also is longer, reaching to the middle of the ultimate segment of the antennular peduncle (fig. 10). The form perhaps deserves nomenclatorial recognition.

Hippolysmata vittata has been recorded from the Inland Sea of Japan (de Man), Hongkong (Stimpson), Cebu (Thallwitz), Penang (Lanchester) and the Red Sea (Nobili).

H. vittata var.?

Two specimens in the collection differ from typical *H. vittata* in the development of the second pair of peraeopods.

In the larger example the left merus of this pair of limbs reaches beyond the apex of the antennal scale by one-fifth of its length and the carpus, which is composed of 31 segments, is as long as the rostrum and carapace combined. In this specimen the right leg of the second pair is unfortunately missing.

In the smaller example the right merus reaches to three-quarters the length of the antennal scale and the carpus, which is composed of 28 segments, is almost three-quarters the length of the carapace and rostrum. On the left side the ischium, merus and carpus are each almost exactly two-thirds the length of the same segments on the right; the carpus, however, is composed of the same number of segments.

The rostrum in each case bears seven teeth above and two below.

The form is, in all probability, merely a variety of *H. vittata* in which the second peraeopods are unequal and with a greater number of segments in the carpus. In all other respects there appears to be the closest resemblance between the specimens and typical examples.

The variation is similar to, though not as extensive as that found in *Processa canaliculata* on the Irish coast.[1]

The two specimens were found at the Andamans, in which locality typical *H. vittata* have not yet been found.

$\frac{6396}{10}$ East I., Andamans. A. R. Anderson. Two, 14 and 23 mm.

Hippolysmata kükenthali (de Man).

Plate VI, fig. 11.

1892. *Merhippolyte orientalis,* de Man (*nec* Bate), in Weber's Zool. Ergebn. Reise in Niederland. Ost-Ind., II, p. 407.

1902. *Merhippolyte orientalis* Bate ?, de Man, Abhandl. Senck. naturf. Ges. Frankfurt, XXV, p. 849, pl. xxvi, fig. 56.

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[1] Kemp, Fisheries Ireland, Sci. Invest. for 1908, p. 124 (1910).

1902. *Hippolyte kükenthali*, de Man, *ibid.*, p. 850.
1905. *Nauticaris unirecedens*, Pearson (*nec* Bate), Ceylon Pearl Oyster Rep., IV, p. 81.
1907. *Hippolysmata kükenthali*, de Man, Trans. Linn. Soc. Zool. (2), IX, p. 426.

Along with an example of the preceding species obtained by Mr. T. Southwell on the Ceylon pearl banks and forwarded to the Indian Museum preserved in formalin are specimens of a very closely allied form which appears to be the same as that originally described by de Man under the name of *Merhippolyte orientalis*, Bate When received, the two forms were distinguished at once by their colouration, for the specimen of *H. vittata* was streaked longitudinally with narrow red stripes, as already described, while those of *H. kükenthali* were broadly banded transversely, the colour of the bands being bright red in the preserved material.

The species is so closely allied to *H. vittata* that had it not been for the colour distinction it is possible that the distinctions would have escaped detection; the only important structural differences that I have been able to find are the following:—

H. vittata.	*H. kükenthali.*
A minute spine at antero-lateral angles of carapace (fig. [illegible]).	No spine at antero-lateral angles of carapace
Fingers of first peraeopods, when closed, meeting only at the tips (fig. 7).	Fingers of first peraeopods, when closed, meeting throughout their length (fig 11)

These two characters seem to prevail with absolute constancy.

The rostrum in *H. kükenthali* is a trifle more bent downwards and is provided on an average with fewer teeth. On the dorsal margin there are from four to seven, usually five or six; the two hindmost, as in *H vittata*, are situated on the carapace and are separated by a considerable interval from the next of the series. On the inferior margin there are one or two, rarely three, small teeth.

The lateral process of the antennular peduncle is a trifle longer than in the allied form and often reaches the distal end of the proximal segment.

In the antennal scale, oral appendages, maxillipedes and peraeopods there appears to be the closest resemblance between the two forms, the only difference being that noticed above in the shape of the chelae of the first peraeopods, a feature not mentioned by de Man. The carpus of the second peraeopod is divided into 19-21 segments, the proportions of the proximal segment and of the chela being as in *H. vittata*; the spinulation of the dactyli of the last three pairs is the same as in that species.

The epipod at the base of the fourth leg appears to be more deeply bifid apically than in *H. vittata*, otherwise the branchial formulae of the two forms are in agreement. No differences could be found in the structure of the male pleopods, in the proportions of the abdominal somites, or in the characters of the telson and uropods.

I believe I am correct in referring these specimens to *H. kükenthali* (de Man); at any rate I am unable to point to any features in which they differ noticeably from his lengthy descriptions. The examples recorded by Pearson in 1905 from the Ceylon pearl banks under the name of *Nauticaris unirecedens*, Bate, almost certainly belong to the same species. *N. unirecedens*, Bate, as de Man has pointed out, is a synonym of *H. vittata*; but Pearson notes that in his specimens the rostral teeth are less numerous than in those described in the 'Challenger' Report.

The specimens in the Indian Museum were caught during the months of January and February and many of the females bear eggs.

$\frac{8445-9}{10}$	N. Cheval Paar, Ceylon, 6 fathoms.	T. Southwell.	Many, 20-32 mm.

The species is recorded by de Man from Ternate and Flores.

Hippolysmata dentata, sp. nov.

Plate VI, fig. 5.

This species differs from *H. vittata* in the following particulars:—

The rostrum, which is only slightly shorter than the carapace, extends beyond the apex of the antennular peduncle (fig 5). Dorsally it is provided with seven or eight teeth, the hindmost of which, as in *vittata*, is situated just in front of the middle of the carapace and is separated by a considerable interval from the next of the series. On its inferior margin it is furnished with six or seven teeth which are as large as those above. The pterygostomian spine on the antero-lateral angle of the carapace is much more prominent than in *H. vittata*, but is not nearly as large as the antennal.

The eyes are short and reach only to half the length of the basal segment of the antennular peduncle; the cornea is a little wider than the stalk. The antennular peduncle reaches almost or quite to the apex of the antennal scale and its lateral process scarcely extends as far as the eyes[1].

The form of the antennal scale is similar to that of *H. vittata* but in the larger (type) specimen the apical spine reaches well beyond the lamellar part.

The oral appendages, maxillipedes and first peraeopods resemble those of *H. vittata*; in the chelae of the first pair the fingers meet only at the tips when the claw is closed. In the second peraeopods the carpus is composed of from 20 to 22

[1] In the smaller of the two examples this process is considerably shorter than the eyes, which themselves reach well beyond the middle of the basal peduncular segment.

segments; the merus in the larger example is divided into eight segments and there are traces of sub-division in the ischium. The last carpal segment, the palm and the dactylus are almost equal in length.

The last three peraeopods are longer than in *H. vittata* or *H. kükenthali*. Those of the third pair reach beyond the antennal scale by the whole length of the carpus, propodus and dactylus; the fourth reach beyond the same point by the length of the last two segments and the fifth by the dactylus and one-half of the propodus. The usual spines are found on the ischium and merus; in the third peraeopod there are two or three on the former and four on the latter. The dactylus in all three pairs is slender and curved and nearly one-third the length of the propodus. It bears a few very slender spines close to the base, but otherwise is wholly unarmed, offering a striking contrast to the same appendage in *H. vittata* (cf. figs. 5 and 8).

In the proportions of the abdominal somites and in the characters of the telson and uropods *H. dentata* does not present any noticeable difference from its allies.

Two specimens are preserved in the Indian Museum:—

$\frac{1630}{7}$	Off M. of Irrawaddy R., 15°20′ N., 94° 55′ E., 20 fms.	'Investigator.' One, 33 mm. TYPE.
$\frac{2945}{7}$	False Point Harbour, Orissa, Bay of Bengal.	'Investigator.' One, 18 mm.

The colour of the species in life, according to a note found in the bottle containing the smaller specimen, is as follows:—"Carapace and abdomen striped pink. Antennae and antennules pink. Thoracic appendages light pink."

Hippolysmata ensirostris, sp. nov.

Plate VII, figs. 1—4.

The carapace, measured dorsally from the back of the orbit to the posterior margin, is a little less than half the length of the abdomen, excluding the telson. The branchiostegal walls are smooth in some specimens, in others punctate, sometimes rather closely so. The pterygostomian spine is prominent and is as large as the antennal (fig. 1).

The rostrum (figs. 1, 2) is always longer than the carapace and in some specimens (presumably those in which it has escaped fracture throughout the animal's existence) is fully twice the length. Dorsally it bears from 11 to 16 teeth, of which the posterior 7 to 12 form an elevated basal crest, extending on to the carapace. The teeth on this crest diminish in size from before backwards. In front of the crest there are scarcely ever more than five widely separated teeth on the upper edge of the blade. The inferior margin is armed with 7 to 16 stout teeth which are close-set proximally. The rostrum is a little depressed basally; but, after passing the second segment of the antennular peduncle, is slightly ascendant and thence to the apex is quite straight or (rarely) a trifle upturned.

The carapace is bluntly carinate mid-dorsally in its anterior half and bears one, less commonly two, minute spinules behind the basal crest of the rostrum.

The corneal portion of the eyes is, in dorsal view, only very little wider than the stalk and is smaller than in the preceding species. The antennular peduncle hardly reaches to two-thirds the length of the antennal scale; the second segment is longer than the third and the lateral process, though it extends beyond the eyes, fails to reach the distal end of the segment. The antennal scale is unusually variable in form and ranges from three to rather more than three and a half times as long as wide. The distal end of the lamella always extends well beyond the spine which terminates the straight or slightly concave outer margin, and the flagellum is nearly twice the entire length of the animal measured from the tip of the rostrum to the apex of the telson.

The mandibular palp bears neither incisor-process nor palp and the oral appendages are closely similar to those of *H. vittata*. The third maxillipede falls short of the apex of the antennal scale, the exopods reaching to rather more than half the length of the antepenultimate segment.

The carpus of the first peraeopods is a little shorter than the chela, the dactylus is scarcely two-thirds the length of the palm and the fingers, when the claw is closed, are in contact throughout their length. In the second peraeopods the merus is indistinctly divided into from 7 to 11 segments, while the carpus is composed of from 12 to 17. The palm of the chela is shorter than the last carpal segment and is a little longer than the fingers.

The last three pairs of peraeopods are provided with a variable number of spines on the ventral aspect of the merus. Those of the fifth pair extend to two-thirds or three-quarters the length of the antennal scale. The dactylus varies considerably in length; it is usually one-quarter or one fifth the length of the propodus; but occasionally in smaller examples is longer (two-sevenths the length of the propodus). The dactylus (fig. 4) is furnished with a few small spinules posteriorly; in several ovigerous females a small spine is also found near the apex; but this is never sufficiently large to give it the characteristic appearance seen in *H. vittata* and *H. kükenthali*.

The epipods at the base of the first four pairs of peraeopods are strikingly different from those found in the preceding species. They are short and rudimentary and entirely concealed from view by the downward growth of the pleurobranchs.

The sixth abdominal somite is one-quarter longer than the fifth. The telson (fig. 3) is about twice the length of the sixth somite and bears two pairs of dorsal spinules. Its lateral margins are concave, setose towards the apex, and terminate in a very narrow and acute point which reaches almost to, or considerably beyond, the distal end of the uropods. It differs widely in shape from that found in the preceding species and there is no trace of the usual terminal spines.

This very variable and, as it appears, abundant species of *Hippolysmata* seems to be rather an outstanding form, differing markedly from any species of the genus with which I am acquainted in the peculiar characters of the rostrum and telson and in the rudimentary condition of the epipods.

The following specimens are in the Indian Museum :—

$\frac{680-1}{7}$	Madras.	...	Two, 51 and 54 mm.
$\frac{6676}{10}$	Pondicherry.	J. Wood-Mason.	One, 64 mm.
$\frac{6395}{10}$	Colombo.	J. Anderson.	Six, 50-79 mm. TYPES.
$\frac{6397}{10}$	Akyab, Lower Burma.	F. Stoliczka.	Four, 52-60 mm.
$\frac{6402}{10}$	Bombay.	H. P. Mesurier.	Two, 35 and 63 mm.

var. **punctata**, nov.

Plate VII, figs. 5—7.

The rostrum in this form is nearly always more upturned distally than in typical *ensirostris* (figs. 5, 6). It bears from 8 to 13 dorsal teeth of which the posterior 4 to 8 form a basal crest. On the carapace a groove above the oral region, barely distinguishable in the typical form, is comparatively well-marked and a depression between the branchial and cardiac regions is always definite (fig. 5). The cardiac regions are somewhat swollen on each side of the middle line, so that the posterior third of the carapace is nearly flat dorsally. The branchiostegal walls are covered with a rather coarse pitting, the pits being very close and often confluent (fig. 7).

The antennal scale is hardly ever more than three times as long as wide. The third maxillipedes reach as far as, or a little beyond, the apex of the antennal scale. The carpus of the second pair of peraeopods is composed of 15 to 22 segments and the fifth pair reaches beyond the antennal scale by at least the whole of the propodus and sometimes by as much as one-half of the propodus as well. The dactylus of this pair is longer than in most typical examples of the species, the propodus being only three and a half times its length.

After careful examination I have come to the conclusion that this form is nothing more than a variety of *H. ensirostris*, for the points of difference are entirely matters of degree. The variety *punctata* appears to be an extreme form of *ensirostris* in which the areolation and pitting of the carapace is more definite, the legs longer and more slender and the basal crest of the rostrum composed of a smaller number of teeth.

$\frac{3434-5}{10}$	Green I., Amherst, Tenasserim.	'Investigator.'	Fifty-two, 35-60 mm.
$\frac{8471}{10}$	Thongwa, Burma.	I. H. Burkill.	Three, 51-63 mm.
$\frac{3137-47}{7}$	Sandheads, Ganges delta.	A. J. Milner.	Twenty-four, 37-60 mm.

Genus **Merguia**, nov.

Carapace without supra-orbital or antero-lateral (pterygostomian) spines; antennal spine present. Upper antennular flagellum uniramous. Mandible without incisor-process or palp. Third maxillipede without exopod. Neither epipods nor arthrobranchs at base of first four peraeopods. Carpus of second peraeopods composed of many (24 or 25) segments.

This genus is founded to receive de Man's *Hippolyte oligodon*, of which species the type and only known example is preserved in the Indian Museum.

Examination of the mandible shows that both incisor-process and palp are absent (pl. VII, fig. 8) and that in the number of segments in the carpus of the second peraeopods and in the suppression of the arthrobranchs at the base of the first four thoracic limbs it approaches the genera *Lysmata* and *Hippolysmata*. From both these it is easily distinguished by the absence of the exopod on the third maxillipede and of the epipods at the base of the peraeopods.

In addition the species differs from other Hippolytidae in two very peculiar features. The first of these is the enormous development of the second segment of the antennal peduncle, which reaches beyond the apex of the antennal scale: this feature is well shown in de Man's figure The second is the undivided condition of the distal endite of the second maxilla (pl. VII, fig. 9). Except in the Pasiphaeidae in which both endites are suppressed, the distal endite is, in the Caridea, always divided.

Merguia oligodon (de Man).

Plate VII, figs. 8, 9.

1888. *Hippolyte oligodon*, de Man, Journ. Linn. Soc., XXII, p. 27, pl. xviii, figs. 1-6.

To de Man's detailed description there is little to add except as regards the characters of the oral appendages, noted above, the absence of the exopod on the third maxillipede and the suppression of the epipods at the base of the peraeopods.

The specimen, as de Man noted, is not in perfect condition; the antennules are broken off shortly above the base of the peduncle, but enough remains to render it almost certain that no additional ramus is present on the upper flagellum The flagellum is, indeed, very different in appearance to that found in *Hippolysmata*, for it is round in section and without setae, whereas in the preceding genus it is more or less oval at the base, apparently formed by the fusion of two rami, and bears numerous setae, probably olfactory in function, on its inferior aspect.

$\frac{8239}{6}$ Elphinstone I., Mergui Archipelago. J. Anderson. One, 28 mm. TYPE.

SYNONYMIC LIST OF THE INDO-PACIFIC SPECIES OF HIPPOLYTIDAE.

Genus **Saron**, Thallwitz.

Saron marmoratus (Olivier).

See p. 84.

Saron neglectus, de Man.

See p. 87.

Genus **Nauticaris**, Bate.

Nauticaris marionis, Bate.

1888. *Nauticaris marionis*, Bate, Rep. 'Challenger' Macrura, p. 603, pl. cviii.
1902. *Merhippolyte australis*, Hodgson, Rep. 'Southern Cross' Crust., p. 233, pl. xxix.
1902. *Nauticaris marionis*, Lenz, Zool. Jahrb. Syst., suppl. Bd. V, p. 735.
1906. *Nauticaris marionis*, Calman, Ann. Mag. Nat. Hist. (7), XVII, p. 31.

Prince Edward I., Falkland Is., Auckland I., Cavancha.

Nauticaris stewarti (Thomson).

1888. *Hippolyte stewarti*, Thomson, Trans. N. Z. Inst., XXI, p. 259, pl. xiii, fig. 1.
1903. *Nauticaris stewarti*, Thomson, Trans. Linn. Soc. (2), VIII, p. 445, pl. xxix, fig. 1.

New Zealand.

Genus **Merhippolyte**, Bate.

Merhippolyte calmani, Kemp and Sewell.

See p. 88.

Merhippolyte kauaiensis (Rathbun) (see pp. 88, 89).

1906. *Spirontocaris kauaiensis*, Rathbun, Bull. U. S. Fish Comm. for 1903, XXIII, iii, p. 913, pl. xxiv, fig. 5.

Hawaiian Is.

Merhippolyte orientalis, Bate.

1888. *Merhippolyte orientalis*, Bate, Rep. Challenger Macrura, p. 621.
1907. *Merhippolyte orientalis*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 426.

Off New Guinea.

The original description is almost valueless and the type specimen (*fide* Calman, see de Man, *loc. cit.*) is in hopelessly bad condition.

Genus **Ligur**, Sarato.

1885. *Ligur*, Sarato, Moniteur des Etrangers, IX, année, n. 222, p. 2, (Nice)[1].
1902. *Parhippolyte*, Borradaile, in Willey's Zool. Results, p. 414.
1903. *Ligur*, Senna, Bull. Soc. entom. Ital., ann. XXXIV, p. 319.

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[1] I have not been able to consult this publication.

Ligur uveae (Borradaile).

1902. *Parhippolyte uveae*, Borradaile, in Willey's Zool. Results, p. 414, pl. figs. 11, *a-g*.

Loyalty Is.

Genus **Alope**, White.

Alope palpalis, White.

See p. 89.

Alope australis, Baker.

See p. 91.

Genus **Spirontocaris**, Bate.

Spirontocaris alcimede, de Man.

1906. *Spirontocaris alcimede*, de Man, Ann. Mag. Nat. Hist. (7), XVII, p. 404.
1907. *Spirontocaris propugnatrix*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 416, pl. xxxii, figs. 42-46.

Japan.

Spirontocaris geniculata (Stimpson).

1860. *Hippolyte geniculata*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 34.
1890. *Hippolyte geniculata*, Ortmann, Zool. Jahrb., Syst., V, p. 503, pl. xxxvii, figs. 3, 3*d-i*.
1902. *Hippolyte geniculata*, Doflein, Abh. Akad. Wiss. München, XXI, iii, p. 636.
1902. *Spirontocaris geniculata*, Rathbun, Proc. U. S. Nat. Mus., XXVI, p. 45, fig. 19.

Japan.

Spirontocaris gracilirostris (Stimpson).

1860. *Hippolyte gracilirostris*, Stimpson, Proc. Acad. Sci. Philadelphia, p. 34.

Japan.

Spirontocaris grebnitskii, Rathbun.

1902. *Spirontocaris grebnitzkii*, Rathbun, Proc. U. S. Nat. Mus., XXVI, p. 44, fig. 18.

Japan.

Spirontocaris jordani, Rathbun.

1902. *Spirontocaris jordani*, Rathbun, Proc. U. S. Nat. Mus., XXVI, p. 44, fig. 17.

Japan.

Spirontocaris leptognatha (Stimpson).

1860. *Hippolyte leptognatha*, Stimpson, Proc. Acad. Sci. Philadelphia, p. 34.
1879. *Hippolyte leptognatha*, var., Miers, Proc. Zool. Soc., pp. 22, 56.

Japan.

Spirontocaris mororani, Rathbun.

1902. *Spirontocaris mororani,* Rathbun, Proc. U. S. Nat. Mus., XXVI, p. 43, fig. 16.

Japan.

Spirontocaris ochotensis (Brandt).

1851. *Hippolyte ochotensis,* Brandt, in Middendorff's Reise Sibiriens, II, Zool., i, p. 120, pl. v, fig. 17.
1860. *Hippolyte ochotensis,* Stimpson, Proc. Acad. Sci. Philadelphia, p. 34.
1910. *Spirontocaris ochotensis,* Rathbun, Harriman Alaska Exped., X, Crust., p. 71, text-fig. 26.

Bering Sea to Sitka, Kamchatka, Okhotsk Sea, Japan.

Spirontocaris orientalis (de Man).

1890. *Hetairocaris orientalis,* de Man, Notes Leyden Mus., XII, p. 122, pl. vi, fig. 6.
1890. *Hippolyte ponapensis,* Ortmann, Zool. Jahrb., Syst., V, p. 502, pl. xxxvi, figs. 20, 20d.
1892. *Hippolyte ponapensis,* de Man, Notes Leyden Mus., XIV, p. 263.

Caroline Is.

Spirontocaris pandaloides (Stimpson).

See p. 93

Spirontocaris pectinifera (Stimpson).

1860. *Hippolyte pectinifera,* Stimpson, Proc. Acad. Sci. Philadelphia, p. 35.

Japan.

Spirontocaris profunda, Rathbun.

1906. *Spirontocaris profunda,* Rathbun, Bull. U. S. Fish Comm. for 1903, XXIII, iii, p. 914, pl. xxiv, fig. 10.

Hawaiian Is.

Spirontocaris propugnatrix, de Man.

1906. *Spirontocaris propugnatrix,* de Man, Ann. Mag. Nat. Hist. (7), XVII, p. 404.
1907. *Spirontocaris propugnatrix,* de Man, Trans. Linn. Soc., Zool. (2), IX, p. 414, pl. xxxii, figs. 35-41.

Japan.

Spirontocaris rectirostris (Stimpson).

1860. *Hippolyte rectirostris,* Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 33.
1902. *Hippolyte rectirostris,* Doflein, Abh. Akad. Wiss. München, XXI, iii, p. 637, pl. iii, fig. 7.
1906. *Spirontocaris rectirostris,* de Man, Ann. Mag. Nat. Hist. (7), XVII, p. 403.
1907. *Spirontocaris rectirostris,* de Man, Trans. Linn. Soc., Zool. (2), IX, p. 411, pl. xxxii, figs. 31-34.

Japan.

Genus **Thor,** Kingsley.

Thor paschalis (Heller).

See p. 94.

Genus **Hippolyte**, Leach.

Hippolyte acuta (Stimpson).

1860. *Virbius acutus*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 35.
1906. *Hippolyte acuta*, Rathbun, Bull. U. S. Fish Comm. for 1903, XXIII, iii, p. 912, pl. xxiv, fig. 3.

Liu Chiu Is.; Hawaiian Is.

Hippolyte australiensis (Stimpson).

See p. 98.

Hippolyte bifidirostris, Miers.

1876. *Virbius bifidirostris*, Miers, Ann. Mag. Nat. Hist. (4), **XVII**, p. 224.
1876. *Virbius bifidirostris*, Miers, Cat. N. Z. Crust., p. 81, pl. xi, fig. 1.
1903. *Hippolyte bifidirostris*, Thomson, Trans. Linn. Soc., Zool. (2), VIII, p. 443, pl. xxviii, figs. 13-16.

New Zealand.

Hippolyte orientalis, Heller.

See p. 97.

1861. *Hippolyte orientalis,* Heller, Sitz-ber. Akad. Wiss. Wien, XLIV, p. 277.
? 1875. *Virbius proteus,* Paulson, Rech. Crust. Mer Rouge, p. 109, pl. xviii, fig. 1, pl. x, figs. 2-5.
1906. *Virbius orientalis,* Nobili, Ann. Sci. nat., Zool. (9), IV, p. 33.

Red Sea.

Hippolyte ventricosus, H. Milne-Edwards.

See p. 96.

Genus **Latreutes,** Stimpson.

Latreutes acicularis, Ortmann.

1890. *Latreutes acicularis,* Ortmann, Zool. Jahrb., Syst., V, p. 506, pl. xxvii, figs. 6, 6 d-k, 6 n.
1902. *Latreutes acicularis,* Doflein, Abh. Akad. Wiss. München, XXI, p. 638.
1907. *Latreutes acicularis,* de Man, Trans. Linn. Soc., Zool. (2), IX, p. 421.

Japan.

Latreutes anoplonyx, Kemp.

See p. 104.

Latreutes (?) ceylonensis, Pearson (see p. 99).

1905. *Latreutes ceylonensis,* Pearson, Ceylon Pearl Oyster Rep., IV, p. 81, pl. ii, fig. 7.

Ceylon.

Latreutes compressus (Stimpson).

1860. *Rhynchocyclus compressus,* Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 28.

Port Jackson, Australia.

Latreutes dorsalis, Stimpson.

1860. *Latreutes dorsalis*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 27.

Hakodadi, Japan.

Latreutes laminirostris, Ortmann.

1890. *Latreutes laminirostris*, Ortmann, Zool. Jahrb., Syst. V, p, 506.
1907. *Latreutes laminirostris*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 422.

Japan.

Latreutes mucronatus (Stimpson).

See p. 101.

Latreutes phycologus, Nobili.

1905. *Latreutes phycologus*, Nobili, Bull. Mus. Hist. nat., p. 159.
1906. *Latreutes phycologus*, Nobili, Bull. sci. France. Belg., XL, p. 41, pl. ii, figs. 6, 6 d.

Persian Gulf.

Latreutes planirostris (De Haan).

1849. *Cyclorhynchus planirostris*, De Haan, Fauna Japonica, Crust., p. 175, pl. xlv, fig. 7.
1860. *Rhynchocyclus planirostris*, Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 27.
1879. *Rhynchocyclus planirostris*, Miers, Proc. Zool. Soc., p. 55.
1890. *Latreutes planirostris*, Ortmann, Zool. Jahrb., Syst., V, p. 505, pl. xxxvii, figs. 4d-l, 4 n.
1902. *Platybema planirostre*, Rathbun, Proc. U. S. Nat. Mus,, XXVI, p. 46.
1907. *Latreutes planirostris*, de Man, Trans. Linn. Soc., Zool. (2), IX, p. 421.

Japan.

Latreutes pristis (Nobili).

1899. *Platybema pristis*, Nobili, Ann. Mus. civ. Genova (2), XX, p. 233 (p. 4 of reprint).

Beagle Bay, New Guinea.

Latreutes pygmaeus, Nobili.

See p. 99.

Genus **Tozeuma**, Stimpson.

Tozeuma armatum, Paulson.

See p. 106.

Tozeuma elongatum (Baker).

1904. *Angasia elongata*, Baker, Trans. Roy. Soc. S. Australia, XXVIII, p. 147, pl. xxvii, figs. 1-4.

Port Victor, S. Australia ; 15 fms.

Tozeuma erythraeum, Nobili.

1904. *Tozeuma erythraeum,* Nobili, Bull. Mus. Hist. nat. Paris, p. 231.
1906. *Angasia erythraea,* Nobili, Ann. Sci. nat., Zool. (9), IV, p. 44.

Red Sea.

Tozeuma kimberi (Baker).

1904. *Angasia kimberi,* Baker, Trans. Roy. Soc. S. Australia, XXVIII, p. 149, pl. xxvii, fig. 5.

Port Willunga, S. Australia ; 4 fms.

Tozeuma lanceolatum, Stimpson.

1860. *Tozeuma lanceolatum,* Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 27.
1879. *Tozeuma lanceolatum,* Kingsley, Proc. Acad. Nat. Sci. Philadelphia, p. 413.

Hongkong.

Tozeuma pavoninum (Bate).

1863. *Angasia pavonina,* Bate, Proc. Zool. Soc., p. 498, pl. xl, fig. 1.

St. Vincent's Gulf, Australia ; $4\frac{1}{2}$ fms.

Tozeuma robustum (Baker).

1904. *Angasia robusta,* Baker, Trans. Roy. Soc. S. Australia, XXVIII, p. 150, pl. xxviii, figs. 1-8.

St. Vincent Gulf, S. Australia, 10-12 fms.

Tozeuma tomentosum (Baker).

1904. *Angasia tomentosa,* Baker, Trans. Roy. Soc. S. Australia, XXVIII, p. 152, pl. xxix, figs. 1-4.

S. Australia ; 20 fms.

Genus **Gelastocaris,** Kemp.

Gelastocaris paronae (Nobili).

See p. 107.

Genus **Mimocaris,** Nobili.

Mimocaris heterocarpoides, Nobili.

1903. *Mimocaris heterocarpoides,* Nobili, Boll. Mus. Torino., XVIII, no. 447, p. 6, fig. 2.

Borneo.

Genus **Lysmata,** Risso.

Lysmata seticaudata (Risso).

1816. *Melicerta seticaudata,* Risso, Hist. nat. Crust. Nice, p. 110, pl. ii, fig. 1.
1825. *Lysmata seticauda,* Guerin, Encycl. méthod., X, p. 328.
1826. *Lysmata seticaudata,* Risso, Hist. Nat. de l'Europe Mérid., V, p. 62.
1863. *Lysmata seticauda,* Heller, Crust. südlich. Europa., p. 234, pl. viii, fig. 1.
1902. *Lysmata seticaudata,* Senna, Bull. Soc. entom. Ital., xxxiv, p. 326.

Mediterranean ; Atlantic Coast of France and Spain ; Channel Is.

var. **ternatensis,** de Man.

? 1849. *Lysmata seticaudata,* De Haan, Fauna Japonica, Crust., p. 176, pl. xlv, fig. 13. (*P. dentatus* on plate).
1888. *Lysmata seticaudata,* de Man, Arch. f. Naturgesch., LIII, i, p. 492.
? 1890. *Lysmata seticaudata,* Ortmann, Zool. Jahrb. Syst., V, p. 507 *(partim).*
1902. *Lysmata seticaudata,* de Man, Abhandl. Senck. naturf. Ges. Frankfurt, XXV, p. 846.

Ternate; Amboina. Japan ?

Lysmata trisetacea (Heller).

1861. *Hippolyte trisetacea,* Heller, Verhandl. zool-bot. Ges. Wien, XI, p. 29.
1861. *Lysmata pusilla,* Heller, Sitz-ber. Akad. Wiss. Wien, XLIV, p. 287, pl. iii, fig. 26.
1888. *Lysmata pusilla,* de Man, Arch. f. Naturgesch., LIII, i, p. 493.

Red Sea.

Lysmata chiltoni, Kemp.

See p. 110.

Genus **Hippolysmata,** Stimpson.

Hippolysmata amboinensis, de Man.

1881. *Hippolysmata vittata* var. *amboinensis,* de Man, Arch. f. Naturgesch., LIII, i, p. 494.
1907. *Hippolysmata amboinensis,* de Man, Trans. Linn. Soc., Zool. (2), IX, p. 426.

Amboina.

Hippolysmata acicula, Rathbun.

1906. *Hippolysmata acicula,* Rathbun, Bull. U. S. Fish Comm. for 1903, XXIII, iii, p. 912, pl. xxiv, fig. 6.

Hawaiian Is.

Hippolysmata dentata, Kemp.

See p. 117.

Hippolysmata ensirostris, Kemp.

See p. 118.

var. **punctata,** Kemp.

See p. 120.

Hippolysmata kükenthali, de Man.

See p. 115.

Hippolysmata multiscissa, Nobili.

1906. *Hippolysmata multiscissa,* Nobili. Ann. Sci. nat. Zool., Paris (9), IV, p. 47, pl. ii, fig. 5.

Red Sea.

Hippolysmata paucidens, Rathbun.

1906. *Hippolysmata paucidens,* Rathbun, Bull. U. S. Fish Comm. for 1903, XXIII, iii, p. 913, pl. xxiv, fig. 4.

Hawaiian Is.

Hippolysmata vittata, Stimpson.

See p. 113.

Genus **Merguia,** Kemp.

Merguia oligodon (de Man).

See p. 121.

INCERTAE SEDIS.

1888. *Nauticaris futilirostris,* Bate, Rep. Challenger Macrura, p. 606, pl. cix, fig. 1.
1905. *Nauticaris futilirostris,* Pearson, Ceylon Pearl Oyster Rep., IV, p. 81, pl. ii, fig 8.

Japan, Ceylon.

1839. *Hippolyte gracilipes,* Randall, Journ. Acad. Nat. Sci. Philadelphia (1), VIII, p. 142.

Hawaiian Is.

1871. *Hippolyte grayi,* Cunningham, Trans. Linn. Soc., XXVII, p. 496, pl. lix, fig. 8.

Port Otway.

1858. *Hippolyte ignobilis,* Kinahan, Journ. Roy. Dublin Soc., I, p. 131.

Port Philip, Victoria.

1830. *Hippolyte leachii,* Guérin, Voy. de 'La Coquille', II, pt. 2, p. 37.

Caroline group.

1904. *Virbius* (?) *jactans,* Nobili, Bull. Mus. d'Hist. nat., Paris, p. 239.
1906. *Virbius* (?) *jactans,* Nobili, Ann. Sci. nat., Zool., Paris (9), IV, p. 37, pl. ii, fig. 2.

Red Sea.

1888. *Latreutes planus,* Bate, Rep. Challenger Macrura, p. 584, pl. lxxix, fig. 5.

Philippine Is.

1837. *Hippolyte quoyanus,* H. Milne-Edwards, Hist. nat. Crust., II, p. 375.

New Guinea.

1837. *Hippolyte serratus,* H. Milne-Edwards, Hist. Nat. Crust., II, p. 377.

" Baie de Jarvis. "

1837. *Hippolyte spinicaudus,* H. Milne-Edwards, Hist. nat. Crust., II, p. 378.
1882. *Hippolyte spinicaudus,* Haswell, Cat. Australian. Crust., p. 184.

New Holland.

1888. *Latreutes unidentatus,* Bate, Rep. Challenger Macrura, p. 586, pl. lxxix, fig. 6.

Philippine Is.

EXPLANATION OF PLATE I.

Alope palpalis, White.

FIG. 1.—Left second peraeopod of a specimen in the Indian Museum : $\times$ 6.

,, 2.—Right second peraeopod of the same specimen : $\times$ 6.

Alope australis, Baker.

,, 3.—Anterior part of a specimen from Burma, dorsal view : $\times$ 3.

,, 4.—Right second peraeopod of a large male showing abnormal segmentation : $\times$ 6.

,, 5.—The processes on the thoracic sternum of the same specimen : $\times$ 5.

Thor paschalis, Heller.

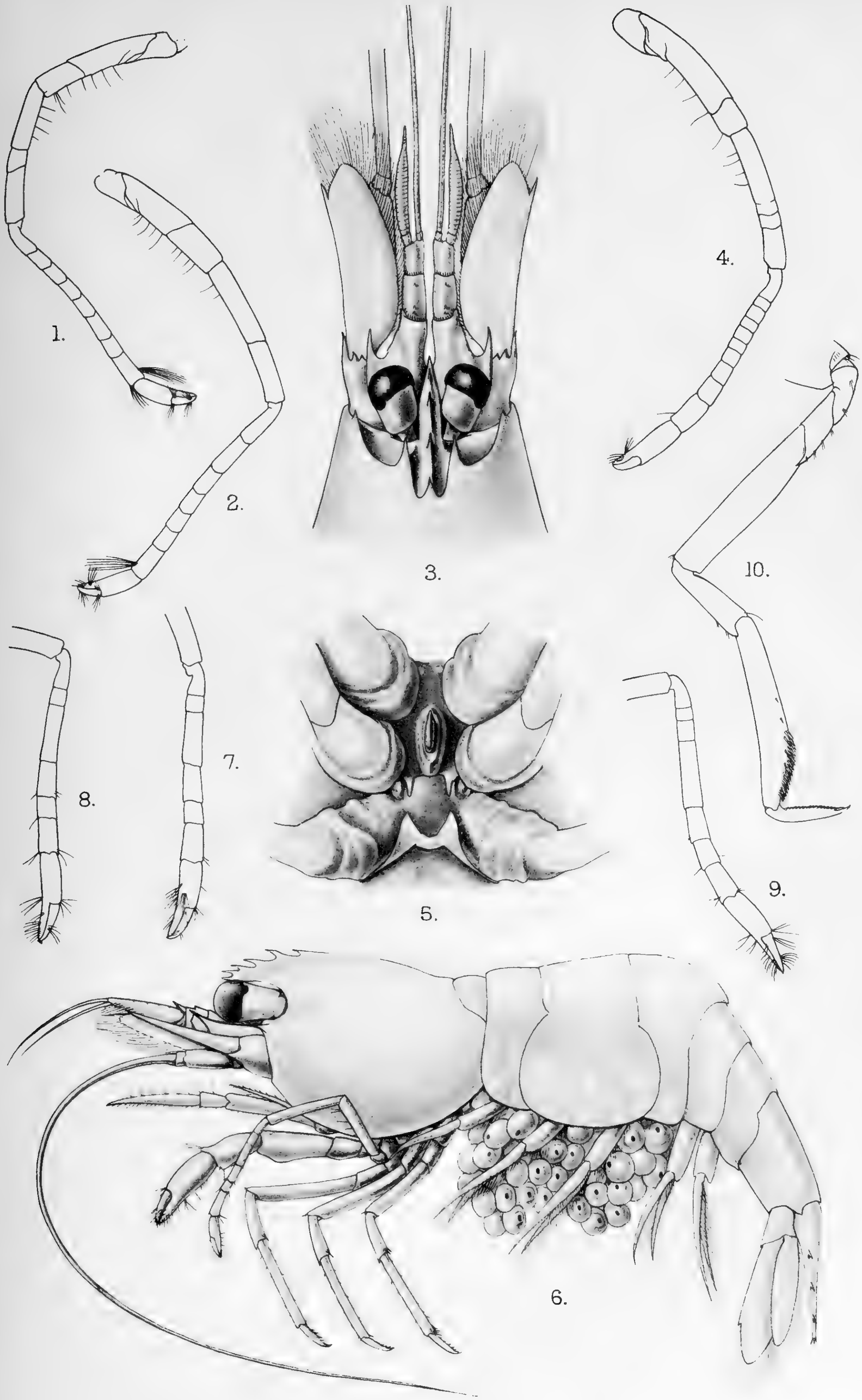
,, 6.—An ovigerous female from S. India in lateral view : $\times$ 12.

,, 7.—Carpus and chela of second peraeopod of a specimen from Florida : $\times$ 16.

,, 8.—Same segments of a specimen from S. India : $\times$ 25.

,, 9.—Same segments of another specimen from S. India showing abnormal segmentation : $\times$ 30.

,, 10.—Third peraeopod of male : $\times$ 15.



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ALOPE, THOR.

EXPLANATION OF PLATE II.

Hippolyte ventricosus, Milne-Edwards.

FIG 1.—An ovigerous female from S. India in lateral view: × 6.
,, 2.—Antennal scale: × 20.
,, 3.—Carpus and chela of second peraeopod: × 30.

Hippolyte varians, Leach.

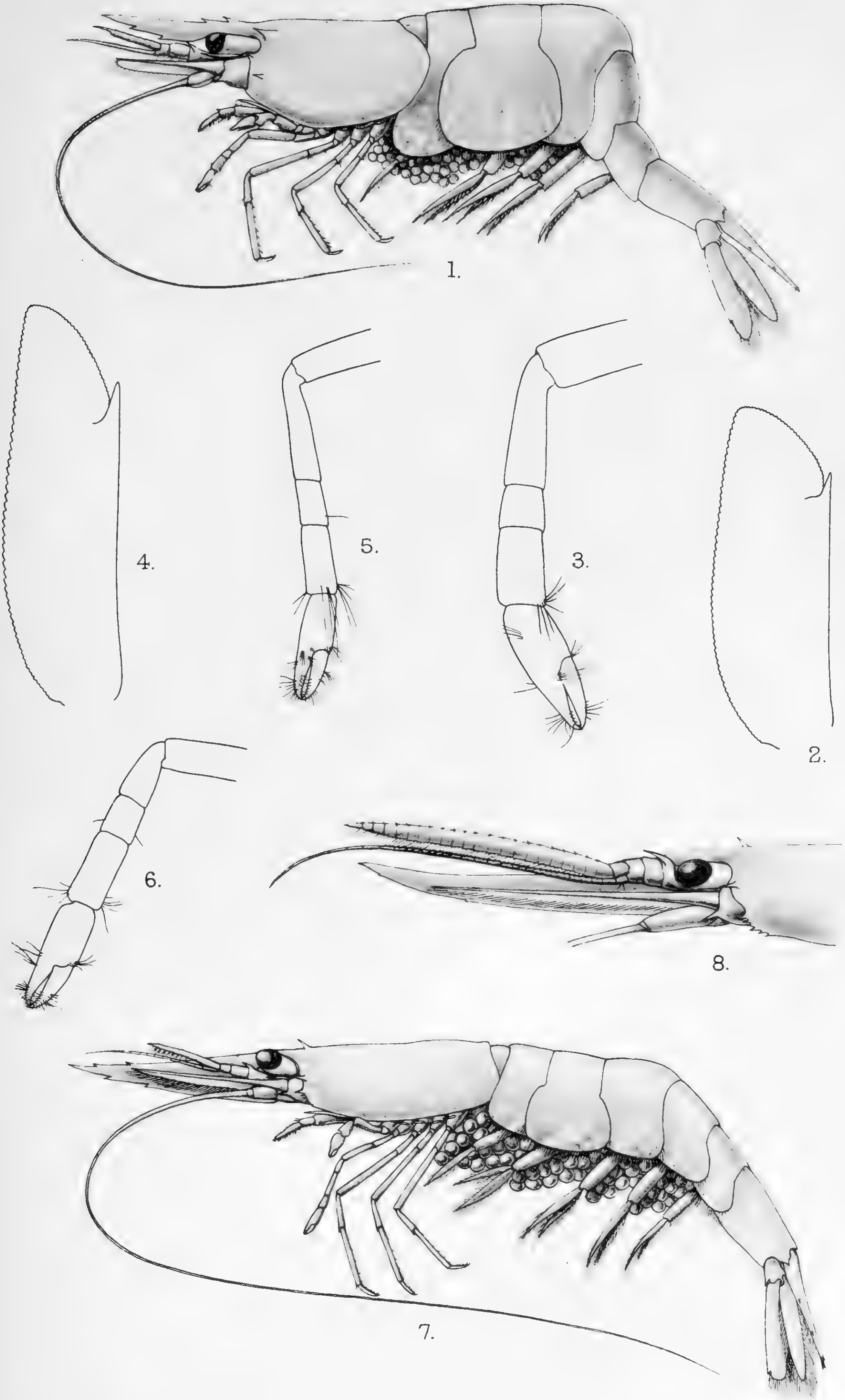
,, 4 —Antennal scale: × 16.
,, 5.—Carpus and chela of second peraeopod: × 20.

Hippolyte australiensis (Stimpson).

,, 6.—Carpus and chela of second peraeopod: × 20.

Latreutes pygmaeus, Nobili.

,, 7.—An ovigerous female from S. India in lateral view: × 7½.
,, 8.—Rostrum, antennule, etc. of a male in lateral view: × 18.



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HIPPOLYTE, LATREUTES.

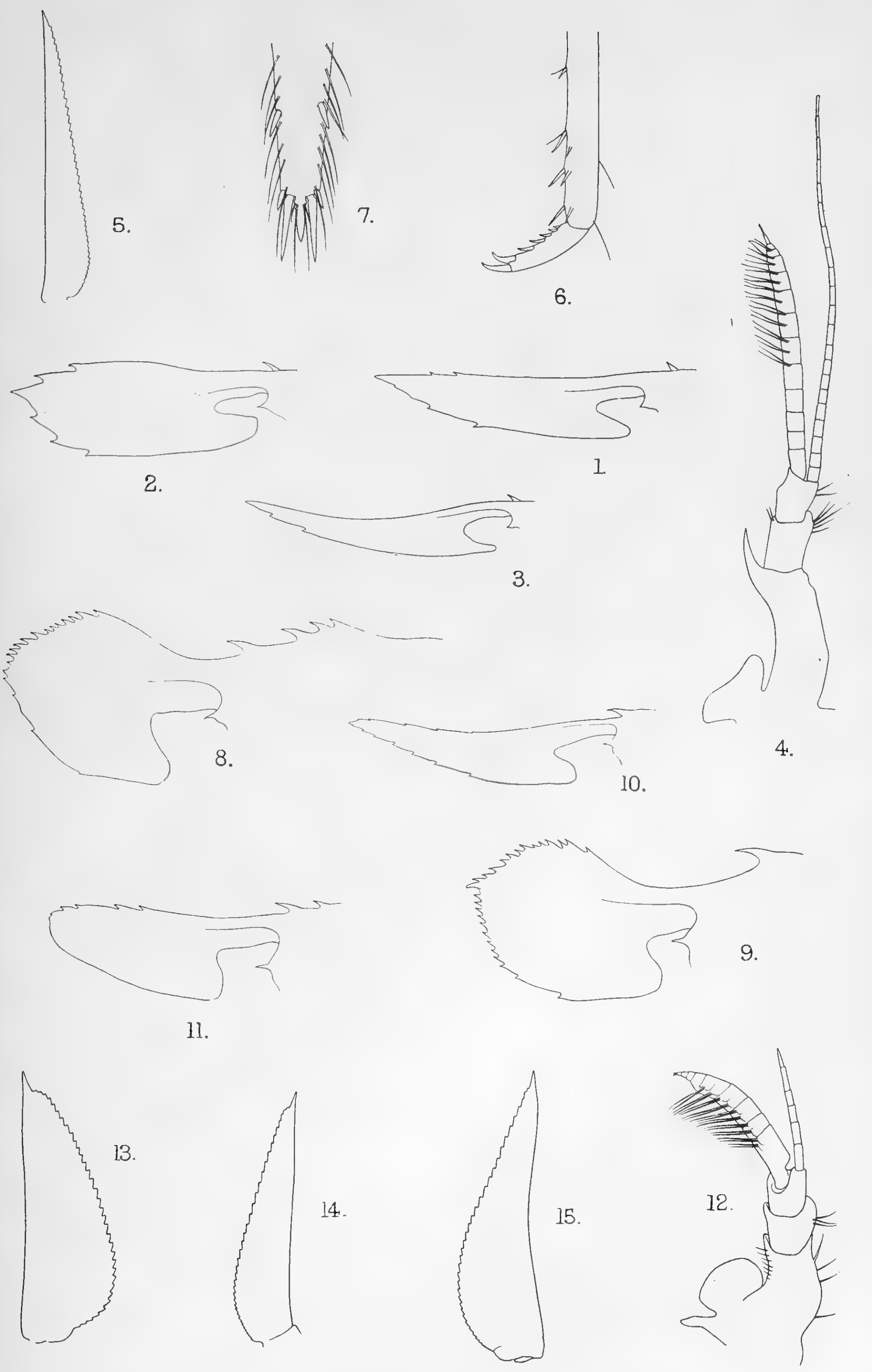
EXPLANATION OF PLATE III.

Latreutes pygmaeus, Nobili.

FIG. 1.—Rostrum of a female : × 7.
,, 2.—Rostrum of another female with abnormally deep blade : × 8.
,, 3.—Rostrum of a male : × 9.
,, 4.—Antennule of a female : × 22.
,, 5.—Antennal scale of a female : × $10\frac{1}{2}$.
,, 6.—Dactylus and part of propodus of fifth peraeopod : × 33.
,, 7.—Apex of telson : × 24.

Latreutes mucronatus (Stimpson).

,, 8.—Rostrum of a female with four dorsal spines on the carapace : × 13
,, 9.—Rostrum of another female with an unusually large number of teeth : × 13.
,, 10.—Rostrum of a male : × $10\frac{1}{2}$.
,, 11.—Rostrum of another male with two dorsal spines on the carapace, resembling the type specimen of *L. gravieri*, Nobili : × 12.
,, 12.—Antennule of a female · × 20.
,, 13.—Antennal scale of a female : × 20.
,, 14.—Antennal scale of a male : × 20.
,, 15.—Antennal scale of another male : × 20.



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LATREUTES.

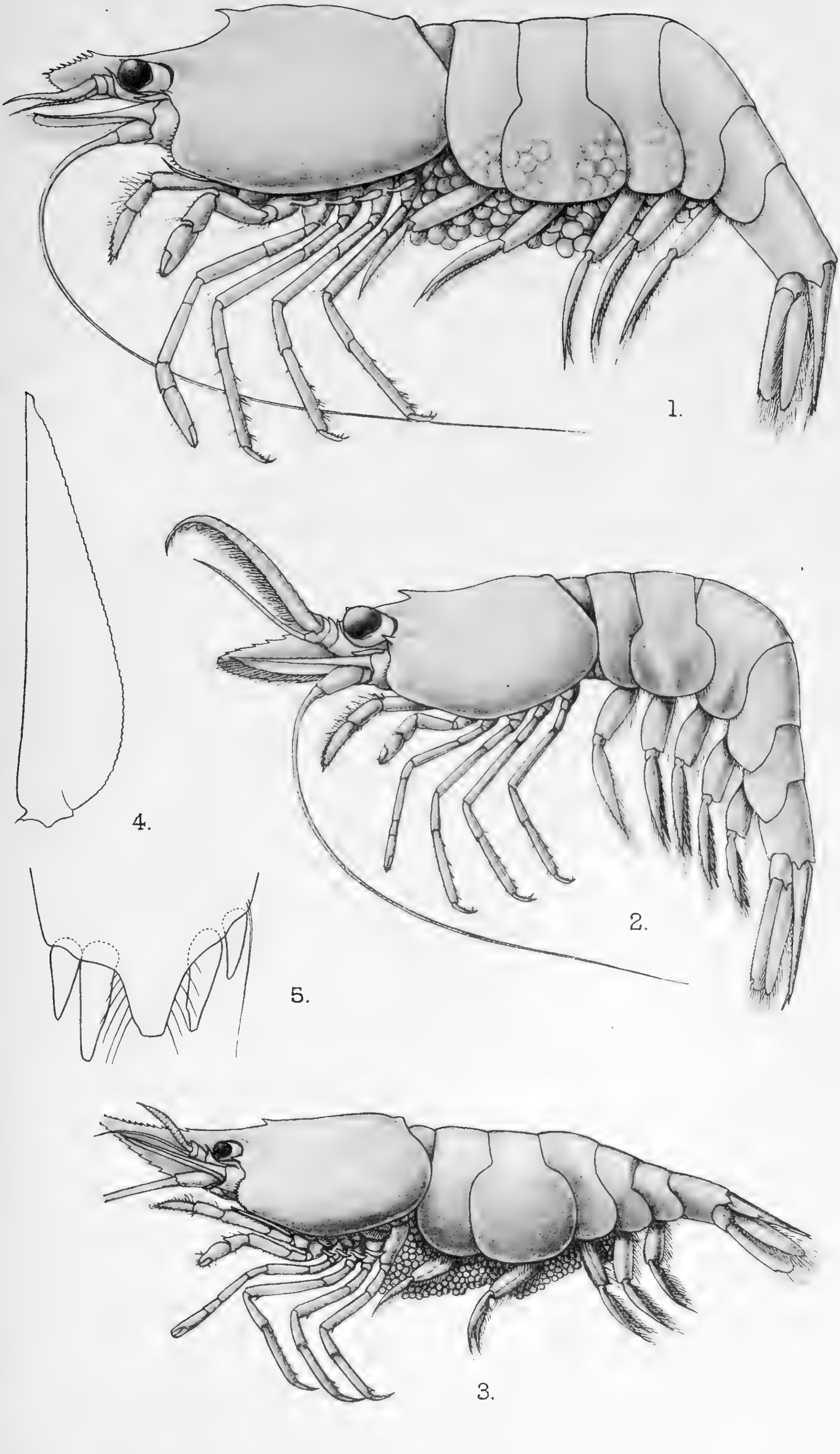
EXPLANATION OF PLATE IV.

Latreutes mucronatus (Stimpson).

FIG. 1.—An ovigerous female in lateral view : $\times$ $9\frac{1}{2}$.
,, 2.—A male in lateral view : $\times$ $9\frac{1}{2}$.

Latreutes anoplonyx, sp. nov.

,, 3.—Type specimen, an ovigerous female, in lateral view : $\times$ 3.
,, 4.—Antennal scale : $\times$ 10.
,, 5.—Apex of telson ; highly magnified.



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LATREUTES.

EXPLANATION OF PLATE V.

Gelastocaris paronae (Nobili).

FIG. 1.—An ovigerous female in lateral view : × $9\frac{1}{2}$.

,, 2.—Antennal scale : × 15.

,, 3.—A portion of margin of antennal scale seen from below, showing plumose setae : × 75.

,, 4.—Second maxillipede : × 15.

,, 5.—Third maxillipede : × 15.

,, 6.—First peraeopod : × 15.

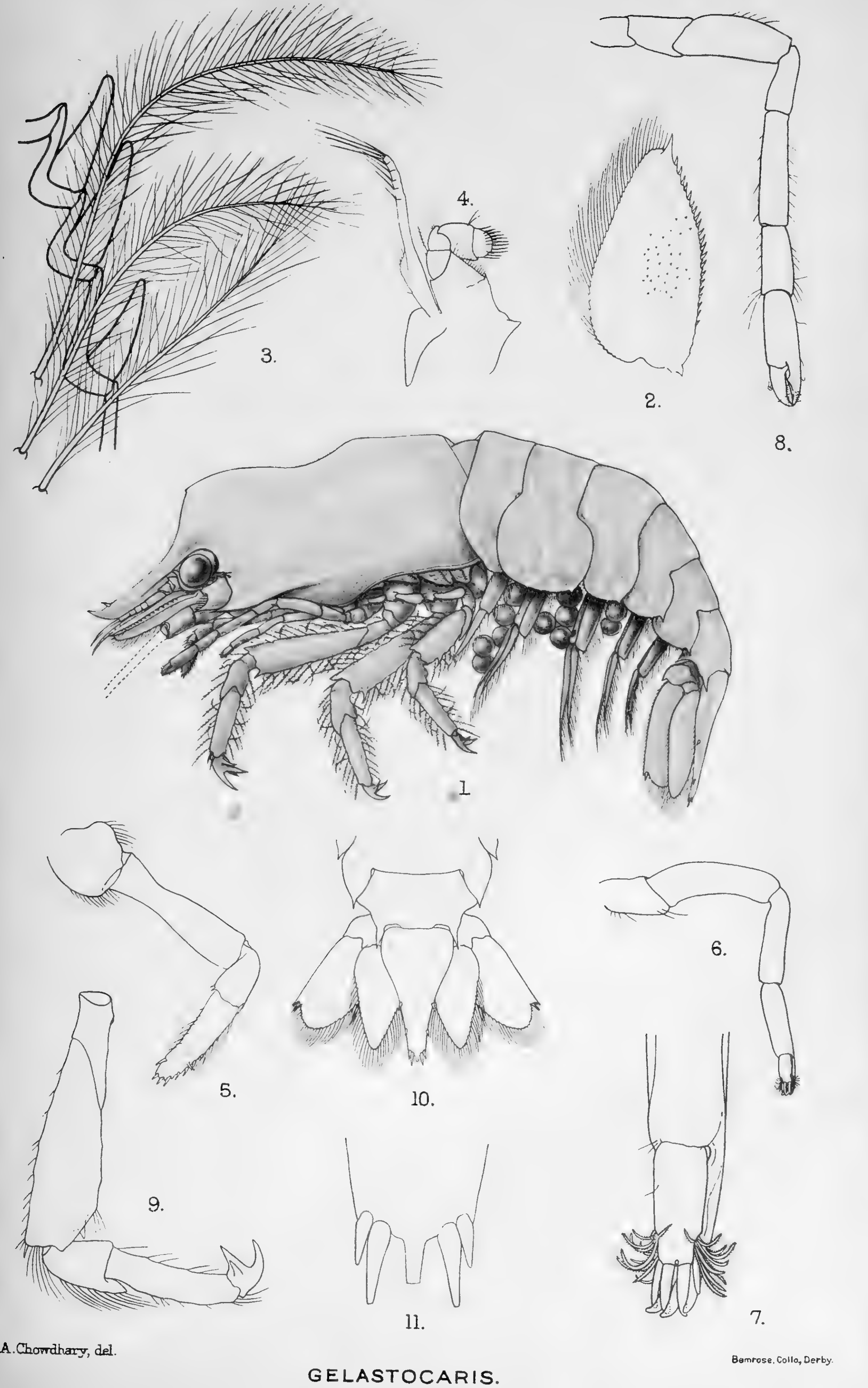
,, 7.—Chela of first peraeopod, further enlarged.

,, 8.—Second peraeopod : × 15.

,, 9.—Third peraeopod : × 15.

,, 10.—Last abdominal somite and telson in dorsal view : × 8.

,, 11.—Apex of telson, further enlarged : × 50.



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GELASTOCARIS.

EXPLANATION OF PLATE VI.

Lysmata chiltoni, sp. nov.

FIG. 1.—Rostrum, carapace, etc. of the type specimen : × 4.
,, 2.—Antennule of another specimen : × 8.
,, 3.—Antennal scale : × 12.
,, 4.—Last two carpal segments and chela of second peraeopod : × 40.

Hippolysmata dentata, sp. nov.

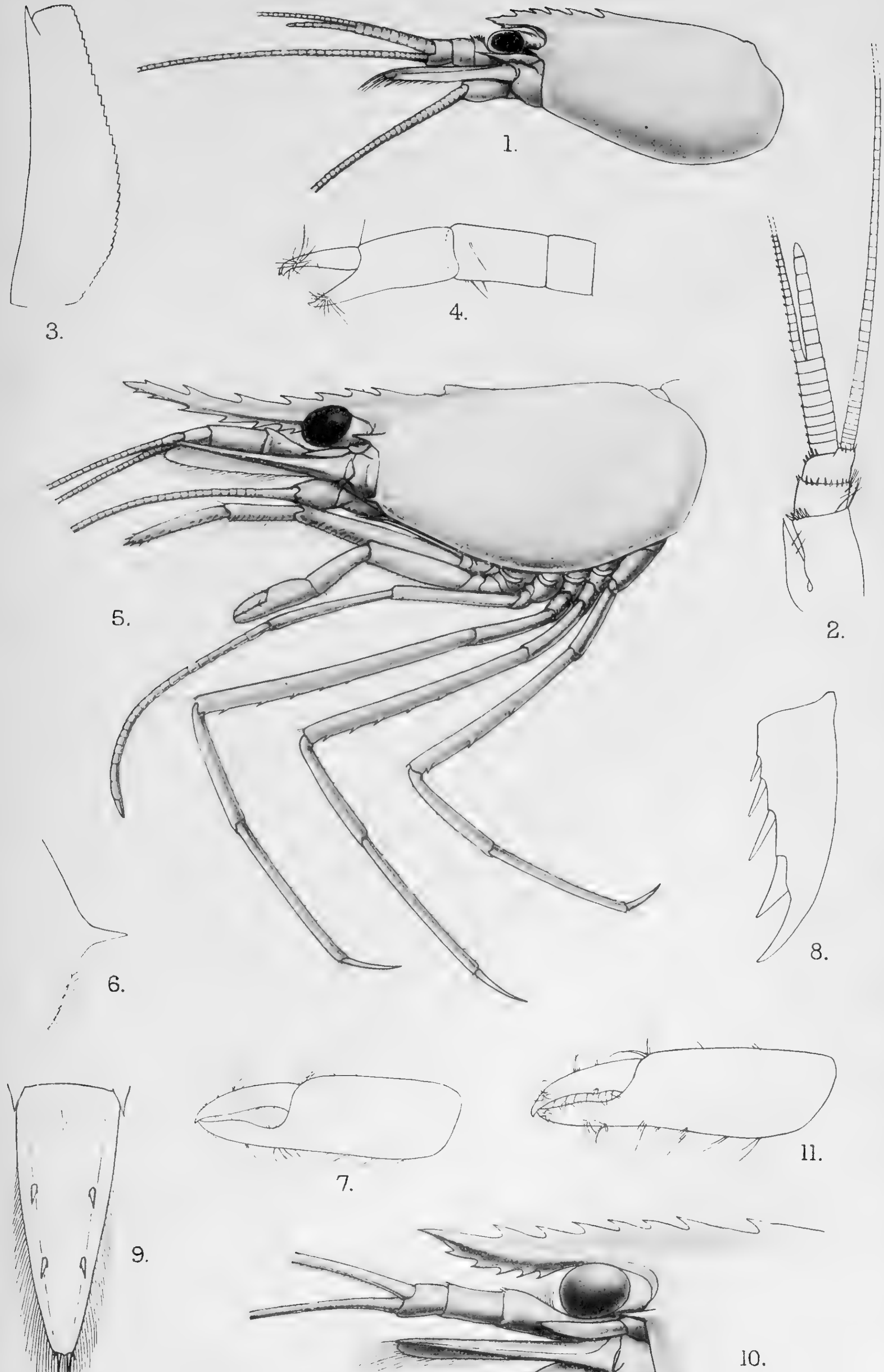
,, 5.—Rostrum, carapace, thoracic appendages, etc. of the type specimen : × 5.

Hippolysmata vittata, Stimpson.

,, 6.—Pterygostomian angle of carapace : × 34.
,, 7.—Chela of first peraeopod : × 14.
,, 8.—Dactylus of fifth peraeopod : × 34.
,, 9.—Telson : × 8.
,, 10.—Rostrum, carapace, etc. of a specimen from the Persian Gulf with unusually long rostrum : × 6.

Hippolysmata kükenthali, de Man.

,, 11.—Chela of first peraeopod ; × 14.



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LYSMATA, HIPPOLYSMATA.

EXPLANATION OF PLATE VII.

Hippolysmata ensirostris, sp. nov.

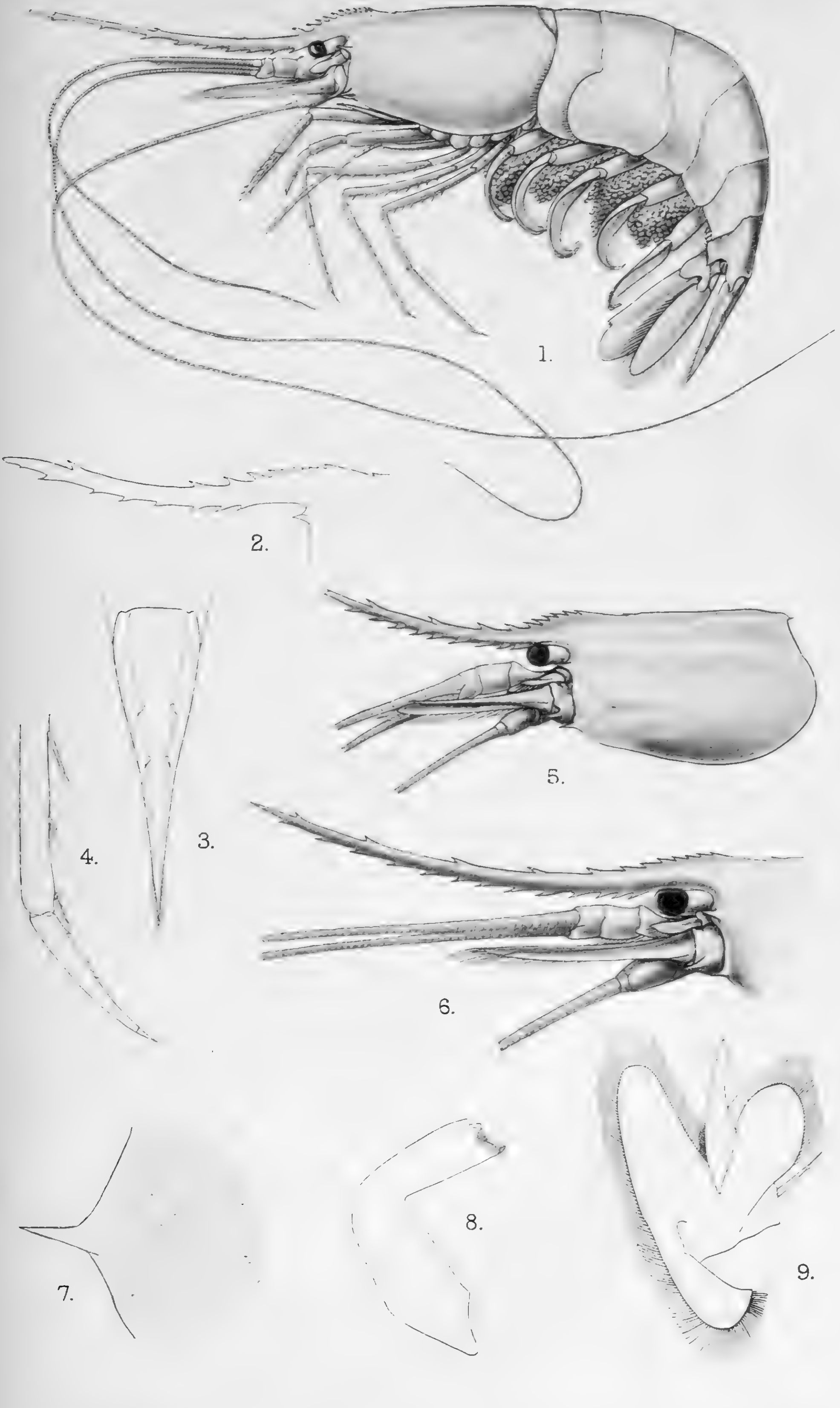
FIG. 1.—An ovigerous female in lateral view : × 2.
,, 2.—Rostrum of another specimen : × 3.
,, 3.—Telson : × 5.
,, 4.—Dactylus and part of propodus of fifth peraeopod : × 16

Hippolysmata ensirostris var. *punctata*, nov.

,, 5.—Carapace, rostrum and frontal appendages in lateral view ; × 3.
,, 6.—Rostrum of another specimen : × 4.
,, 7.—A portion of the carapace in the vicinity of the antennal spine, showing the pitting of the surface : × 16.

Merguia oligodon (de Man).

,, 8.—Mandible : × 22.
,, 9.—Second maxilla : × 16.



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HIPPOLYSMATA, MERGUIA.

V. NOTES ON INDIAN FISH.

By R. B. SEYMOUR SEWELL, *B.A., Capt., I.M.S., Surgeon-Naturalist to the Marine Survey of India; Hon. Assistant, Zoological Section, Indian Museum, Calcutta.*

(Plate VIII.)

I.—NOTES ON THE GENUS *Malthopsis*.

This genus was created by Wood-Mason and Alcock for a new species of deep-sea fish obtained by the R.I.M.S.S. "Investigator" in the Andaman Sea.

As has previously been pointed out (Lloyd, 1909–10, p. 171), the collection in the Indian Museum, Calcutta, contains two forms which differ very considerably in size and other characters, and the original description by Wood-Mason and Alcock (1891) applies only to the larger form; possibly they thought that the smaller form was merely an immature stage. Further examples of the smaller form were subsequently obtained from the same region and a full description was published by Lloyd (loc. cit., 1909–10) under the name *Malthopsis triangularis*: in the second part of the same paper, however, this author assumes that both these forms are in reality members of the same species and, arguing on this assumption, proceeds to demonstrate "supposed evidence of mutation." Recently Lloyd (1912) has reiterated his views on this supposed evidence: as he himself shows, the individuals of this genus in the present collection can be divided into two groups by the difference in the arrangement of the dermal scutes and the form and degree of development of the opercular spine—groups that he terms "orderly" and "disorderly" respectively. In both forms very considerable differences are to be found in the breadth of the disc proportionally in proportion to the total length, but such differences are only to be expected in cases where the disc is, as in the present case, supported by flexible bony arches and must largely depend on the degree of external pressure and muscular contraction existing at the time of death. As I have elsewhere shown (Sewell, *Rec. Ind. Mus.*, vol. VII, p. 8, Calcutta, 1912), similar variations are to be found in examples of the closely-allied species *Halicmetus ruber*, Alcock.

I have recently had occasion to re-examine the collection and I have no doubt that it contains two absolutely distinct species, the chief structural characters of which I give below:—

Malthopsis luteus, Wood-Mason & Alcock.

(Plate viii, fig. 1.)

Malthopsis luteus, Wood-Mason and Alcock, 1891, p. 26, pl. viii, figs. 2, 2*a*.
Malthopsis luteus, Goode and Bean, 1895, p. 53, fig. 411.
Malthopsis lutea, Alcock, 1899, p. 64.
Malthopsis luteus, A. Brauer, 1908, p. 326.
Malthopsis (in part), Lloyd, 1909-10, p. 171, pls. xlviii, xlix, l.
Malthopsis (in part), Lloyd, 1912, pp. 140-148, fig. 7.
Malthopsis lutea, Ill. Zool. Invest., Fishes, pl. xix, fig. 4.

In this form "the body is covered with hard, granular, adherent plates, each with a large radially striated conical tubercle in its centre. On the dorsal surface of the disc they are of moderate size, in contact along the middle line, but distant and slightly sunken laterally. On the ventral surface of the cephalic disc they are small, distant and sunken" (Alcock). "The space between the pelvic fins and vent is covered with about thirty minute plates which are widely separated from one another by naked skin" (Lloyd). Lloyd described this state of affairs by the term "dermal disorder."

"The subopercular spine is relatively small and irregular" (Lloyd).

In this form the nasal spine takes its origin from the anterior end of the snout, in line with the middle of the eye, and projects forwards and, in some cases, slightly upwards. Immediately behind the spine the dorsal profile rises upwards, to a point above the centre of the eye, and then slopes gradually downwards and backwards.

Below the spine is the tentacular pit, the floor of which also slopes downwards and backwards, so that in a ventral view the pit is easily visible.

The interorbital region narrows considerably about the middle of its length.

In the Indian Museum collection are six specimens obtained at the following "Investigator" stations:—

Station 115: 11° 31′ 40″ N., 92° 46′ 40″ E. 188–220 fathoms.
Station 222: 13° 27′ 00″ N., 93° 14′ 30″ E. 405 fathoms.
Station 233: 13° 17′ 15″ N., 93° 10′ 25″ E. 185 fathoms.

Malthopsis triangularis, Lloyd.

(Pl. viii, fig 2.)

Malthopsis triangularis, Lloyd, 1909-10, p. 169, pl. xlv, figs. 1, 1*a*.
Malthopsis (in part), Lloyd, 1909-10, p. 171, pls. xlviii, xlix, l.
Malthopsis (in part), Lloyd, 1912, pp. 140-148, fig. 7.

In this species the dermal plates are arranged according to a very definite pattern, a condition that Lloyd terms "dermal order."

"On the dorsal surface is a median row of four or five large plates. On either side of the median row is an area of naked skin, which is bounded externally by an oblique row of plates converging in the direction of the base of the tail. On the ventral surface the space between the pelvic fin and vent is occupied by seven large plates, a central one surrounded by the six others. The plates are in contact. The subopercular spine is relatively large and tetrafid" (Lloyd).

The nasal spine arises, in this species, from a point opposite the upper border of the eye, at the junction of the dorsal surface and snout, and points strongly upwards and somewhat forwards; from its point of origin the dorsal profile at once slopes downwards and backwards.

The floor of the tentacular pit, below the spine, is vertical as also is the line of profile of the snout, so that when the animal is viewed from below, the pit cannot be seen.

The interorbital region narrows only very slightly, if at all.

In the Indian Museum there are fifteen specimens obtained at the following "Investigator" stations:—

Station 115: 11° 31′ 40″ N., 92° 46′ 40″ E. 188–220 fathoms.
Station 222: 13° 27′ 00″ N., 93° 14′ 30″ E. 405 fathoms.
Station 233: 13° 17′ 15″ N., 93° 10′ 25″ E. 185 fathoms.
Station 332: 10° 21′ 00″ N., 92° 46′ 15″ E. 279 fathoms.

Further differences between these two species can be seen by comparing their measurements and ratios:—

	Malthopsis luteus.	*Malthopsis triangularis.*
Total length (less caudal fin)	from 39 to 65 mm. Specimens which have been subsequently caught by the 'Siboga' and the 'Valdivia' are even larger. 'Siboga' examples 68, 80 mm. 'Valdivia' example 92·5 mm.	from 27 to 42 mm.
Ratio: $\frac{\text{Breadth} \times 100}{\text{Length}}$	from 49 to 73: average 58·3	from 53 to 93: average 75·9.
,, $\frac{\text{Total length}}{\text{Length of spine}}$ ...	from 11·1 to 12·5: average 12·86	from 8·6 to 11·1: average 10·0
,, $\frac{\text{Total length}}{\text{diam. of eye}}$	from 6·1 to 6·5: average 6·325	from 5·0 to 6·3: average 5·5.
,, $\frac{\text{Total length}}{\text{Interorbital diam.}}$ ...	from 12·25 to 14·6: average 13·4.	from 8·4 to 9·5: average 8·85.
,, $\frac{\text{Length of spine} \times 100}{\text{diam. of eye}}$ ...	from 50 to 57: average 51·1.	from 50 to 87: average 54·7.

From the above statement it would seem to be fairly evident that we have here two absolutely distinct species.

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Lloyd, 1909-10. A description of the Deep-sea Fish caught by the R.I.M.S. Ship 'Investigator' since the year 1900, with supposed evidence of mutation in *Malthopsis*. Mem. Ind. Mus., vol. II, p. 139. Calcutta.

Lloyd, 1912. The growth of groups in the Animal Kingdom. Longmans, Green & Co. London.

Max Weber, 1913. Die Fische der Siboga Expedition, vol. LVII. Leiden.

Wood-Mason and Alcock, 1891. Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator'' series II, No. 1. "On the results of Deep-sea Dredging during the season 1890-91. Ann. Mag. Nat. Hist. (6th series), vol. VIII, p. 16. London.

II.—A NEW SPECIES OF *Cryptocentrus*.

Cryptocentrus rubropunctatus, sp. nov.

(Pl. viii, fig 3.)

A single example of what appears to be a new species of *Cryptocentrus* was discovered at "Investigator" Station 414: Fisher Bay in Port Owen, Tavoy Island on the coast of Burma. The animal was found concealed beneath a large stone between tide-marks.

The chief structural characters are as follows:—

D.VI.I/10. A.I/10 C. 17. P. 17. V. 5. Ll. 75.

	mm.
Total length (less caudal fin)	55·0
Length of caudal fin	16·0
Length of head	16·0
Length of snout	4·5
Diameter of eye	4·0
Interorbital space	1·0
Height of body	11·0
Ratio of height of body to length ..	1 : 5
,, ,, length of head to total length ..	1 : 34
,, ,, diameter of eye to length of head	1 : 4

The body is covered with small cycloid scales which increase somewhat in size towards the posterior extremity; the depth of the body is greatest at the insertion of the spinous portion of the dorsal fin and from that point it tapers gradually to the caudal peduncle.

The head is nearly as wide as it is deep: the measurements of width and height being 11·5 mm. and 12·5 mm. respectively.

The mouth is wide and is somewhat oblique; the jaws are equal and the maxilla extends back to a point situated vertically below the centre of the eye: the jaws are furnished with numerous teeth of unequal size and the lower jaw bears a pair of lateral canines. The head is naked and the cheeks and operculum are traversed with rows of minute warts.

The lateral line, as in the case of *C. filifer* (Cuv. and Val.), is represented by a series of vertical rows of small pores; there appear to be eighteen such rows in all, of which the first is separated by a fairly wide interval from the remainder, of these latter the more anterior are about 2 mm. apart but posteriorly the distance is somewhat less than this.

Fins.—The spinous portion of the dorsal fin is completely separate from the posterior rayed part and is also somewhat greater in height; the 3rd spine is the longest and measures 15 mm. in length, the rayed part of the fin is 10·5 mm. in height. The anal fin is 9 mm. in height. Both caudal and pectoral fin are sharply rounded.

In colouration the specimen was of a pale green on the dorsal aspect fading to a dull white below: the body and tail were crossed by a series of eight nearly vertical bands of a pale mauve colour. The tail was dotted with a series of small ocelli of a bright blue colour, while the cheeks and operculum were marked with scattered crimson spots, each spot being surrounded by a dark circle; a single similar spot was situated on the muscular base of each pectoral fin. The caudal and ventral fins were marked by faint longitudinal stripes of alternate pale green and mauve.

As is usually the case, the spots on the head and tail have completely lost their colour in spirit and the former are now a dull white.

A very closely allied species has been described by Tate Regan[1], but the present specimen differs from it in several particulars and is, I think, a new species. I, therefore, propose the name *Cryptocentrus rubropunctatus* for it.

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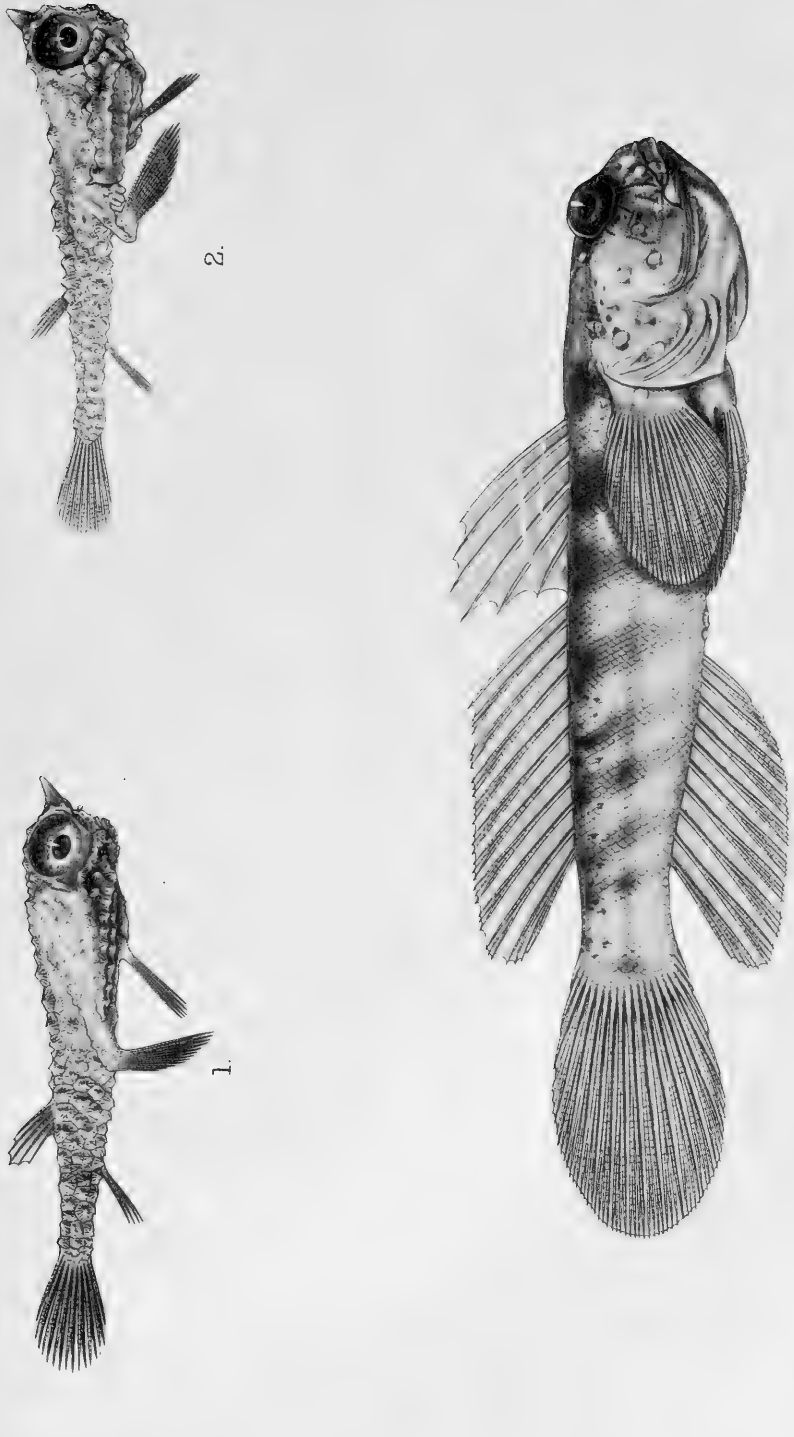
[1] Tate Regan, 1907-09. "Report on the Marine fishes collected by Mr. J. Stanley Gardiner in the Indian Ocean." Trans. Linn. Soc., 2nd Ser., Vol. XII, p. 241, pl. 29, fig. 2. London.

EXPLANATION OF PLATE VIII.

1.	*Malthopsis luteus*, Wood-Mason and Alcock,	lateral view, × 1.
2.	*Malthopsis triangularis*, Lloyd, ..	lateral view, × $1\frac{1}{2}$.
3.	*Cryptocentrus rubropunctatus*, sp. nov.,	lateral view, × 2.

Plate VIII.



INDIAN MARINE FISH.

S. C. Mondul, del.

Bemrose, Collo. Derby

VI. FURTHER NOTES ON THE SPONGES OF LAKE BAIKAL.

By N. Annandale, *D.Sc., F.A.S.B., Superintendent, Indian Museum.*

(Plate IX).

In a paper recently published[1] but written some little time ago, I expressed the opinion, tentatively, that the characteristic sponges of Lake Baikal belonged to the subfamily Chalininae and should probably be assigned to the genus *Veluspa*, Miklucho-Maclay. At the time I had had, as I pointed out, no opportunity of comparing specimens from the Siberian lake with marine Haploscleridae. This was still the case at the end of 1912 when I was preparing my report on the sponges of the Lake of Tiberias;[2] but within the last few months I have been able, thanks very largely to the rearrangement of the collection of marine invertebrates in the Indian Museum carried out by Mr. S. W. Kemp, to examine a considerable number of marine Monaxon sponges from different parts of the world. The result has been to confirm my more important contention, that certain of the Baikal sponges were Chalininae; but I find that I was not justified in re-uniting Dybowski's genus *Lubomirskia* with the older genus *Veluspa*, from which he separated it in 1879, or in asserting that all the sponges of the lake (with the exception of those belonging to the Spongillid genera *Spongilla* and *Ephydatia*) were congeneric. It becomes necessary, therefore, to reconsider the generic portion of the species examined, and this will render it possible to discuss their geographical significance.

The precise systematic position of the sponges that constitute one of the most characteristic features of the fauna of Lake Baikal is not only a problem of considerable difficulty, but also one of great geographical interest. Most authorities on the Spongillidae have treated these sponges as a subfamily thereof, or merely as a highly specialized genus allied to the African *Potamolepis* and the South American *Uruguaya*. It is noteworthy that none of those who have hitherto treated in a comprehensive manner of the Spongillidae as a whole have had before them collections from Lake Baikal. Thanks to the authorities of the Zoological Museum of the Imperial Academy of Sciences in St. Petersburg I have been more fortunate in this respect, in that I have been able to examine

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[1] *Ann. Mus. Zool. Ac. Sci. St. Pétersb.* XVIII, p. 96 (1913).

[2] *Journ. As Soc. Bengal*, 1913, p. 77.

a very representative set of specimens of the species assigned by Dybowski to his genus *Lubomirskia.* In discussing more fully the result of comparing preparations of these sponges on the one hand with similar preparations of many true Spongillidae, and on the other with those of marine Monaxon sponges, it will be as well to commence by giving a brief abstract of what has already been published on the Baikal species as a result of the examination of collections from the lake.

So long ago as 1772 or 1773 Pallas [1] described the first of these sponges under the name *Spongia baikalensis.*

In 1870 Miklucho-Maclay [2] redescribed this sponge very briefly and assigned it to his new genus *Veluspa*, treating it as a variety of the Arctic marine species *V. polymorpha.*

In 1879 Dybowski [3] again reinstated *Spongia baikalensis* as a distinct species and created a new genus for its reception and for that of all the other sponges from Lake Baikal with which he was acquainted. For this genus he coined the name *Lubomirskia.*

In 1895 several additional species and varieties were described and assigned to *Lubomirskia* by Soukatschoff.[4]

In 1901 Swartschevski [5] pointed out that two distinct genera had been confused under the name *Lubomirskia* and distributed the species described by former authors, together with several new forms described by himself, between the genera *Lubomirskia* and *Veluspa.* He also described some true Spongillinae from Lake Baikal. In the same year Korotneff [6] based some general observations (briefly describing the same Spongillidae) on his own collection, on which Swartschewski also worked. This collection is still being described in a series of monographs.

In my paper of last year [7] I suggested, as a provisional arrangement, that all the genera and species from Lake Baikal placed in *Veluspa* and *Lubomirskia* by other authors, should be reassembled in the latter genus, and that they should be assigned to the subfamily Chalininae of the family Haplosceridae, instead of the Spongillidae.

I. SYSTEMATIC.

It is a disputed point among students of the Porifera whether the classification of the Monaxonida (or Monaxonellida) should be based mainly, if not exclusively, on the form of the microscleres, or whether that of the skeleton-spicules and other macroscleres should not rather be taken first into account. Both parties, how-

[1] Gauthier de la Peronie's French translation of Pallas's "Travels": "*Voyages de M. P. S. Pallas............Traduits de l'Allemand* (1778–1793)" is the only version available in Calcutta. The reference to the description of *Spongia baikalensis* in this version is vol. IV, p. 680.

[2] *Mém. Acad. Sci. St. Pétersb.* XV, No. 3 (7), p. 4 (1870).

[3] *Mém. Acad. Sci. St. Pétersb.* XXVII, No. 6 (6), p. 11 (1880).

[4] *Trav. Soc. Nat. St. Pétersb.* XXV (2), p. 11 (1895).

[5] *Zapiski Kiev. Obšč. Jest.* XVII (2) (1901).

[6] *Biol. Centralbl.* XXI, p. 306 (1901).

[7] *Ann. Mus. Zool. Ac. Sci. St. Pétersb.* XVIII, p. 96 (1913).

ever, seem to acknowledge that, whatever criterion is adopted in the separation of families, some or all of them will be of polyphyletic origin and include genera that resemble one another because of convergent evolution rather than of direct common descent. The precise classification adopted is, therefore, largely a matter of convenience. If great stress is laid on the microscleres alone there is this difficulty, that in certain genera (*e.g. Homaeodictya*)[1] the microscleres are very liable to be overlooked or lost altogether, and species assigned not only to the wrong genera but even to the wrong family; while in many genera microscleres are invariably absent. In those genera, however, in which they are present there can be little doubt that they form by far the readiest means of identification and separation in the case of properly preserved specimens, and on the whole it is perhaps most convenient to consider them first in separating the larger divisions, although in their absence other characters must be found.

In Prof. Dendy's[2] report on the sponges collected by Prof. Herdman in the Gulf of Manaar (1905) there is, on pp. 133 to 135, a useful discussion of the composition and position of the families of the suborder Sigmatomonaxonellida. This suborder consists of Monaxon sponges in which the typical microscleres are sigmata, or forms derived therefrom, true asters being absent. The first family assigned by Dendy to the suborder is the Haploscleridae, in which, following Topsent[3] he includes the Homorrhaphidae and Heterorrhaphidae as defined by Ridley and himself[4] in 1887 and by other authors He assigns to the Haploscleridae those genera in which chelae and anchorae are absent, the skeleton spicules being as a rule amphioxi or amphistrongyli and the spicule-fibres typically nonplumose. The marine subfamilies to be considered here belong to this family but have no microscleres.

In dealing with the Baikal sponges it is necessary to consider the relationship between the Haploscleridae and the Spongillidae, in which all other freshwater sponges must at present be placed. In individual specimens, and even in some cases in species and genera, it is often extremely difficult, if not impossible, to find any definite character that would separate a Spongillid from a Haplosclerid. In both families we find sponges totally devoid of microscleres and having a somewhat amorphous skeleton composed of amphioxi held together by a greater or less amount of chitinoid substance.

The typical microsclere of the Haploscleridae is a C-shaped spicule (sigma), which may be modified in different ways but never assumes the complicated form of the chela or of the anchora and rarely becomes straight and rod-like. Microscleres are in

[1] Lundbeck, '*Ingolf*' *Exp.* VI, pt. 1, p. 6, footnote (1902).
[2] Herdman's *Rep. Pearl Oyster Fisheries* (Roy. Soc. London), III (1905).
[3] *Mem. Soc. Zool. France* VII, p. 5 (1894).
[4] '*Challenger*' *Rep. Zool.* XX (Monaxonida) (1887).

some genera completely lost by degeneration. The skeleton consists of a more or less well defined network in the structure of which diactinial or occasionally tylote spicules take an important part, if they do not compose it altogether. In cases in which the spicules form definite fibres they either lie parallel or nearly parallel to one another in the core of these fibres, the chitinoid covering of which varies greatly in strength and thickness (if it exists at all), or else are connected together in a chain-like formation by means of small patches of a similar substance. In some species no spicule-fibres can be detected and the skeletal network is constructed entirely of single spicules either joined together by patches of chitinoid substance and each encased in a thin film of the same substance so as to form a lattice-like reticulation, or else merely massed in the parenchyma without any definite arrangement.

In many genera of Haplosceridae the life-history is unknown, but in those in which it has been investigated a free-swimming larva is produced that is covered externally (except at the broader end) with cilia and has a *solid* body. In many cases the larval ciliated cells exhibit distinct signs of specialization in certain regions, but a pigment-spot is not present.

In the Spongillidae, which are closely related to the Haploscleridae and by some authors given only subfamily rank, the typical microsclere is a small amphioxous spicule covered with minute spines, which are evenly disposed on its surface. That this spicule may be convergent towards the sigma is proved by a study of the gemmule-spicules of *Spongilla*, the most primitive genus of the family, and *Pectispongilla*, in both of which certain microscleres have a distinctly C-like outline. The evolution of the microscleres takes, however, a very characteristic course in the family as a whole. In the first place a tendency for the differentiation of the minute spicules that have no part in the formation of the skeleton into two distinct, but not widely divergent types makes its appearance in the most primitive forms. In *Spongilla* it is already well established; we find simple spiny amphioxi, which are never strongly curved, lying free in the dermal membrane and the parenchyma, and also other amphioxi of stouter build and slightly more complicated structure associated only with the gemmules. Although the latter spicules often approach the sigma-type in outline more closely than the "flesh-spicules" do, they are more highly specialized as regards the spines that cover them, in that these spines are often distinctly longer and more recurved at the extremities of the spicule than on the middle part. Unimportant as this specialization usually is in *Spongilla* (it is much more strongly marked in *Pectispongilla*, an offshoot from the direct line of evolution in the family), it has a well-defined significance in other, more highly developed genera. In *Ephydatia*,[1] a genus closely resembling *Spongilla* in general

[1] In the genus *Iotrochota* of the family Desmacidonidae, which as a family is characterized by the presence of the chela or its derivatives, and again in certain

structure, the terminal or subterminal spines of the gemmule-spicule form a regular crown or rotule at both extremities; in *Pectispongilla* they fuse together at both ends of the spicule to

ERRATUM.

P. 141 line 3 for *Pectispongilla* read *Trochospongilla*.

genera and many species these free microscleres disappear altogether; whereas this is the case with the gemmule-spicules only in a few degenerate forms.

The skeleton of the Spongillidae differs in no essential feature from that of the Haplosceridae; but the chitinoid sheath of the spicule-fibres, if it exists at all, is never so stout as it is in some Haploscleridae, notably in those of the subfamily Chalininae, and the lattice-like network of single spicules characteristic of *Reniera* among the Haploscleridae is never found in its full development.

The free-swimming larva of the Spongillidae has a very characteristic structure, consisting of a *hollow*, bladder-like body, entirely covered externally with homogeneous cilia and invariably without a pigment spot.

The most characteristic feature of the Spongillidae has, however, as yet been mentioned only incidentally, *viz.* the elaboration of the gemmule.

Gemmules are produced by many Haploscleridae, but consist merely of masses of cells stored with food-material and enclosed in a simple chitinoid case without specialized spicules or a pneumatic covering. In the Spongillidae on the other hand both these structures are commonly associated with the gemmule; in the subfamily Spongillinae the one critical character of most of the genera is the form of the microscleres with which the gemmule is armed, a foraminal tubule or cup (or at any rate a very definite depression in the covering at which the contents of the gemmules may escape on germination) is found in all but a few cases, while in most instances there is a special coat of chitinoid substance containing air-spaces of one kind or another. In the subfamily Potamolepidinae, in which microscleres of all kinds are absent, the gemmule, if it exists at all, is of a much simplified nature and resembles in many respects that of the Haploscleridae: that this is the result of convergence rather than of genetic relationship is proved by the very close structural resemblance between certain Potamolepidinae and certain Spongillinae not of a primitive type.

Hexactinellida, free microscleres very similar superficially to the gemmule-spicules of *Ephydatia* have been produced in totally different lines of evolution.

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structure, the terminal or subterminal spines of the gemmule-spicule form a regular crown or rotule at both extremities; in *Pectispongilla* they fuse together at both ends of the spicule to form smooth-edged disks; in *Tubella* one of the rotules begins to disappear and a trumpet-shaped spicule is the result, while in *Parmula* this rotule has vanished together with the greater part of the shaft of the spicule, which takes the form of a flat plate (representing the other rotule) with a spine (all that is left of the shaft) projecting upwards from its centre

The evolutionary development of the free microscleres or flesh-spicules of the Spongillidae is much less striking than that of the gemmule-spicules and need not be considered here. In several genera and many species these free microscleres disappear altogether; whereas this is the case with the gemmule-spicules only in a few degenerate forms.

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Hexactinellida, free microscleres very similar superficially to the gemmule-spicules of *Ephydatia* have been produced in totally different lines of evolution.

There is one anatomical feature of the Spongillidae which I have left to the last in considering the distinctive features of the family, because I am not sure of its precise significance; I mean the well-developed subdermal cavities Under this term two quite distinct structures or rather systems have sometimes been confused, *viz.* (*a*) the cavity between the derma and the parenchyma into which water is drawn through the dermal pores on its way into the inhalent or afferent channels of the sponge, and (*b*) the superficial exhalent or efferent channels that extend along the surface of the parenchyma immediately beneath the derma and open into the oscula direct. Both these systems may be traced in all Spongillinae and in *Nudospongilla* among the Potamolepidinae, although the actual dimensions of the channels differ in different species. In *Cortispongilla* and *Pachydictyum* they can also be detected, but not so easily. I have examined only dry specimens of *Potamolepis*, but the structure of the skeleton certainly suggests their presence in this genus also.

In the Haplosceleridae (as also in many other marine Monaxon sponges) many genera and species have both systems well developed. This is the case in many of the Renierinae, the subfamily most nearly related to the Spongillidae. It is not the case, however, in the Chalininae. In this subfamily (or at any rate in all its representatives I have examined) there is practically no subdermal inhalent cavity and the main exhalent channels run up vertical or obliquely to the surface of the sponge, on which they open as a rule in groups.

In all the Baikal sponges I have examined, or of which suitable figures have been published—I have not seen the forms of *Spongilla* and *Ephydatia* described by Swartschevski (1901), whose figures do not illustrate this point—both subdermal systems appear to be absent and the structure of the sponge is in this respect exactly like that of the Chalininae, the distal part of the vertical or radial fibres of the skeleton being buried in the parenchyma to their tips, instead of standing out above the parenchyma and supporting the dermal membrane as a tent-pole supports a tent. Stress has been laid by Dybowski and others on the "grouped" nature of the oscula in the Baikal sponges, and this would seem to be a character usually correlated with the absence of an exhalent subdermal sytem. In the Potamolepidine sponge *Nudospongilla aster* from Palestine, however, it is not so.

Family HAPLOSCLERIDAE.

Subfamily *CHALININAE*.

Genus **Lubomirskia**, Dybowski.

This genus may be defined as follows :—

Sponge massive, consisting of upright cylindrical stems or flabelliform, tough, elastic, not at all friable, with shallow oscula scattered, as a rule in groups, on the surface ; main exhalent channels never running in a horizontal direction immediately below the dermal membrane; inhalent subdermal cavity absent.

Skeleton consisting of a network of well-defined, compact, strongly coherent series of spicules lying parallel or nearly parallel to one another in a thick sheath of chitinoid substance. The vertical fibres branch dichotomously, especially in the outer part of the sponge, and are joined together by transverse fibres containing fewer spicules than themselves. On the surface branching becomes more vigorous and more irregular, so that the external extremities of the vertical fibres form broom-like bunches of slender fibres the central part of which is as a rule hollow and forms a nursery for the young embryos. Together these bunches of fine vertical fibres constitute a skeletal cortex (pl. ix, figs. 1, 1*a*).

Spicules.—There are no true microscleres. The skeleton spicules are amphioxous and spiny, the spines being sometimes concentrated at or near the extremities. Smooth slender amphioxi also occur occasionally in the parenchyma.

Type species: *Spongia baicalensis*, Pallas.

No gemmules have been described in this genus and the form of the free-swimming larva is unknown. Embryos in an early stage of development are frequently present in large numbers; they appear to migrate to the cavities in the terminal bunches of the spicule-fibres and probably escape thence on reaching the larval stage.

The only species that can be assigned to the genus are *L. baicalensis* (Pallas) and *L. abietina* (Swartschevski). The latter has been found only in Lake Baikal, but the former occurs also in Arctic seas.[1]

Dybowski has described (1880) several well-defined varieties of *L. baicalensis*, but Soukatschoff's[2] *L. baicalensis* var. *e* cannot belong either to the species or the genus. It is probably a form of *Baikalospongia bacillifera* (Dybowski). A phase to which no name or letter has been assigned was submitted to me by the authorities of the St. Petersburg Academy. In it the upright part of the sponge, instead of consisting as in the typical form of cylindrical systems, is fan-like, the broad, compressed growths usually being curved in horizontal section and sometimes forming incomplete cups. This form evidently reaches a considerable size. Its spicules agree with those of the typical form.

L. baicalensis and *L. abietina* differ mainly in the structure of the skeleton; in the latter the vertical fibres branch much less freely, the skeletal cortex is less well developed and the transverse fibres are fewer and more slender than in the former. *L. abietina* never produces upright growths like those characteristic of the typical form or the phase described above of *L. baicalensis*, but the formation of such growths does not take place in all varieties of the latter species.

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1 Dybowski, *Sitzb. Nat. Gesellsch. Dorpat*, 1884, p. 44.
2 *Trav. Soc. Nat. St. Pétersb.* XXV, p. 11 (1895).

The affinities of *Lubomirskia* are, in my opinion, with *Pachychalina*, Schmidt, from which the genus differs in its spiny spicules and in the peculiar structure of the terminal part of the vertical fibres, and, with *Veluspa*, Miklucho-Maclay, which has smooth tylote spicules. The structure of the skeleton-fibre appears to have been misunderstood by Dybowski and by most subsequent writers owing to the facts that the section figured by him (1880; pl. II, fig. 5) was too thin to show the real structure, and that the precaution of staining preparations of this genus with some reagent that would display the chitinoid sheath of the fibre has not hitherto been adopted.

The method I have myself used in making the preparations of *L. baicalensis* figured on plate ix is a very simple one. After cutting a thick hand-section of the dried sponge I dissected out a few fibres with their attachments under a binocular microscope and washed them in running water, brushing them at intervals with a camel's-hair brush, until the cellular debris was removed. I then placed them for about ten minutes in a strong aqueous solution of pyrogallic acid. This solution of course stained both the sheath and any remains of cells that still adhered to it, but the former were easily distinguished by their apparently granular nature and removed by further brushing in water. This method is naturally applicable only to skeleton-fibres that have a definite horny sheath.

It will be noted that in fig. 1*a* on plate ix that the horny or chitinoid substance is deposited in the interstices between the smaller twigs of the fibres in concentric layers and that these interstices are often almost completely filled up in this manner.

Subfamily *RENIERINAE*.

Baikalospongia, gen. nov.

Sponge massive or encrusting, resembling *Lubomirskia* in general structure but friable (though hard) and not at all elastic. A stout basal membrane of a horny nature is present.

Skeleton superficially resembling that of *Lubomirskia*, *except that there is no horny sheath to the fibres and that the vertical fibres do not form definite brush-like tufts at their distal extremity* but are more or less distinctly splayed out to form a horizontal skeletal reticulation

Spicules.—There are no true microscleres. The skeleton-spicules as a rule resemble those of *Lubomirskia*, but the spines at their extremities are usually differentiated more distinctly. In one species (*B. irregularis* (Swart.)) the macroscleres are smooth and blunt at both ends.

Gemmules.—These bodies have been discovered as yet only in one species (*B. bacillifera*), in which they are ovoid or pear-shaped structures with a simple horny covering which is distinctly depressed in a crateriform manner at the narrower end (pl. ix, fig. 3*b*). They lie in the stout basal membrane of the sponge with their long axis parallel to it.

Type-species: *Lubomirskia bacillifera*, Dybowski.

The embryos, which are often abundant in *B. bacillifera*, resemble those of *Lubomirskia*, but the free-swimming larva is unknown.

The following species must be assigned to this genus:— *Lubomirskia bacillifera*, *L. papyracea* and *L. intermedia*, Dybowski, *L. tscherskii*, *L. fusifera* and (probably) *L. baikalensis* var. *e*, Soukatschoff, and *L. irregularis*, Swartschevski. All these sponges are, so far as is known, found only in Lake Baikal.

I have examined numerous specimens of *B. bacillifera* and *B. intermedia*, both of which I assigned in 1913 (or rather in 1911) to the same genus as *Lubomirskia baicalensis*. This was, however, before I had attempted to dissect out individual fibres from the skeleton or to use pyrogallic acid as a stain in their examination. When I attempted to isolate the fibres an essential difference at once became apparent: it was impossible to disassociate them without breaking them into fragments, and they had none of the springiness and elasticity of those of *Lubomirskia*. They were moreover, so fragile that attempts to brush them clean always ended in disaster. Fragments of the skeleton, cleaned as far as possible in running water, were then stained in pyrogallic solution, and the difference in the structure of the skeleton-fibres of the two genera at once became clear. *There is in* Baikalospongia *no horny fibre-sheath*, but the fibres are built up in a ladder-like formation of groups of spicules, which adhere together in bunches and series of bunches by means of thin veil-like films of horny or chitinoid substance secreted at the points at which they are actually in contact. This formation is identical with that found in the skeleton of the harder species of Spongillidae (*cf.* plate ix, figs. 3*a* and 4) and also in many sponges of the subfamily Renierinae.

In assigning *B. bacillifera* and its allies to this subfamily I rely rather on negative than on positive evidence, placing them there rather because they are neither Spongillidæ (having no subdermal cavities) nor Chalininae (having no horny sheath to their skeleton-fibres) than on account of any definite character they possess. There are two genera *Nudospongilla* (Spongillidae of the subfamily Potamolepidinae) and *Metschnikowia* (probably Renierinae) to which they bear a very close resemblance in many characters, but both of these genera occupy an anomalous and somewhat unsatisfactory position.

Nudospongilla,[1] a genus of my own, is confessedly no more than a convenient generic appellation for those freshwater sponges in which the microscleres have disappeared but the skeleton has not the hardness or compactness of *Potamolepis*, Marshall. The skeleton-spicules may be either smooth or spiny and in the type-species (*N. coggini*, pl. ix, fig. 5) have a form not unlike those of some varieties of *B. bacillifera*; they are invariably amphioxous or practically so, whereas those of *Potamolepis* are amphistrongylous.

[1] *Journ. As. Soc. Bengal* 1913, p. 62.

The genus only differs from the subgenus *Stratospongilla* of the genus *Spongilla* in being devoid, apparently in all circumstances, of true microscleres. The skeleton of most species [1] resembles that of *Baikalospongia*, except that the reticulation is never quite so dense and the sponge is therefore even more fragile. *B. intermedia* is, however, a connecting link in this respect. In all the species of *Nudospongilla* I have examined both subdermal cavities can be traced, but in one Syrian form (*N. aster*) the disposition of the oscula somewhat resembles that characteristic of both *Lubomirskia* and *Baikalospongia*.

The genus *Metschnikowia* was described by Grimm from the Caspian Sea. His paper, which is apparently in Russian and was published in 1876 or 1877, is not available to me. Dybowski (1880); pp. 52-59) has redescribed three species, as well as redefining the genus, from the same inland waters. Topsent [2] and Lundbeck [3] refer to *Metschnikowia* Carter's *Isodictya spinispiculum* and also the species originally described by Topsent himself as *Reniera filholi*; both these sponges being found in the Atlantic. But it does not appear that either author had had an opportunity of examining material from the type-locality of *M. tuberculata*, the type-species of the genus, and I would prefer to compare Caspian specimens with true marine ones before expressing an opinion on this point. Dybowski's figures of the skeleton of *M. tuberculata* and *M. flava* (1879; pl. iii, figs. 5 and 6) are detailed and clear, but I have seen no similar figures of that of the marine species placed in the genus by the two authors just named. In any case, Dybowski's figures show that there is a somewhat thin and irregular fibre sheath present in the sponges he illustrated, and that this sheath is strictly comparable to that of some species of *Reniera*. His figure of *M. flava* (*op. cit.* pl. i, fig. 8) proves the existence in that species of well-defined subdermal exhalent channels.

On the whole, keeping in view the close similarity between some species of *Stratospongilla* and some of *Nudospongilla*, and also the biological conditions in which those of the latter genus are found, I am inclined to regard the indubitable resemblance between *Nudospongilla* and *Baikalospongia* as due to convergence, but to accept as probable the view that *Baikalospongia* is closely related to *Metschnikowia*. Until, however, the larval history of the different species assigned to all these genera is more fully known, it is impossible to express with any confidence a dogmatic opinion as to their mutual relationships.

Of the nominal species assigned to *Baikalospongia* on a preceding page I have examined only two, *B. bacillifera* and *B. inter-*

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[1] Evans, *Quart. Journ. Micro. Sci.* XLI, p. 425, pl. 38, figs. 6-8 (1899) has, however, described a well-defined fibre-sheath in one species (*N. moorei*) which I assign provisionally to *Nudospongilla*. The systematic position of this sponge is problematical.

[2] *Mém. Soc. zool. France* XI, p. 226 (1898) and *Res. Camp. Sci. Monaco* XXV (Sponge. Açores), p. 243 (1904).

[3] *'Ingolf' Exp.* VI (1), p. 52 (1902).

media. Of the former Dybowski and others have described varieties; these I have experienced great difficulty, owing to the existence of intermediate forms, in distinguishing. Soukatschoff's *Lubomirskia tscherskii* and *L. fusifera* are possibly no more than varieties of *L. bacillifera*, but *L. papyracea*, Dybowski and *L. irregularis*, Swart., appear to be specifically distinct.

Family SPONGILLIDAE

Subfamily *SPONGILLINAE.*

Swartschevski (1901; pls. iv (figs. 13-15) and v), in a paper written throughout in Russian, has described a *Spongilla* and two forms of *Ephydatia* from Lake Baikal; it should be possible to recognize all of them from his figures, if not from Korotneff's German descriptions (1901; p. 307). He has named them *Spongilla microgemmata*, *Ephydatia olchonensis* and *E. goriaëvii.*

All these sponges are remarkable for the abnormal character of their microscleres and I am inclined to think that they represent merely abortive varieties or phases, respectively of *Spongilla lacustris*, auct., *Ephydatia mulleri*, Liebk. and *E. fluviatilis*, auct. Without examining specimens it is, however, impossible to insist on this opinion.

2.—GEOGRAPHICAL.

In view of the foregoing observations it seems to be possible to consider the sponges of Lake Baikal from a geographical point of view under three headings, (1) sponges of marine origin, (2) sponges of uncertain origin, and (3) undoubted freshwater forms.

(1) In the first of these categories belong the two species assigned here to the genus *Lubomirskia*. The better-known of these (*L. baicalensis*) has actually been found in Behring's Straits, while the other is very closely allied to it. All other Chalininae are marine, but several species occur in semi-detached bodies of water such as the Black Sea.

(2) Although the affinities of *Baikalospongia* are doubtful, it seems probable that its species are derived from a marine stock.

(3) The true Spongillidae that occur in Lake Baikal are all abnormal forms.

The evidence therefore, such as it is, points to a marine origin for the greater part of the sponge-fauna of the lake. There is nothing definite to connect it with any other sponge-fauna but that of the Arctic Sea, but possibly a remote relationship other than convergent may exist between *Lubomirskia* and the species described from Lake Tanganyika by Evans as *Spongilla moorei.* Personally I am of the opinion that the resemblance is merely another instance of convergence, a phenomenon of constant reoccurrence in the Monaxon sponges. But here again, in the absence of embryological evidence, dogmatism is impossible.

The species *Lubomirskia baicalensis*, existing as it does both in the Arctic Sea and in Lake Baikal, and, moreover, being devoid of reproductive bodies that would be easily transported by external agencies, affords, in any case, strong support for the view that the fauna of the lake includes a real marine element derived from northern waters; while the prolific evolution of species in the apparently endemic genus *Baikalospongia* is exactly parallel to the state of affairs found in the Amphipoda[1] and the Gastropoda[2] of the lake and points to isolation for a considerable period.

[1] Dybowski, "Beitr. der in dem Baikal-See vorkommenden . . . Gammariden," *Horae Soc. Ent. Russ.* X (1874).

[2] Lindholm, *Wiss. Ergebn. Zool. Exp. Baikal-See, Die Mollusken* (1909).

ADDENDUM.

When this paper went to the press I had not seen Topsent's paper on the classification of the Halichondrine sponges on larval characters (*Arch. Zool.* (5) VII, pp. i–xv). He points out (p. xiv) that the larvae of the Haploscleridae (*s.s.*) possess a coloured cap or collar at the posterior, non-ciliated extremity.—*April 24th, 1914.*

EXPLANATION OF PLATE IX

FIG. 1. *Lubomirskia baicalensis* (Pallas).

Fig. 1. Spicule-fibres dissected out of the external part of the sponge; photographed by reflected light and magnified by about 6 diameters. *Fig.* 1*a*. A fragment of the same dissection stained with pyrogallic acid and viewed by transmitted light; × 50. *c.s.* = sheath of spicule-fibre.

FIG. 2. *Baikalospongia intermedia* (Dybowski).

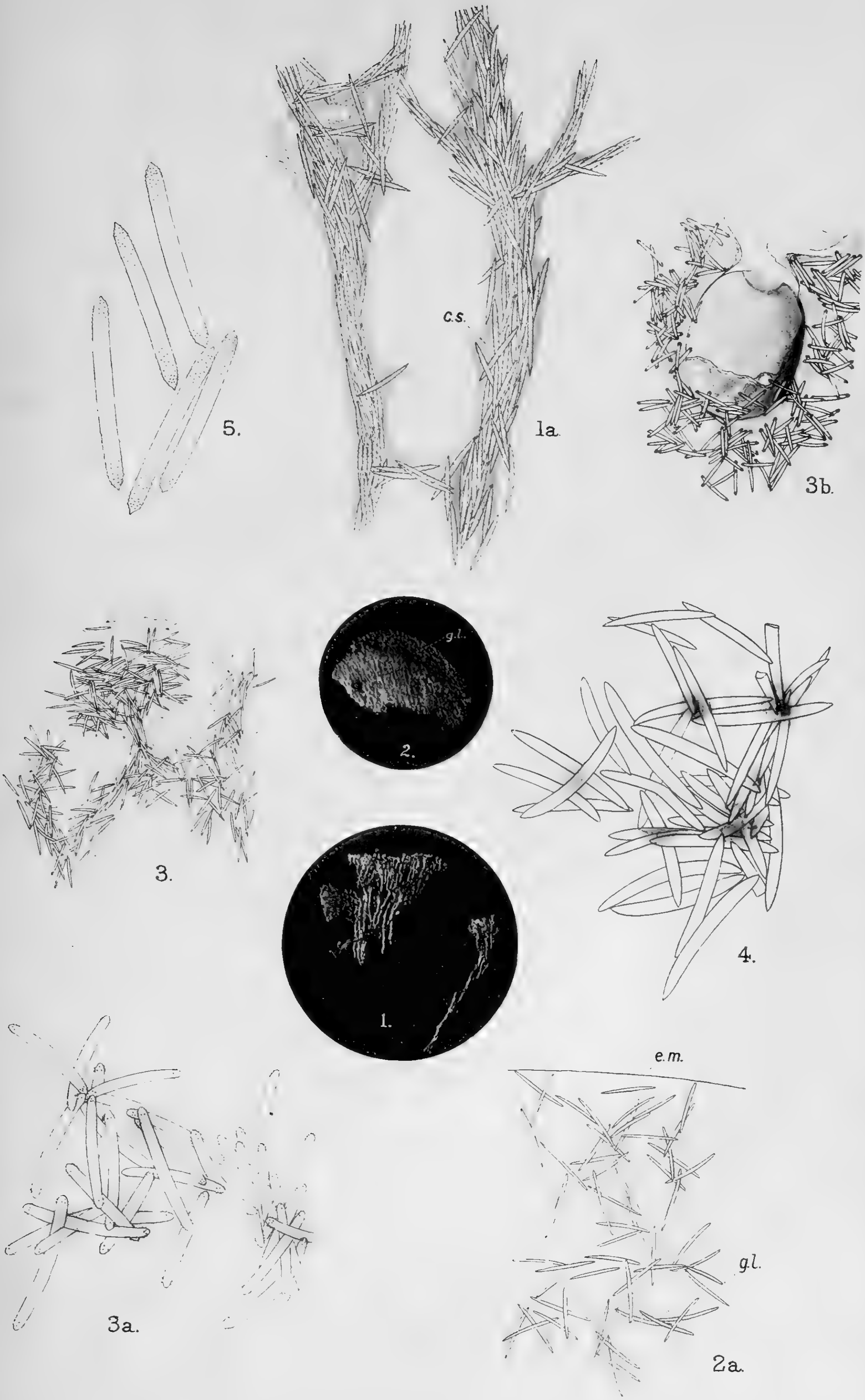
Fig. 2. A hand section (vertical) from the external region of the sponge, showing its compact nature and the absence of a subdermal cavity; photographed by reflected light and magnified by about 6 diameters. *Fig.* 2*a*. Thinner section of the skeleton in the same region; × 50. *e.m.* = dermal membrane; *g.l.* = growth-line.

FIG. 3. *Baikalospongia bacillifera* (Dybowski).

Fig. 3. Fragment of the skeleton (unstained); × 20. *Fig.* 3*a*. Portion of the same stained with pyrogallic acid; × 100. *Fig.* 3*b*. Gemmule, × 20.

FIG. 4. Fragment of the skeleton of *Corvospongilla ultima* var. *spinosa* similarly treated (for comparison); × 100.

FIG. 5. Spicules of *Nudospongilla coggini* (for comparison with those of *B. bacillifera*); × 100.



A.C. Chowdhary, del.

Bemrose. Collo. Derby

SPONGES OF LAKE BAIKAL.

VII. FAUNA SYMBIOTICA INDICA.

No. 5.—Some Sponges commonly associated with Oysters and Mussels in Madras Harbour and the Chilka Lake.

By N. Annandale, *D.Sc., F.A.S.B., Superintendent, Indian Museum.*

(Plates X, XI.)

The sponges described in this paper all occur commonly on living shells of *Ostrea* and *Mytilus* either in the harbour of Madras or in lagoons of brackish water on the east coast of India. There is no evidence that any one of them is invariably associated with any one genus or species of mollusc, or with molluscs at all. Indeed, we know that one of them (*Suberites aquaedulcioris*) is not always associated with molluscs. But the fact that an association of the kind is common, although it is not exclusive, is of considerable interest, and, as I stated in the introduction to this series of papers (*Rec. Ind. Mus.* V, p. 123), I propose to deal in it with associations of varying degrees of intimacy.

From the systematic and geographical point of view the interest of the sponges lies in the fact that they are from a region hitherto practically unexplored so far as the Porifera are concerned. The multitudinous species that are found in the Gulf of Manaar have been described in a series of papers by Bowerbank,[1] by Carter[2] and by Dendy[3] and the marine sponges of Ceylon are now at least as well known as those of any other tropical country; but those that form a part of the much less luxuriant fauna of the littoral zone north of Palk Straits have hitherto almost escaped the notice of zoologists.

The biological differences between the portions of the east coast of India that lie respectively north and south of Palk Straits are much greater than is perhaps as a rule realized. In the one we have a sea full of coral reefs; in the other an almost uninterrupted stretch of barren sand and mud. It is only at a few places, notably in the harbour of Madras, that any solid support for fixed sedentary organisms exists, and there it is mostly artificial.

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[1] *Proc. Zool. Soc. London*, 1873, p. 25.

[2] *Ann. Mag. Nat. Hist.* (5) V, p. 437; VI, pp. 35 and 129 (1880) and VII, p. 361 (1881).

[3] *Ann. Mag. Nat. Hist.* (5) XX, p. 153 (1887) and (6) III, p. 73 (1889); *Herdman's Pearl Oyster Fisheries* III, p. 57 (1905).

South of the estuaries of the Mahanaddi, north of which mud prevails, the coast is sandy and the sand extends outwards from the shore for some miles. Off the northern part of this coast, in from 15 to 30 fathoms of water, there are areas in which the sea-bottom is coated with a recent conglomerate of sand and partially dissolved shells,[1] while in the southern part solid masses are produced at about the same depth by the growth of gregarious gastropods and stony sponges.[2] These harder areas are, however, restricted to water which, although shallow as compared with the abysses of the central region of the Bay of Bengal, is deep as compared with the strictly marginal zone, from which the species to be considered here were obtained.

The sponges described below are all encrusting species, dependent, therefore, for their existence on comparatively hard areas on which to spread. These areas they find on the surface of the shells of oysters and mussels.

The general absence of algae of any considerable size from the Indian coast north of Palk Straits is one of its most striking biological features; it is one that naturally restricts the space suitable for the growth of small encrusting sponges, which in other seas are frequently found on the stems and fronds of seaweeds.

A.—Sponges from Madras Harbour.

The stonework of Madras harbour affords a support for large numbers of mussels (*Mytilus latus*, Lam.) which in their turn are usually coated with various encrusting organisms. During a recent visit to Madras I was indebted to the assistance of Prof. K. Ramunni Menon of the Presidency College of that city in obtaining a large supply of these mussels in a living condition. The majority of them bore on their surface, mingled with compound ascidians, branching Cheilostomatous polyzoa, barnacles (*Balanus amphitrite*), etc., specimens of one or more of the sponges here described.

The largest shell measures 11 cm. in length and 5·6 cm. in breadth.

The list of the encrusting sponges found on the mussel-shells is as follows :—

Family DESMACIODONIDAE.

Mycale aegagropila (Johnston) var. *militaris*, nov.
Mycale mytilorum, sp. nov.
Mycale madraspatana, sp. nov.
Lissodendoryx balanophilus, sp. nov.

In addition to these encrusting forms a small and poorly developed specimen of the widely distributed and well characterized

[1] Jenkins, *Rec. Ind. Mus.* VII, p. 51 (1912).
[2] Annandale, *ibid.*, VI, p. 47 (1911).

tubular Haplosclerid *Reniera implexa*, Schmidt, was found on a shell of the same mussel. This sponge will probably be discovered in all warm and tropical seas; it has been recorded from the Adriatic, the West Indies, Ceylon and the Red Sea, and I have examined specimens from a rock-pool on the island of Bombay. Its bathymetrical range is also great:—from between tide-marks to at least 450 fathoms.

No burrowing sponge was found in oysters or mussels in the Madras harbour, but I have a specimen of *Cliona celata*, Hancock, in a chank shell (*Turbinella pyrum*, L) from the immediate neighbourhood of the town; it was presented to me by Professor Ramunni Menon.

Genus **Mycale**, Gray.

Mycale, Gray, *Proc. Zool. Soc.*, 1867, p. 533; Thiele, *Abh. Senckenb. Nat. Gesellsch.* XXV, p. 949 (1903); Lundbeck, *Dan. 'Ingolf'-Exp.* VI, pt. 2, pp. 7, 23 (1905).
Esperia, Nardo, *Isis*, 1833, p. 522.
Esperella, Vosmaer, *Bronn's Thierreichs, Porifera*, p. 353 (1885); Ridley, *Rep. Zool. 'Challenger'* XXII (LIX) (Monaxonida), p. 62 (1887); Dendy, *Herdman's Ceylon Pearl Fish.* III, p. 159 (1905); Row, *Journ. Linn. Soc.* (Zool.) XXXI, p. 33 (1911).

Mycale aegagropila (Johnston).

Esperella aegagropila, Vosmaer and Pekelharing, *Verh. K. Akad. Wet. Amsterdam* VI (2), p. 17 (1897).

var. **militaris**, nov.

(Plate x, fig. 2.)

In the structure of their skeleton and soft parts and in the general form of their spicules my specimens from mussel-shells in Madras harbour agree well with Vosmaer and Pekelhering's description.

The sponge in these specimens forms a film not more than 2 mm. thick. In life it is of a bright scarlet colour owing to the presence of symbiotic algae in the parenchyma. In spirit these minute organisms turn of a dull green colour. The lengths of the spicules of my specimens are as follows; their forms are shown in figs. 2, 2*a*, pl. x:—

Megascleres, 0·257 mm. (average): 0·24 to 0·27 (extremes).
Anisoschelae, 0·044 mm. (very uniform).
Sigmata, about 0·095 mm.
Toxa, 0·148 to 0·2 mm.

The microscleres of all forms are somewhat scarce.

Type No. Z.E.V. $\frac{6152}{7}$ Ind. Mus.

Locality.—Madras harbour in 4 to 6 feet of water; on living shells of *Mytilus latus*, Lam.

The spicules do not agree precisely with those of any of the forms included in the synonomy of *M. aegagropila* by Vosmaer and Pekelharing, who have discussed the species in an exhaustive manner. I, therefore, describe my specimens as the type of a new "variety." Whether it is a true variety or a geographical race (subspecies) cannot of course be settled until more is known of the smaller and more delicate sponges of Indian seas.

The authors mentioned in the preceding paragraph found *M. aegagropila* only on young oysters (*op. cit.*, p. 29). They describe the method of growth as follows: "They [the sponges] formed their crusts, generally not more than 0·5 or 1 mm. thick. They often covered the shells entirely, growing over the free borders. If new layers of shell are formed, the sponge immediately covers them. Hence in sections there can be found shell-layers in the middle of the sponge body." Nothing of the kind occurred in the case of sponges growing on mussel-shells at Madras, but these shells are of course much smoother than oyster-shells and the layers of calcareous matter of which they consist are much more closely compacted. No sponge that I saw grew over the edge of a shell, although in some cases the exposed surface of one valve was almost completely covered.

Mycale mytilorum, sp. nov.

(Plates x, fig. 1 and xi, figs. 2, 3.)

The *sponge* forms a delicate film not more than 2 mm. thick and of a bright brick-red colour; it sometimes covers the whole of a large mussel-shell. In spirit the colour, which is apparently not due to the presence of symbiotic algae, disappears rapidly. The external surface is smooth except for the presence of angular and apparently (not actually) spiny ridges on the central parts, often interrupted and never as much as 1 mm. high. These are largely artifects, not being visible in the living sponge; they occupy the spaces between the superficial exhalent canals.

Both *dermal pores* and *oscula* are minute and inconspicuous. The latter are situated in the central, thicker parts of the sponge; their position is indicated by the course of the superficial canals that converge towards them. The dermal pores, when not entirely obliterated by contraction, are oval in outline and of variable size; they are scattered on the peripheral parts of the sponge. Their position can be dicovered readily by the aid of a hand-lens, because they open, either directly or by short passages partly closed by diaphragms, into larger circular lacunae belonging to the inhalent system. These extend downwards nearly to the base of the sponge and the finer inhalent canals lead from them to the ciliated chambers. The finer exhalent canals open into broader ones which run obliquely upwards through the sponge and, long before reaching the oscula, form branching grooves on the surface of the parenchyma easily seen through the colourless dermal membrane that forms their roof.

The *skeleton* is composed of single fibres which ramify feebly or not at all. Its exact structure differs considerably in different parts of the sponge. Towards the periphery (pl. xi, fig. 3) the spicule-fibres are short, slender and simple; their course is almost vertical; they are somewhat sparsely scattered and they never branch; their upper extremities form comparatively small brushes that support the dermal membrane, hardly penetrating it. The sponge contains numerous tubes made by polychaete worms and in their intermediate vicinity the fibres, which to some extent radiate out from them take on a somewhat different character, becoming longer, branching dichotomously or even trichotomously at the upper end and adopting a more nearly horizontal course. It is, however, in the central parts of the sponge that the fibres are best developed, especially at the sides of the superficial exhalent channels. Here they assume a contorted but mainly horizontal course, are greatly elongated and densely crowded together. Their upper extremities, indicated by the fact that the pointed ends of the skeleton-spicules are directed towards them, are arranged in parallel lines of fan-like brushes along the sides of these channels, one row on each side, and thus forms a support for the floor of the channels (pl. xi, fig. 2).

Towards the periphery of the sponge there is no dermal skeleton except a fairly dense layer of sigmata, but in the central parts numerous macroscleres lie scattered, without fasciculation, in the dermal membrane.

Spicules: Megascleres.—The megascleres are slender, smooth, sharply pointed, straight or nearly straight tylostyles with well-defined, narrowly oval heads. The axial tubule is well developed in them, extending into the head. The average length of the whole spicule is about 0·216 mm. and the average diameter 0·0047 mm., the corresponding measurements of the heads being 0·008 mm., and 0·0047 mm.; but considerable variation in size and proportions occurs, the total length varying from 0·18 to 0·26 mm. and the diameter of the shaft from 0·004 to 0·0054 mm.

Microscleres.—There are no toxa. The sigmata, which are most numerous in the dermal membrane but also occur singly in the parenchyma, are not grouped in any definite manner. They are smooth and slender and as a rule somewhat twisted in their long axis; the average sector of their arc is about 0·04 and the average thickness of their shaft 0·0027 mm. The anisochelae are found scattered sparingly in the dermal membrane and parenchyma; they are very minute. Their form, in which they differ from those of *Mycale aegagropila* (Johnston), is best shown by figures (figs. 1, 1*a*, pl. x); their average length is about 0·0189 mm.; they are the most uniform in size of the spicules and by far the smallest in numbers as well as size.

Habitat.—Madras harbour in from 4 to 6 feet of water; on shells of living *Mytilus latus*, Lam.

Type No. Z.E.V. $\frac{6151}{7}$ Ind. Mus.

This sponge is closely allied to *Mycale aegagropila.* The size and proportions of the spicules are, however, different; the skeleton, at any rate in the central parts of the sponge, is much denser, and the complete absence of toxa, substantiated by an examination of many fragments mounted whole as well as by preparations of cleaned spicules, is apparently a distinctive character.

Gemmules closely resembling those of *M. aegagropila* as figured by Vosmaer and Pekelharing (*op. cit.*, p. 30, pl. 1, fig. 3) occur in specimens collected in October.

Mycale madraspatana, sp. nov.

(Plates x, fig. 3 and xi, fig. 4.)

In the structure of its soft parts, in dimensions and in the form of its spicules this species closely resembles *M. aegagropila*, but the chelae are arranged in rosettes and the skeleton is much more highly organized: the colour in life is that of *M. mytilorum.*

Skeleton.—Two distinct kinds of spicule-fibres can be recognized. On the external surface, partly in the dermal membrane and partly in the parenchyma immediately below it, run comparatively stout, sinuous, non-anastomosing fibres, which cross one another occasionally but branch sparingly and do not fuse together. They are a little splayed out and occasionally fork at both extremities, but form regular brushes at neither; in optical section as many as 12 spicules abreast can sometimes be detected. These broad fibres are best developed round the oscula. In the lower part of the parenchyma thinner fibres, 2 (or even 1) to 7 spicules abreast in optical section form a regular horizontal network, branching freely and anastomosing. Transitionary forms between the two kinds of fibres occur very sparingly. In addition to the fibres there are many macroscleres scattered horizontally in the parenchyma. These are not shown in figure 4, pl. xi.

Spicules: Macroscleres.—The majority of the macroscleres closely resemble those of *M. aegagropila* except that the shaft tapers more distinctly towards the blunt extremity; the heads, if they can be distinguished, are narrowly oval. Together with macroscleres of this type very much more slender styli of approximately the same length occur sparingly. The average length of the typical macroscleres is 0·279 mm., the extremes being 0·265 and 0·296 mm.

Microscleres.—Anisochelae, sigmata and toxa are found. The anisochelae are arranged in rosettes, but the size and regularity of these groups varies, together with the number of anisochelae present in the sponge, in different specimens from the same locality. The form of the spicule closely resembles that of the spicule of the same type in *M. aegagropila*, but there are certain differences (best shown in figs. 2*a* and 3*a* on pl. x) in the structure of the extremities and the size is a little greater, the average length being 0·0473 mm. (extremes 0·043 and 0·0516 mm.). Sigmata are very scarce; they are a little more contorted as a rule than those of *M. aegagropila* from the same locality. The toxa, which are fairly abundant, are extraordinarily variable in size: 0·140 to 0·352 mm. in length. Most of them fall into one of two series characterized by size. In the smaller toxa the central curve is as a rule more compressed than in the larger ones, which are actually longer than the macroscleres.

Type No. Z.E.V. $\frac{6118}{7}$ Ind. Mus.

Locality.—Madras harbour in 4 to 6 feet of water; on living shells of *Mytilus latus*, Lam.

The degree of development reached by the skeleton in this species is probably somewhat variable, but it is only in well-preserved specimens on which no artificial pressure has been exerted that the double system of spicule-fibres can be adequately observed.

Specimens of this species collected in October are full of gemmules in early stages of development. Indeed, parts of the sponge appear to consist of little else but morula-like masses of cells evidently of this nature.

Genus **Lissodendoryx** (Topsent) Lundbeck.

Topsent, *Mem. Soc. Zool. France* IV, p. 457 (1897); *Rés. Camp. Sci. Monaco*, fasc. II, p. 173 (1907); Lundbeck, *Dan. 'Ingolf'-Exp.* VI (2), p. 153 (1905).

Lissodendoryx balanophilus, sp. nov.

(Plates x, fig. 4 and xi, fig. 5.)

The *sponge* forms a crust not more than 4 mm. thick on the shells of Lamellibranchs, often occurring together with *Balanus amphitrite*, Darwin. It fills up the interstices between individual barnacles as well as growing over their shells in a thin film. The external surface is irregular, but not spiny and without definite projections. The colour is pale yellowish green and fades little in spirit. The structure is somewhat cavernous owing to the comparatively great calibre of the main exhalent channels, which run obliquely upwards through the sponge and do not form branching grooves on the surface of the parenchyma. The oscula are rather larger than those of the species of *Mycale* described above, but the pores are minute and difficult to detect. The whole sponge is very fragile, but rather less so than the others found with it.

The *skeleton* contains little binding substance. The dermal macroscleres form short, somewhat plumose fibres in which as many as 12 spicules abreast can sometimes be seen in optical section. These fibres branch dichotomously or irregularly at their extremities, or at any rate at the extremity nearest the surface. They are usually somewhat contorted, but they do not anastomose; their course is mainly horizontal but as a rule dips down into the sponge more or less deeply; they are connected together to form a somewhat loose reticulation by single tornote spicules. The styli and tylostyl form in the parenchyma a fairly regular reticulation for the most part composed of single spicules and comparable with the typical skeleton of *Reniera*; but traces of fasciculation can be detected at some points.

Spicules: Macroscleres.—The majority of the dermal macroscleres are tornota with well-defined smooth oval extremities of comparatively large size. Their shafts are as a rule smooth, slender and straight. Both amphioxi and amphistrongyli occur, however, among them, always sparingly. These spicules, which must be regarded as abnormalities, invariably have their shafts irregular in outline and as a rule are inflated at several or many points. The skeleton-spicules are as a rule a little shorter and stouter than the tornota; their shafts are usually smooth, but occasionally bear a few scattered spines near the blunt end; this end, which is in most cases distinctly globular and well differentiated from the shaft, is rarely or never quite smooth, but as a rule may be called irregular in outline rather than actually spiny. The other extremity is sharply and gradually pointed. These spicules are from 0·124 mm. to 0·16 mm. long. Sometimes much shorter and stouter tylostyles of very irregular form occur in small numbers, and even what may be called normal spicules of the type vary considerably both in proportions and in outline. Typical tornota are on an average about 0·167 mm. in length (0·166 to 0·176 mm.).

Microscleres.—The microscleres include minute and very slender **C**- and **S**-shaped sigmata as well as isanchorae. In the latter the shaft is stout, somewhat compressed laterally and feebly curved; the three teeth at either end are subequal, narrow and sharply pointed; those at the sides project outwards in such a way that it is hardly possible for the spicule to rest on its dorsal surface. (This makes it impossible to obtain an accurate *camera lucida* drawing of the front view).

Type No. Z.E.V. $\frac{9070}{7}$ Ind. Mus.

Locality.—Madras harbour in 4 or 5 feet of water; on living shells of *Mytilus latus*, Lam. (together with *Balanus amphitrite*, Darwin) and also on those of *Ostrea* sp.

This sponge would not fall within the genus *Lissodendoryx* as originally defined by Topsent, for all the parenchymal macroscleres are not smooth, although most of them are nearly so. Lundbeck has, however, pointed out that the critical character lies not in the form of the macroscleres, but in that of the hooded microscleres. These belong to the type known to him and to some other writers as iso-anchorae, whereas the corresponding spicules in *Myxilla* are true iso-chelae. The distinction may be accepted as convenient; but it should be noted that the importance thus attributed to the difference between the two types of microscleres is not accepted by all spongologists.

B.—A Sponge common on Oyster-shells in Brackish Water.

Fam. SUBERITIDAE.

Suberites aquae-dulcioris, sp. nov.

Sponge.—The sponge forms a film not more than 2 mm. thick, in most places quite flat but slightly raised in the neighbourhood of the oscula, which are sparsely scattered on the surface. The oscula are very small and can be closed completely; each is connected with a branching and occasionally anastomosing system of superficial exhalent channels the roof of which is formed by the dermal membrane. Except over these channels, the external surface is minutely hispid. The dermal pores are minute and occur in considerable numbers all over the membrane except where it forms the roof of the exhalent channels. The subdermal cavity is ample, being supported by bunches of spicules. The inhalent canals run vertically downwards below the pores. The colour of the living sponge varies from leaf-green to orange-yellow; in specimens in spirit or dry it is dirty white. The superficial area of the largest specimen seen did not exceed that of a moderate-sized oyster-shell.

Skeleton.—In living or carefully preserved sponges the skeleton consists of numerous plumose spicule-fibres which radiate outwards and obliquely upwards through the sponge, their general course being directed away from the oscula, towards which their blunt ends point. At their external extremity, as they approach the surface of the sponge, each fibre bears a large bunch of vertical spicules with their sharp ends pointing upwards and outwards. It is these bunches of spicules that support the dermal membrane over the dermal cavity; only their tips protrude through it. The floor of the superficial exhalent channels, in which there are no bunches of spicules, is supported by single spicules, which are directed outwards from the oscula and never project vertically upwards. There are numerous loose spicules lying parallel to the base of the sponge, especially in its lower parts. The spicule-fibres are devoid of any binding substance and the regular arrangement just described is apt to break down if specimens are not carefully preserved. In this case the skeleton-fibres often disappear almost completely, but the terminal bunches are more consistent.

Spicules.—The only spicules proper to the sponge are macroscleres, but if, as is often the case, it is growing in close contact with *Cliona vastifica*, Hancock, the zigzag microscleres of that sponge are apt to intrude into it. The macroscleres are of two sorts, amphioxi and tylostyles; the former are, however, extremely scarce and should be regarded as abnormalities. They are slender and always more or less distorted. With few exceptions, therefore, the skeleton is composed of slender tylostyles of very variable size and proportions. One extremity is sharply and gradually pointed, while the other forms a distinct head, which usually bears some resemblance to an acorn, being divided into a rounded terminal portion, as a rule longer than broad, and an enlarged ring-like base. The differentiation is, however, not always distinct and the exact form of the whole head is very variable. The largest macroscleres are about 0·033 mm. in length and their stem nowhere exceeds 0·0056 mm. in thickness. The curvature of the spicules is usually slight and regular, if they are not absolutely straight; but some are a little sinuous and a few are always to be found in which the stem is curved or angularly bent at one point. The head is relatively small, as a rule distinctly longer than broad.

Type No. Z.E.V. $\frac{6039}{7}$ Ind. Mus.

Habitat.—Chilka Lake, Orissa, near the east coast of India, in brackish water on leaves of *Halophila* and shells of *Ostrea*; also on the latter in the backwater at Ennur near Madras. This sponge has been found at two places in the Chilka Lake, namely about a mile off Burkul near the inner shore and at Manikpatna in the outer channel a few miles from the mouth.[1] At the former place several very young specimens were found in July on the leaves of a plant actually floating on the surface but probably detached from the bottom in about 6 feet of water. The specimens from Manikpatna are larger and were found in September on the external surface of the valves of oysters (*Ostrea* sp.) living in about 4 feet of water.

In its form and method of growth this sponge approaches *Prosuberites*, Topsent, but the possession of horizontal spicule-fibres distinguishes it from the species of that genus.

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[1] Further particulars about the distribution, etc., of this sponge will be given in a subsequent paper on the fauna of the Chilka Lake. *Feb.* 24th, 1914.

EXPLANATION OF PLATE X.

FIGS. 1, 1*a*. *Mycale mytilorum*, sp. nov.
1.—Spicules, × 300 1*a*.—Anisochela, × 1800.

FIGS. 2, 2*a*. *Mycale aegagropila* var. *militaris*, var. nov.
2.—Spicules, × 300. 2*a*.—Anisochela, × 750.

FIGS. 3, 3*a*. *Mycale madraspatana*, sp. nov.
3.—Spicules, × 300. 3*a*.—Anisochela, × 1350.

FIGS. 4, 4*a*. *Lissodendoryx balanophilus*, sp. nov.
4.—Spicules, × 300. 4*a*.—Isanchora, × 1350.

In figures 1 and 4 two of the chelae are represented on a larger scale than the rest of the spicules. In figure 4 the drawing of the **S**-shaped sigma has been blotted in reproduction.

A. C. Chowdhary, del. & lith.

SPONGES FROM MADRAS HARBOUR.

EXPLANATION OF PLATE XI.

FIG. I. *Suberites aquae-dulcioris*, sp. nov.

Portion of skeleton supporting subdermal exhalent channels, as seen from above, × 75.

FIGS. 2, 2*a*, 3. *Mycale mytilorum*, sp. nov.

2.—Portion of skeleton supporting a subdermal exhalent channel, as seen from above, × 20. 2*a*.—Terminal part of a single spicule-fibre, × 75.

3.—Scattered spicule-fibres at periphery of sponge, as seen from above, × 20. *w.m.* = worm-tube.

FIGS. 4, 4*a*. *Mycale madraspatana*, sp. nov.

4.—Portion of skeleton surrounding an osculum, as seen from above, × 20. 4*a*.—Terminal part of one of the stouter spicule-fibres, × 75.

FIGS. 5, 5*a*. *Lissodendoryx balanophilus*, sp. nov.

5.—Superficial spicule-fibres, × 75. 5*a*. Part of the same preparation, × 225. The part further enlarged in fig. 4*a* is indicated by a circle in fig. 4.

A.C.Chowdhary, del & lith.

SPONGES FROM MADRAS & ORISSA.

VIII. ON A NEW SPECIES OF BLEPHAROCERID FLY FROM KASHMIR, TOGETHER WITH A DESCRIPTION OF SOME LARVAE FROM THE SAME LOCALITY.

By S. P. AGHARKAR, *M.A.*, *Rashbihari Ghosh Professor of Botany, Calcutta University.*

(Plates xvi-xvii.)

While working in the Indian Museum in January and February, 1914 I was asked by Dr. Annandale to examine and report on the collection of Blepharocerid larvae and adults made by Mr. H. B. Bion of the Geological Survey of India at Nagaberan, in Kashmir. The collection has proved very interesting in more ways than one. The adults have proved to be specimens of a new species (*Philorus bionis*) of the genus *Philorus*, which genus has not hitherto been recorded from India. The larvae include specimens of 3 species, none of which appear to agree with the descriptions and figures of any of the previously described species; they either represent new species or belong to species whose larvae are unknown at present. It has to be noted that this is the first time that any Blepharocerid larvae are being described from India. The collection was made at an altitude of 10,000—10,500 ft., which appears to be the greatest height from which any species of the family have been recorded. All the specimens were obtained in rapid-running streams and were captured by means of a hand-net inserted into places where stones had just been overturned. The adult flies were taken in the same way and at the same time as the larvae.

An interesting point is the occurrence of such a large number of species (four) in the same locality. This, however, is a fact which has been previously noticed by Kellogg with reference to his New California larva, which was found to occur along with the larvae of *Bibiocephala comstocki* and *B. doanei* in most streams (*cf.* Kellogg, *Proc. Cal. Acad. Sci.* Zool., Vol. iii, No. 6, 1903).

I have to thank Dr. Annandale for giving me the opportunity of examining such an interesting collection. I have also to thank him and Mr. Brunetti for valuable suggestions and help during the course of the work. The illustrations were all drawn by Babu D. N. Bagchi of the Indian Museum staff under my supervision, and he has done the work with his usual skill. All the specimens described are in alcohol.

KEY TO THE SPECIES OF THE GENUS *PHILORUS*, KELLOGG.

Second longitudinal vein simple without branches; a cross-vein present between the 4th and 5th longitudinal veins.

A_1 Eyes contiguous, bisected by a simple groove.

1. *P. ancilla*, Osten-Sacken.

A_2 Eyes separated by a broad front; not bisected by a cross-band or groove.

b_1 Submarginal cell with a long pedicel.

2. *P. yosemite*, Osten-Sacken.

b_2 Submarginal cell sessile.

C_1 Second vein curving *downwards*, nearly parallel to the third vein; forking of 5th and 6th veins at nearly $\frac{1}{4}$ its length from the base.

3. *P. bilobata*, Loew.

C_2 Second vein curving *upwards*, in an opposite direction to that of the third vein; forking of the 5th and 6th veins at nearly $\frac{1}{3}$ its length from the base.

4. *P. bionis*, sp. nov.

Philorus bionis, sp. nov.

(Plate xvi, figs. 1-7.)

♂ ♀. *Head* (figs. 4, 5) transverse, narrower in width than the thorax; nearly black in colour; ocelli conspicuous. Proboscis brownish yellow, somewhat shorter than the vertical height of head in length.

Eyes widely separated; not bisected by any non-facetted cross-band; facets all of the same size, pubescent all over, black in colour.

Antennae (figs. 6, 7) 14-jointed; the scapal and 1st flagellar joints brown in colour, the remaining joints black.

Palpi 5-jointed; the 1st rather a short joint, the 2nd longer with a slightly swollen head, the 3rd pear-shaped with the terminal part coloured dark brown, the 4th a trumpet-shaped joint, the last nearly oblong in shape with a small peduncle by which it is inserted on the side of the 4th.

Mandibles absent in both ♂ and ♀.

Thorax strongly arched on the dorsal side, with a distinct transverse suture. Dorsum is black with a trefoil-shaped yellowish-white mark on the posterior region. This is much more conspicuous in the ♀ than in the ♂.

Abdomen: ♂ terga clove-brown in colour, sterna and pleura nearly white; hypopygium conspicuous, clove-brown in colour. ♀ terga light cinnamon-brown in colour, much less chitinised than in the ♂. A black line is seen on each side which is really formed by the tracheal vessel with its branches going to the abdominal stigmata.

Genitalia (figs. 1-2) very conspicuous. ♂ The hypopygium is during life bent upwards very much like the forceps of an earwig; there is a small dorsal plate covering only the basal parts of the genitalia. A much larger ventral plate with its sides turned upwards so as to enclose the genitalia from below and the sides is present. Its posterior edge has a wide shallow notch in the middle. From near the sides of this notch arise two leaf-like claspers which are folded in the middle along their length. They bend towards each other and meet nearly in the middle line. From the sides of the ventral plate, a little behind these claspers arise a pair of stiff three-lobed claspers. During life they are apparently turned towards each other so that one of the lobes of one meets the corresponding lobe of the other enclosing an arched surface between. Arising from the anterior part of the ventral plate are two beak-headed claspers, with their beaks turned towards one another and enclosing a space through which the penis is protruded. The penis is not visible in all specimens, but where it is seen it appears to be a cylindrical structure from which eight fine filamentous structures arise.[1] These appear to be the actual intromittent organs.

♀ The genitalia of the female are neither so conspicuous nor so complicated as those of the ♂. There is a dorsal and a ventral plate similar to that of the ♂ but much smaller. There is a pair of leaf-like claspers situated similarly to the claspers of the male but much smaller. The only other organs are a pair of small leaf-like claspers arising from near the middle of the anterior edge of the ventral plate. These guard the ♀ genital aperture.

Legs long and slender. The legs of the ♂ are proportionately much larger than those of the female. Colour of legs in ♂ brown, in the ♀ yellowish-white. *Front tibiae* without any spurs, the middle ones with a single terminal spur, the hind ones with a small spur in addition to and by the side of the terminal spur. *Ungues* pointed and hook-like. Pulvilli absent, empodia rudimentary.

Wings (fig. 3). The venation can be distinguished from that of other species of *Philorus* by the following characters: (1) the 2nd vein is bent upwards instead of downwards near its termination; (2) the forking of the 5th and 6th veins takes place at about $\frac{1}{3}$ its length from the base.

Halteres well-developed; both stem and club light brown in colour.

Immature stages unknown; it is possible that one of the three species of larvae found occurring with it may belong to it. But nothing can be said on this point until more information is available.

Length ♂ 4 to 5 mm. ♀ 5·5 to 6 mm. Described from 9 ♂ and 5 ♀ specimens, collected by Mr. Bion at Nagaberan, Kashmir.

Types preserved in the Indian Museum.

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[1] Fig. 1, 2 does not show the parts in their natural positions; it was drawn from a balsam preparation in which the parts had been pressed out flat.

LARVAE FROM KASHMIR.

Along with the specimens of adult ♂ and ♀ collected at Nagaberan, Kashmir, were enclosed nearly 275 specimens of larvae of all sizes. I first thought that they were all of one species, presumably *Philorus bionis*, sp. nov., with the adults of which they were found to occur. It was only when I examined the whole collection carefully that I found them to belong to three distinct species and a form which appears to be only a variety of one of them. As none of the larvae agree with any Blepharocerid larvae previously described and figured,[1] it has become impossible to assign them to any species. I have, therefore, followed the only course open under the circumstances, *viz.* to describe the larvae and figure them without giving any names.

LARVA A.

(Plate xvii, figs. 8-10.)

The fully-grown larvae are from 7 to 8 mm. in length and moderately broad. In the collection before me there are younger specimens of various sizes from 3 mm. onwards. The general appearance agrees with that of typical Blepharocerid larva, being broadest at the head region with the successive segments slightly narrower than those in front of them. *The colour* of the dorsal surface varies from light cinnamon-brown to deep clove-brown. The difference in shade does not appear to depend on the size of the larva, but to some other cause, such as exposure to light.[2]

The markings on the head consist of a central rectangular dark area and two triangular ones on its sides, on the most anterior region of the head segment. In the centre of the rectangular patch is a nearly ellipsoidal area separated from the rest by a deep groove which appears as a bright line when viewed by transmitted light. The other markings on the head segment are two transverse bands, a faint one in the middle and a dark one in the posterior part of the segment. On each of the other segments of the body there is a transverse dark band in the middle. The ventral surface of the body is white with the exception of the suckers, which appear to the naked eye as dark circular rings. The lateral processes are light brown in colour.

Antennae: two-jointed, the 2nd joint having 4 or 5 small papillose hairs with globular heads at the end. Proximal half of each joint white, distal half black in colour.

Lateral processes single, with a tuft of long fine hair-like processes at the end of each. *Tracheal gills in groups* of 6.[3] There

[1] With the possible (but very improbable) exception of the larva of *P. yosemite*, described by Prof. Kellogg in *Psyche*, Vol. X, p. 186, I could not get a copy of this paper in any of the libraries in Calcutta.

[2] Mr. Bion informs us that all the larvae were much paler in life than they are in spirit.

[3] I have found the number of gills in a tuft vary from 5 to 7, but 6 is the most common number.

are 5 pairs of gill-tufts, one in front of each lateral process, excepting those of the head-segment. Behind the last sucker there are 4 gills much larger than the others. These probably represent another type of tracheal gills. This is the most common larva, over 260 specimens out of a total of over 275 larvae belonging to it.

Among specimens belonging to this species are some forms (Larva **A′**) which are very much broader in proportion to their length than the typical individuals. I have not been able to find any other characters, in which they differ from the type and am not in a position to say whether they really represent the same species. The outline figure (fig. 11) will give a good idea of the appearance. The larvae appear to be very much like those of the genus *Blepharocera* as figured by Kellogg and others and it is to be hoped that they represent the larvae of *Blepharocera indica*, Brun., which has been described from the Western Himalayas (*Rec. Ind. Mus.* IV, p. 316 (1911) and *Fauna Brit. India*, Nematocera, p. 156).

Types preserved in the Indian Museum.

LARVA B.

(Plate xvii, figs. 12-13.)

Length 6-7 mm. The markings in the dorsum of the head and thoracic segment consist of a single dark patch with an ellipsoidal groove in the middle. In some there is a tendency to have this patch divided into three areas like those of the larva A. Behind there are some darkish markings. The abdominal segments have each a single dark transverse bar. There is a row of 6 spines on each side of the body, one spine being placed a little above the base of anterior lateral process; each of the abdominal segments except the last has 4 spines, a pair in front and a pair behind the transverse dark bar. The head and thoracic segment as well as the last segment have two spines only.

Lateral processes not very conspicuous, double; the anterior member of each pair longer and bearing at lip a long spiny hair; lateral processes pale fuscous in colour; tracheal tufts in groups of 4 each, rather short, 3 of them directed anteriorly and 1 posteriorly; antennae rather short, three-jointed.

Described from 15 specimens from among those collected by Mr. Bion at Nagaberan in Kashmir.

Types preserved in the Indian Museum.

LARVA C.

(Plate xvii, figs. 14-15.)

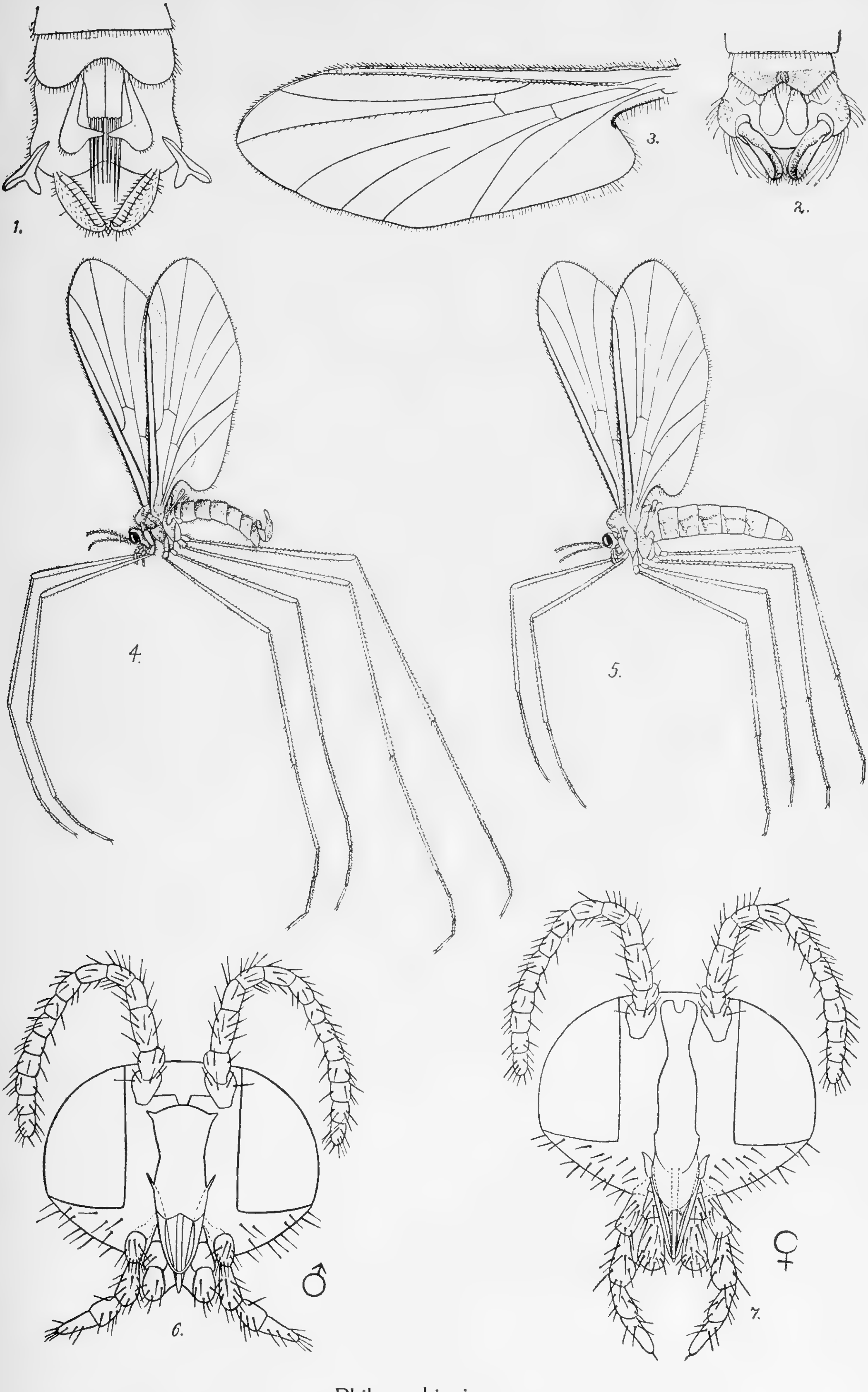
Long and broad; length 8-6 mm. The markings on the head and thoracic segment consist of a central rhomboidal area in two sides of which are two nearly triangular patches; the central part is very pale in colour. Each segment has two spines, one above the other, on each side a little above the base of the lateral processes; besides this there are 2 spines in the mid-dorsal line of the head and thoracic and the last abdominal segment, and 4 on each of the other segments; lateral processes very conspicuous, double, the anterior member of each pair longer, pointed and bearing a number of fine hairs on its side and a single long spiny hair at its tip; the posterior member of each pair blunt and stout and bearing a number of fine hairs on its side; these lateral processes yellow in colour; tracheal tufts in groups of 4, moderately long, 3 directed forwards and 1 backwards. The suckers are proportionately broader than in larvae **A** and **B**; antennae longer than in larvae **A** and **B**, three-jointed, black in colour.

Described from a single specimen from among those collected by Mr. Bion at Nagaberan.

Types preserved in the Indian Museum.

EXPLANATION OF PLATE XVI.

Fig. 1.—*Philorus bionis*, sp. nov.,	♂ genitalia,	×30.		
,, 2.— ,, ,,	♀ ,,	,,		
,, 3.— ,, ,,	wing,	× 8		
,, 4.— ,, ,,	adult ♂,		enlarged.	
,, 5.— ,, ,,	,, ♀,		enlarged.	
,, 6.— ,, ,,	head of ♂,		enlarged.	
,, 7.— ,, ,,	,, ♀,		enlarged.	



D. Bagchi, del

Philorus bionis, sp. nov.

EXPLANATION OF PLATE XVII.

Blepharocerid Larva A.

Fig. 8.—Dorsal view, × 8.
,, 9.—Ventral view, × 8.
,, 10.—Sucker, highly magnified.

Blepharocerid Larva A′.

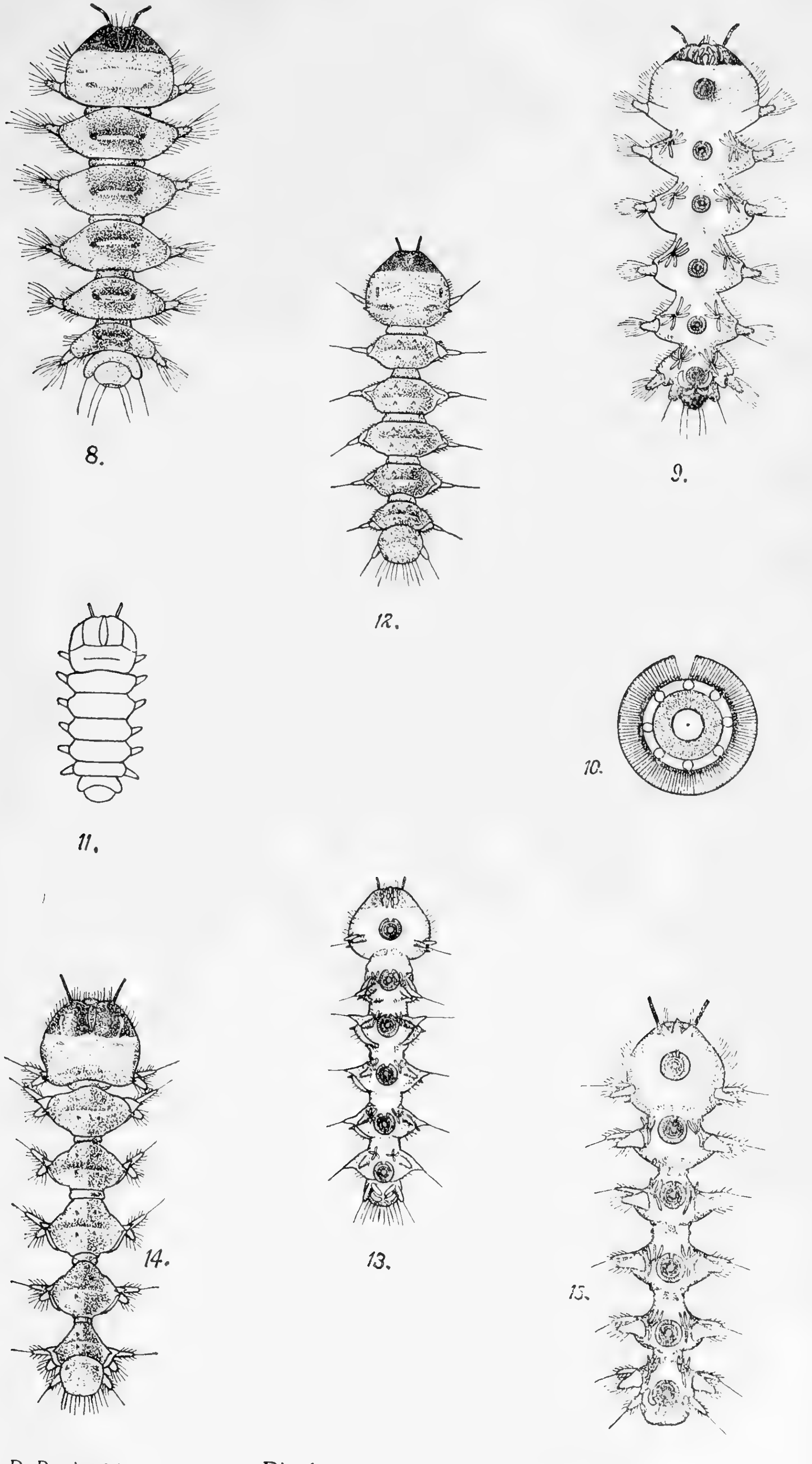
,, 11.—Dorsal view, × 8.

Blepharocerid Larva B.

,, 12.—Dorsal view, × 8.
,, 13.—Ventral view, × 8.

Blepharocerid Larva C.

,, 14.—Dorsal view, × 8.
,, 15.—Ventral view, × 8.



D. Bagchi, del.

Blepharocerid larvae.

IX. STUDIES IN INDIAN HELMINTHOLOGY, No. I.

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(Plates xviii-xxiii).

In the present report the following species are recorded, *viz.*:—

1. *Oxysoma macintoshii*, n. sp.
2. *Oxysoma kachugae*, n. sp.
3. *Heterakis macronis*, n. sp.
4. *Dacnitis callichroi*, n. sp.
5. *Spiroptera denticulata*, R. var. *minor*, n. var.
6. *Atractis kachugae*, n. sp.
7. *Physaloptera*, sp. larva.
8. *Ascaris*, sp., larva (L. 33, 36).
9. ,, ,, ,, (L. 15).
10. Larva undiagnosed (L. 30).
11. ,, ,, (L. 14).
12. *Oncholaimus indicus*, v. Linst.

1. Oxysoma macintoshii, n. sp.

(Pl. xviii, figs. 1–12).

From rectum of *Rana tigrina*, Daud., and *Bufo stomaticus*, Lütken Lucknow.

Plump little worms, the body cavity being more developed and less closely packed with viscera than in many nematodes; greater variations in shape and consequently in the measurements occur—(*vide* tables I and I*a* pp. 184, 185). The head can be invaginated into the anterior part of the body, a fact which also contributes to variations in the measurements.

Females (fig. 1) 1·9–2·78 mm. long. Head (fig.3). The mouth is surrounded by three lips, one dorsal, two subventral. Each lip is low, semicircular and membranous, the edge thickened The lips curve in toward the mouth forming a diaphragm over the shallow oral cavity. The base of this cavity is formed by the anterior end of the oesophagus from which three powerful chitin-covered teeth, one dorsal, two subventral, project into it.

A curved chitinous flagellum can be observed in some specimens, springing apparently from the apex of the dorsal tooth.

The head can be retracted into the neck until the mouth is at the level of the collar.

The cuticle of the head is not ringed, that of the body shows annulation, but this is probably artificial as the rings are completely irregular in breadth.

Lateral membranes extend from the head to the base of the tail, but it has not been found possible to measure them.

A large ventral pore (fig. 1, v. p.) lies in the midline opposite the oesophageal bulb, ·323 mm. from head and opens into a wide sac.

The vulva is transverse, midventral, without prominent lips and lies somewhat nearer the head than the tail (fig. 1, v.).

The anus also has no prominent lips and lies in the midventral line.

Behind the anus, the tail (fig. 2) narrows rapidly and then again more gradually, forming a sharp spine.

The body wall is of the meromyarian type. The lateral lines measure ·039 mm. in breadth shortly behind the oesophageal bulb.

Internal organisation.—Oesophagus. The anterior extremity is slightly thickened, but the greater length of the organ is cylindrical and of uniform calibre. It moves and bends with the retraction or protraction of the head.

The anterior portion of the oesophagus, ·0187 mm. in length, is marked off by a transverse diaphragm of closely set muscle fibres, corresponding to the pharynx described by Dujardin in *Heterakis brevicaudata.*

The lumen of the oesophagus is of the usual triradiate form with a tubular dilatation at the outer end of each radius such as also occurs in *Oxysoma kachugae*, mihi, and which is described by Schneider (9) in *Asc. ferox*, Ehrbg. At its posterior extremity it expands to form the chestnut-shaped bulb, which possesses a triradiate lumen, the inwardly projecting angles of which are armed with chitin.

The bulb is succeeded by a pear-shaped dilatation of the intestine, but behind this the intestine is compressed by the reproductive organs.

Males (fig. 4) are relatively infrequent. Only three specimens were found among a large number of females. They measure ·99–1·07 mm. in length; relatively more stout than the females.

The head probably has the same structure as in the female, but the three membranous lips have not been observed by the present writer. The three teeth arising from the anterior end of the oesophagus are distinct. The head can be withdrawn. The anterior portion of the oesophagus is marked off by a diaphragm. Lateral lines extend from head to anus. Ventral pore as in female.

The cuticle of the body is transversely striated. The striae measuring ·0017 mm. in breadth. The head and tail are unstriated.

The anogenital aperture (figs. 7 and 8) is enclosed in front and at the sides by a fine bursal membrane, which is supported on each side by three papillae shaped like delicate nine pins. A row of three additional papillae lies in front of the bursa on either side.

Thus the characteristic three preanal ⊕ and three perianal papillae of the genus *Oxysoma* are found.

The tail is sharp pointed but relatively stouter than in the female. Postanal papillae (fig. 6) occur, seven pairs on the ventral half of the tail and six pairs on the dorsal half.

The spicules (figs. 8, 9, 11, 12) two in number, are long, measuring each $\frac{1}{5}$ of the body length. They are stout hollow cylindrical structures, ·013 mm. in thickness. In one specimen the wall of the cylinder is so thick that vacuoles can be observed in it. Two muscular bands are attached to the anterior end of each spicule.

The gonads appear to consist of a single tube divided into an upper testicular region, a large seminal vesicle and a short vas deferens.

The species is named in honour of my teacher and friend Professor MacIntosh of St. Andrews.

Comparison of this species with species described by Dujardin (3).

(*A.*) **Heterakis acuminata,** Schrank. The Lucknow specimens differ from *Heterakis acuminata,* Schrank, as described by Dujardin, in that the males possess long spicules ($\frac{\text{Sp. length}}{\text{T.L.}} = \frac{1}{5}$), not short spicules.

(*B.*) **Heterakis brevicaudata,** Duj. They agree with the *Heterakis brevicaudata* of Dujardin in characters of generic value, namely: (i) as regards the head, " tête obtuse, à trois lobes peu distincts, non mucronés, separés a l'intérieur par des pièces cornees ". " Pharynx long de ·05. mm. à trois angles—et séparé de l'oesophage par une sorte de diaphragme armée de trois pointes horizontales " may be the same structure as the anterior portion of the oesophagus described above. A specimen of *Oxysoma* sp.? from the rectum of an English specimen of *Rana temporaria* (kindly given to me by my friend Dr. Dobell) exhibits the structure of the head identical with that of the Lucknow specimens. Dujardin's specimens were obtained in Paris and Rennes; (ii) as regards the tail of the male—" Mâle à queue..munie de deux membranes trèsétroites et de deux rangées de..papilles..; deux spicules trés-longs.

They however differ from this species in many characters. (i) Size—females not longer than 2·78 mm., whereas *H. brevicaudata,* Duj., measures 4·5–6 mm. The relation $\frac{\text{Mx. Br.}}{\text{T.L.}}$ equals $\frac{1}{13}$ as contrasted with $\frac{1}{25}$ in *H. brevicaudata.* (ii) The vulva is in front of the middle, in *H. brevicaudata* it is behind the middle. (iii) $\frac{\text{Postanal length}}{\text{T.L.}}$ in ♀ equals $\frac{1}{6}$: in ♂ equals $\frac{1}{5}$, contrasted with $\frac{1}{20}$ in both sexes in *H. brevicaudata.* (iv) Papillae of tail in ♂ 6 pairs contrasted with 13 in *H. brevicaudata.* (v) Spicules strong, stout, hollow cylinders, not "trés-minces trés-flexibles..terminés en pointe falciforme très-aiguë." (vi) Viviparous not oviparous.

Comparison with **Oxysoma brevicaudatum**, *Zeder as described by Schneider* (19).

Schneider's specimens were "immature" and engaged in moulting. He nevertheless identifies them with *H. brevicaudata*, Dujardin, and on the results of his examination of these dubious specimens criticises adversely and corrects Dujardin's definition.

The Lucknow *Oxysoma* is smaller, since Schneider's measurements are given as ♀ 5·5 mm. ♂ 3 mm. In Schneider's species the $\frac{\text{Hd.—Vulva}}{\text{V.—Tail}}$ is $\frac{1}{\cdot 84}$ and the male does not bear a bursa.

Comparison with **Oxysoma contortum**, *v. Linstow* (7) from the large intestine of *Bufo vulgaris*, Korfu. This species measures

♂ 5·4 long by ·3 mm. in Br.
♀ 5·9 ,, ,, ·35 m. in Br.

the males are therefore more than five times as long as those of *Oxysoma macintoshii*, the females about three times as long; the species does not exhibit the marked difference in size between males and females. The relation of $\frac{\text{Br.}}{\text{Length}}$ in the male is very different, $\frac{1}{18}$, contrasted with $\frac{1}{8}-\frac{1}{10}$ in *O. macintoshii*. The spicules are relatively much longer $\frac{\text{Length of spicule}}{\text{T.L.}}$ in *O. contortum* $=\frac{1}{2\cdot 8}$ in *O. macintoshii* $=\frac{1}{5\cdot 8}$. Caudal papillae of ♂ in *O. contortum* pre-anal 12, postanal 6 pairs, in *O. macintoshii* preanal 6, postanal 13 pairs.

In the female, the vulva is behind the middle of the body in *O. contortum*, in front of it in *O. macintoshii*. $\frac{\text{Postanal L.}}{\text{T.L.}}$ in *O. contortum* $\frac{1}{37}$ in *O. macintoshii* $\frac{1}{5}-\frac{1}{6}$.

The following two species of *Oxysoma* have been described in recent years from batrachians:

Oxysoma tuberculatum, v. Linst., from *Megalophrys montana* (10) differ from *O. macintoshii* in possessing six lips each bearing a thorn-like spine: the immature female measures 4·5 mm.

O. terdentatum, v. Linst. (9) from the gut of *Triton cristatus*. Head with three lips, each lip with two papillae. The oesophagus projects between the lips forming three rounded projections each of which is armed with a tooth (So far agrees with *O. macintoshii*). The oesophagus has no enlargement (Herein differing from *O. macintoshii*) ♀ — 15 mm.—br. ·46 mm.

v. Linstow gives a poor figure of the head of *O. brevicaudatum*, Zed. in (8). The figure does not show any teeth.

2. **Oxysoma kachugae,** sp. nov.

Pl. xxix, figs. 13–16.

From intestine of *Kachuga lineata*, Gray: Lucknow.

A single female specimen was found. For measurements see table II, page 186.

The head (figs. 13, 14) is expanded like the head of a nine-pin. Body diminished in breadth uniformly from the middle toward either extremity. The tail (fig. 16) is moderately sharp pointed and curved on itself at the tip.

The head bears three flattened lips, one dorsal, two sub-ventral, which are entirely composed of cuticle. Each lip is however supplied with two forked papillae of corium. As can be seen in fig. 13 the outer branch of the papilla is flask-shaped and parallel with the length of the body, the inner is thinner and inclined inward. The corium from which these papillae spring surrounds the commencement of the oesophagus.

The cuticle is transversely striated, the striae being very uniform in breadth.

There are narrow lateral membranes.

The vulva is a narrow slit in the ventral line without prominent lips.

The anus has slightly prominent lips.

The oesophagus (fig. 15) is divided into three sections: (1) ·074 mm. long, represents the 'pharynx' of Dujardin. Its anterior extremity is dome-shaped—the dome rising into the space between the lips. Three fine tubular structures—one ventral, two sub-dorsal—are found in this portion, and are doubtless tubular dilatations of the outer ends of the radii of the oesophageal lumen. The body of this part of the oesophagus shows the same muscular structure as the remainder of the organ. Part 1 is separated from part 2, by a transverse diaphragm. (2) 1·416 mm. long, shows three fine cuticular tubes corresponding with those of part 1. The tubes, however, do not appear to be continuous with those of part 1, but are separated from them by the diaphragm. Their anterior extremities are dilated (fig. 15), and it is the cuticle lining these dilatations, which produces the appearance of teeth referred to by Dujardin. With the exception of a short portion at its anterior end, this part of the oesophagus is of a dark brown colour. The colour ceases abruptly at the commencement of the bulb. Special aggregations of this pigment occur on the surface of the organ in the median and lateral lines ·272 mm. from the head. (3) The bulb is pear-shaped ·425 mm. long.

The intestine is dilated at its commencement where it embraces the bulb, but further back is compressed by the gonads. It is coloured in the same manner as the oesophagus.

Impregnation with this colouring matter renders the reproductive organs difficult to decipher. The vagina is apparently non-muscular and runs forward. There appear to be two uteri and ovarian tubes.

The ventral pore is small, 1·275 mm. from the head. Lateral lines were not distinguished. A nerve ring was also not seen.

This specimen agrees with *Oxysoma falcatum*, v. Linst. (14*a*) from the intestine of *Geoemyda* (*Nicoria*) *trijuga*, Schweigg. in size, general shape, structure of head, proportion $\frac{\text{Oes. L.}}{\text{T.L.}}$, and proportion $\frac{\text{Hd.—Vulva}}{\text{V.—Tail}}$. It differs from it in possessing a striated cuticle and in the proportion $\frac{\text{Postanal length}}{\text{T.L.}}$ which is $\frac{1}{8\cdot6}$ instead of $\frac{1}{14}$ as in *O. falcatum*.

3. **Heterakis macronis**, n. sp.

(Pl. xix, figs. 17–24. Pl. xx, figs. 25–34.)

Seven specimens, four males and three females, were found in the intestine of *Macrones aor*, Ham. Buch., obtained from the market, Lucknow. They are delicate hair-like animals. Their absolute and relative measurements are given in table III, page 186. The greatest diameter of the body is situated at the posterior end of the oesophagus, and the breadth of the body diminishes rapidly toward the head, gradually toward the tail. In the majority of fixed specimens, the anterior end of the body is curved toward the dorsum. The tail of the male curves toward the ventral surface.

The head (figs. 17, 18 and 19) is rounded and very slightly greater in diameter than that part of the body which immediately succeeds it. There are no lips (figs. 18 and 19). The mouth is formed by a shallow funnel-shaped depression in the anterior end of the oesophagus, and is surrounded by a ring of slightly thickened cuticle. This ring is somewhat thicker in the ventral than in the dorsal segment; the anterior end of the oesophagus is also slightly more prominent in the ventral than in the dorsal segment, consequently the transverse plane of the mouth is tilted very slightly toward the dorsum. Viewed in the sagittal plane (fig. 17), the same cuticular ring is visible, and it can be seen that it is carried outward in the two midlateral lines to form ribs, which support the commencement of the lateral membranes. Cephalic papillae, if present, are very small and do not raise the cuticle.

The lateral membranes (figs. 17 and 24–34) extend from the head to a level shortly in front of the anus. At the head they are supported by sickle-shaped thickenings of their outer and anterior margins. They increase rapidly in breadth to a maximum of ·048 mm. at the level of the end of the oesophagus. At this level the breadth of each membrane is equal approximately to half the diameter of the body. At a distance of ·56 mm. from the head a thread-like process of protoplasm passes outward from the lateral line in the substance of the lateral membrane to the outer margin of the latter structure (fig. 24). This is doubtless a sense organ.

In cross section the lateral membrane has the form of an equilateral triangle.

The cuticle is entirely plain and unringed.

The lateral lines measure ·0238 mm. in breadth in the oesophageal region. Lateral canals are not visible.

Female.—The tail of the female (fig. 20) is sharply conical, the anus is situated ·25 mm. from the tip. The body cavity of the tail is occupied by a glandular mass. The vulva is situated at the junction of the middle and posterior thirds of the body. It is a transverse slit extending through one-third of the circumference of the body. The internal reproductive organs of the female will be described in a later paper.

Male.—The tail of the male when viewed in profile is seen to be arched on the dorsum and flattened on the ventral surface by the formation of the bursa (figs. 21 and 22, 33 and 34). It is terminated by a sharp narrow caudal appendage ·073 mm. in length. The region of the tail which carries the bursa measures ·44 mm. in length, both the transverse and sagittal diameters are enlarged compared with that portion of the body which immediately precedes it. The bursa is formed by two flatly semicylindrical cushions applied lengthwise to the body between the mid-ventral and lateral lines (figs. 33, 34). The anterior boundary is marked by the sucker (fig. 22), the posterior by the base of the caudal appendage (fig. 21).

Five rows of papillae occur on the surface of the bursa—two sublateral and two subventral on the cushions, and one median ventral in the space between the cushions. The sublateral series consists of three papillae with finger-like pulpae: (i) (numbered from behind forward) situated dorsal to the posterior end of number 1 subventral papilla; (ii) dorsal to the anterior end of number 2 subventral; (iii) dorsal to the interval between numbers 2 and 3 subventral.

The subventral series consists of eight papillae—numbered again from behind forward they are situated and shaped as follows: (1) at the posterior end of the bursa, large and capsule-like showing a tendency to division into two compartments; (2) immediately in front of 1, capsule-like but somewhat smaller; (3) shortly behind the anus; (4) shortly in front of the anus; (5) opposite the junction of the vas deferens and intestine with the cloaca; (6) midway between the anus and the sucker; (7) opposite the sucker; (8) ·14 mm. in front of the sucker.

The median series consists of two papillae which are slightly raised above the surface—1m. shortly in front of the anogenital aperture; 2m.—shortly in front of the termination of the vas deferens.

The space between the two cushions is flat and contains the anogenital aperture and sucker. The former is surrounded by a ring-like thickening of cuticle. The latter is slightly raised above the surface and resembles a flattened volcano. It does not possess a cuticular cup. It is situated ·45 mm. from the tip of the tail.

The spicules (fig. 23) are two in number and are so delicate that they are invisible when not extended. Each spicule measures ·0765 mm. in length; is hollow at its base (figs. 33 and 34), where it measures ·0068 mm. in breadth. Toward the point it becomes flattened and bears five longitudinal ribs on its outer and posterior surface. It has a reversed S-shaped curve, curving outward and backward at the tip. An accessory piece has not been observed.

The testis is a single tube which is sharply bent upon itself. The fundus (fig. 31) lies 1 mm. in front of the tip of the tail. From the fundus the testicular tube runs forward to the mid-point of the body where it comes in contact with the body of the ventral gland. It here bends abruptly and runs backward (fig. 26). After the bend the sperm mother cells are arranged in a definite cylinder, the nuclei around the periphery. The testis is succeeded by a dilated thin-walled seminal vesicle (fig. 31), and this in turn by a thick-walled ductus ejaculatorius (figs. 32–35). The junction of the rectum and ductus is surrounded by unicellular glands the cells belonging to the lateral and midventral lines (fig. 34). The glands have well-developed tubular ducts.

Ventral gland. At the middle of the body a large unicellular gland occupies the ventral half of the body cavity (fig. 25). The protoplasm of this cell stains only with difficulty, is granular and contains two canaliculi in its substance. Shortly behind the middle of the body this cell divides into two finger-like processes (fig. 26), which as they run backward come into more and more close relationship with the two lateral lines (fig. 27), ultimately running in the substance of the lateral lines (fig. 28). The processes can be traced to the three-quarter point of the body length. The canaliculi are visible throughout the entire length of the processes and acquire thickened walls as they run backward. Behind the level at which the processes can be recognized, fine ducts are to be seen in the lateral lines which doubtless open into the canaliculi. These ducts can be recognized as far back as the level of the anus.[1]

Alimentary canal. The oesophagus (fig. 17) is simple and club-shaped. Its walls are darkly pigmented behind the nerve ring. There is no short anterior segment divided off by a transverse diaphragm (pharynx of Dujardin) as in *Heterakis vesicularis*. There is no oesophageal bulb.

This species is placed temporarily in the 'genus' *Heterakis* pending a thorough revision and division of the group. It does not belong to the genus as defined by Dujardin, since (1) it is devoid of lips and of a 'pharynx,' (2) it has no oesophageal bulb, (3) the spicules are equal, (4) the caudal papillae of the male are

[1] The form of this gland is of interest in connection with the evolution of the excretory organs of Nematodes. See Jägerskiöld, Zool. Jahrbb. Anat., Bd. vii, p. 449, and the present writer, Q. J. M. S., vol. L, p. 141.

arranged in three series. On the other hand it resembles Dujardin's *Heterakis* in the following points; (1) the two uterine branches are opposed; (2) lateral membranes are present, (3) the tail of the male bears a sucker and papillae. It cannot be included in Dujardin's genus *Dacnitis* on account of the absence of the characteristic anterior enlargement of the oesophagus.

Schneider's '*Heterakis*' includes many genera. *H. macronis* should be included in the same group as *H. distans*, R., a parasite of *Simia sabaea*, which it resembles in the absence of lips and of a chitinous ring in the sucker. This group is identical with *Heterakis, Acheilostomi* of Railliet (18, p. 409) characterized by 'bouche sans lèvres, deux spicules égaux assez courts, ventouse sans anneau chitineux.' Railliet identifies *Heterakis, Acheilostomi* with *Stelmius* of Dujardin and *Subulura* of Molin. The species at present under consideration differs from *Stelmius* in the fact that the vulva lies in the middle of the body length and not shortly in front of the anus.

4. **Dacnitis callichroi**, n. sp.

(Pl. xxi, figs. 35–38.)

Two females were found in the intestine of *Callichrous macrophthalmus*, Blyth, from Lucknow. Owing to contraction in the preservative (Looss' fluid) the body wall has been thrown into wrinkles to a considerable extent, which diminishes the value of the measurements.

They are moderately plump worms; for measurements see table IV, page 187. The region corresponding to the anterior two-thirds of the oesophagus is narrower than the remainder of the body (fig. 35). The head (figs. 36 and 37) is rounded. The mouth is of the usual *Dacnitis* type, of elongated lozenge-shape, the long axis lying in the sagittal plane, with its aperture directed forward and to the dorsum. It is surrounded by the usual membranous collar springing from a cuticular thickening resembling a wire frame. Each side of the collar bears 32–36 longitudinal striae. There are four cephalic papillae—two subdorsal, two subventral. The head does not curve toward the dorsum.

No lateral membranes.

The cuticle is not striated in the anterior oesophageal region, but is transversely striated from the posterior oesophageal region backward. The striae are caused by fibrillae lying in the deeper layer of the cuticle and encircling the body. Intervals between the striae ·002 mm. in the anterior half, ·0012 mm. in the posterior half of the body.

The vulva is narrow and oval, not prominent, in the mid-ventral line, $\frac{H-V}{V-T}=\frac{1 \cdot 4}{1}$.

The tail (fig. 38) is conical and pointed, and bears a prominent papilla on either side, slightly behind the mid point between the anus and tip of the tail.

The anus (A—T=·2 mm.) is broad transversely and has a prominent anterior lip.

The oesophagus (fig. 35) has the form usual in the genus. Circumoesophageal nerve ring not seen. A large unicellular gland lies on one side of the oesophagus.

Female gonads. The vagina runs forward from the vulva for a distance of ·55 mm. and is furnished with thick walls. The uteri (two, anterior and posterior) are distended with eggs which possess thin shells. The usual coiled ovarian tubes are visible in front of and behind the uteri.

Discussion of the systematic position. Comparison with :—

1. **D. foveolata,** R. (*vide* Dujardin (3) p. 270. Schneider (19) p. 74) = *D. esuriens*, Duj.

D. callichroi is a much more stout animal $\frac{\text{Br.}}{\text{T.L.}} = \frac{1}{17}$ contrasted with $\frac{1}{43}$ in *D. foveolata*.

In figures 39 and 40, representations are given of the head and oesophageal region of *D. foveolata*, R., from *Pleuronectes platessa* (collected at Plymouth) for comparison with figs. 36 and 35, respectively. Some measurements from *D. foveolata* are also included in table IV (see page 187). The difference in the relation $\frac{\text{Oes. Br.}}{\text{Oes. L.}}$ is very marked.

2. **D. abbreviata** R. (Dujardin, p. 269), in *Perca cirrosa*. The description of this species is insufficient for recognition.

3. **D. globosa,** Duj. (Dujardin, p. 269) from *Salmo fario*—is a larger animal than *D. callichroi* ♀ = 16 mm., is thinner $\frac{\text{Mx. Br.}}{\text{T.L.}} = \frac{1}{55}$ $\frac{\text{Post an. L.}}{\text{T.L.}} = \frac{1}{50}$ ($\frac{1}{39}$ in *D. callichroi*). The head bears a tubercle on its dorsal aspect which is absent in *D. callichroi*.

4. **D. hians,** Duj. in *Muraena conger*. A larger animal than *D. callichroi*, length 20·7 mm. contrasted with 6–7·5 $\frac{\text{Br.}}{\text{T.L.}}$ $\frac{1}{39}$ contrasted with $\frac{1}{17}$.

5. **D. sphaerocephala,** Rud. fr. *Acipenser microcephalus*; a larger animal, ♀ length 15·6 mm.; and thinner $\frac{\text{M. Br.}}{\text{T.L.}} = \frac{1}{26}$ not $\frac{1}{17}$. $\frac{\text{Post anal}}{\text{T.L.}} = \frac{1}{56}$ not $\frac{1}{39}$. Ova smaller — ·052 × ·027 contrasted with ·085 × ·055.

6. **D. squali,** Duj., a larger animal, ♀ length 18·5 mm., and thinner $\frac{1}{37}$ (contrast $\frac{1}{17}$). $\frac{\text{Post Anal L}}{\text{T.L.}} = \frac{1}{56}$ (contrast $\frac{1}{39}$). $\frac{\text{Hd. V.}}{\text{V.T.}} = \frac{1}{\cdot 6}$.

7. **D. rotundata,** Mol. (Molin (16) from *Cantharus vulgaris*, Padua, description of ♀ insufficient for recognition.

5. **Spiroptera denticulata,** Rud., var. **minor,** nov.

(Not *Spir. denticulata,* Molin—from *Merops apiaster* and *Falco palumbarius*).

(Pl. xxi, figs. 41-43.)

Two male worms from the stomach of *Wallago attoo*, Bl. Schn., from Lucknow.

For measurements see table V (page 188).

Elongated cylindrical animals expanding in club-like manner at the anterior extremity. The body divided into a series of rings, each of which in the anterior $\frac{1}{3}$ of the body bears a circle of cuticular hooks. Fig. 41 represents the head of one specimen, and shows the cone at the apex of which the mouth opens, and the expanded 1st, 2nd, 3rd and 4th rings.

The hooks are strong outgrowths of cuticle ·0238 mm. in length on the 2nd ring. There are 26 on the 1st ring, 22 on the 2nd, and 20 on the 3rd ring.

The tail (fig. 42) is flattened on its ventral surface, ·277 mm. from the tail end, to form spear-head-shaped adhesive surfaces, the margins of which are sharpened and supported by papillae.

The number of these papillae is as follows:—

Spec. 1.	Right side—Preanal 6.	Postanal 6.	
	Left side ,, 4.	,, 5.	
Spec. 2.	Right side ,, 4.	,, 5.	
	Left side ,, 4.	,, 6.	

The preanal group is separated from the postanal by a distinct gap.

The two spicules are unequal, the right is short and pointed, the left (fig. 43) long ($\frac{1}{4}$ of the body length) and has a curious foot-shaped termination.

It measures ·015 mm. in length. The spicules can be moved independently of one another; in both specimens the right spicule is extended, but the left is withdrawn in the one and extended in the other.

The lateral lines are relatively narrow, $\frac{1}{8}$th of the breadth of the body and show a line in their centre which may represent the longitudinal canal. The animal therefore belongs to the family Secernentes of v. Linstow.

The mouth is devoid of lips, narrow and circular, situated at the end of the oral cone. A tubular pharynx leads from the mouth to the anterior end of the oesophagus; it is slightly curved, and has a very fine cuticular lining. The oesophagus is broadest at its anterior extremity where it expands like the capital of a pillar, and decreases steadily in its first third. The second two-thirds are uniformly cylindrical. Before joining the intestine it forms one complete loop by curling upon itself. There is no bulb.

A nerve ring or ventral pore have not been observed.

The single testis commences ·7 mm. from the anterior extremity and measures ·5 mm. in length. It is followed by the seminal vesicle ·185 mm. long which ends at the base of the left spicule and by a ductus ejaculatorius measuring ·481 mm.

Systematic Position.—The two specimens agree with *Spiroptera denticulata*, R., as described by Schneider (19) except (1) in size—(being only $\frac{1}{5}$th of the length of *S. denticulata*), (2) in the number of spines on each ring—*S. denticulata* bears 56 per ring on the head, (3) the bursal edges are shown as cushion-like in *S. denticulata* by Schneider, whereas they appear sharp in the variety. Schneider does not refer to the remarkable left spiculum.

6. **Atractis kachugae**, n. sp.

(Pl. xxi, figs. 44–47. Pl. xxii, figs. 48-49.)

A large number of small organisms found in the intestine of *Kachuga lineata*, Gray: Lucknow. They were so abundant that the water used for washing the intestine appeared to swarm like a magnified bacterial culture.

The specimens vary in degree of maturity, some possessing merely the rudiments of sexual organs, such as specimen 41/1/1, others, such as 41/1/3, possessing fully developed sexual organs, others, such as 41/4/-, containing larvae in utero.

For measurements see table VI, page 189). It will be observed that they are fine and delicate organisms, the maximum breadth not exceeding 2·4% of T.L. The head is truncated, the maximal breadth lies at the end of the oesophagus at 20% of T.L. (except when the body is distended by larvæ). The tail is long and fine.

The head bears a circle of six lips—two lateral with simple peg-like pulpa and four submedian which possess a pulpa of a curious cross-like figure springing from a thick pedestal. The form of these lips is best appreciated by referring to fig. 44.

Lateral membranes (fig. 45) measuring ·0085 mm. in depth run from the level of the 2nd bulb to behind the anus. A fine cuticular transverse ringing is visible on some specimens only and is probably artificial. The vulva is a transverse slit with slightly prominent lips ·102 mm. in front of the anus.

The anus is not prominent.

Genital papillae in the male. Two pairs of simple papillae preanal and one postanal (fig. 47). The tail of the male is curved to a right angle with the rest of the body at the anus (fig. 49).

Internal organisation.—Alimentary canal. The anterior end of the oesophagus is square and lies at the level of the bases of the lips. The anterior portion of the body of this organ, ·005 mm. in length, is marked off by a ring of vacuoles between the muscle fibres. The remainder is again divided into two portions, each portion terminated by a bulb. The anterior portion shows definite muscular striation, the posterior is granular in appearance. The anterior bulb is fusiform, the posterior pear-shaped, and the latter contains three semi-circular thickenings of the cuticular lining constituting a grinding apparatus.

The intestine presents no features of note.

No oesophageal nerve ring or ventral pore have been observed.

Reproductive organs of male.—Three pairs of simple papillae referrred to above, in the anogenital region, two preanal, one post-anal. Spicules two unequal (fig. 48). Right, short, ·0925 mm. measured in a straight line from head to tip and ·0042 mm. in maximum breadth, nail-shaped with a distinct closed head. Left, long, ·187 mm. in length, ·005 mm. in breadth, simple tubular, narrowing toward the tip, with head slightly expanded, open and receiving insertion of a retractor muscle.

Testis single tubular. Fundus lying dorsal to alimentary canal ·68 mm. from head. Cells at fundus spherical. As it passes backward the tube curves round the left side of the intestine to assume a ventral position, the cellular contents are large square cells with large round distinct nuclei. At a distance of about ·25 mm. from the fundus the cells change abruptly in appearance, the protoplasm becomes filled with small granules. A long simple vas deferens, lying in front of intestine and spicules, leads into the cloaca.

Female reproductive organs (fig. 46).—In immature specimens (measuring ·217 mm. in length) the female gonads are represented by a flattened and elongated group of cells lying ventral to the intestine. The cells are large and angular and contain large spherical nuclei. In the adult (2·63–3·06 mm.) only a single functional ovary is to be found, which is conical in shape, the apex of the cone (the fundus) directed backward. The cellular contents are of the usual type, ova broad and disc-shaped at the junction of ovary and caecum. The caecum contains two large ova and also a considerable number of other smaller cells which appear to arise from proliferation of the wall cells. Attached to the anterior end of the caecum is a cellular appendix possibly representing a second ovary. The opening of the caecum into the uterus lies close to the ovarian opening. The uterus is an elongated spindle-shaped sac. At its anterior extremity its walls are thickened to form a sphincter. In young adults it contains spermatozoa—sometimes in large numbers. A cellular gland surrounds the junction of the uterus and the caecum. In older specimen (3·06 mm.) the uterus contains from 6–8 larvæ, some doubled on themselves, others fully extended but never coiled or enclosed in a shell. The larvae distend the uterus from the sphincter to the vulva.

The following species of *Atractis* have been described up to the present :—

(1) **Atractis dactylura** Duj., from *Testudo graeca*. (Dujardin —(3) p. 654. Diesing (2) ii, p. 151. Schneider (19), p. 124. V. Linst. (11), p. 516.

This species has a two-horned uterus and only one oesophageal bulb—Schneider. The porus excretorius is very prominent and surrounded by a ring of chitinous rods—v. Linst.

(2) **Atractis opeatura,** Leidy. (Leidy (5), p. 410), from the intestine of the iguana *Cyclura baeolopha*, Cope, Australia. The head is tripapillate, ♀ and ♂ both 5 mm. long.

(3) **A. hystrix,** Dies. (Diesing (2) p. 188) from *Podocnemis erythrocephala*, America.

(4) **A. perarmata** v. Linstow (v. Linstow (11), p. 516, from *Cinixys belliana*, German East Africa, ♂ 5·6 mm. ♀ 6·2 mm. Spicules of ♂ almost equal.

(5) **A. cruciata,** v. Linstow (v. Linstow (12), p. 29) from *Metapoceros cornutus*, Daud. Haiti, ♀ 6·2 mm.

(6) **A. fasciolata,** Gendre. (Gendre. (4), p. 30). I have not been able to obtain a copy of this article.

7. **Physaloptera,** sp. Larva.

(Pl. xxii, figs. 50-51.)

Two specimens were found encysted in the wall of the urinary bladder of *Bufo stomaticus*, Lütken (=*B. andersoni*, Blgr.[1]) at Lucknow. The cyst wall consisted of an outer capsule of loose connective tissue and an inner membranous capsule. The embryo was coiled up within the cyst

The measurements of one specimen are given in table VII, p. 190.

The body (fig. 50) tapers slightly and gradually toward the head, abruptly at the conical tail.

The head (fig. 51) is surmounted by two lateral lips, each of which bears a nipple-shaped tooth at its apex. Each lip is shaped roughly as the half of a hemisphere, the two lips together forming a hemisphere. On the inner aspect of each lip a flat triangular area (1) projects slightly inwards, the apex of which forms the tooth referred to. The outer aspect of each lip bears two papillae, one subdorsal, one subventral. The third, lateral, pair of papillæ, which occur in *Physaloptera* have not been distinguished in this larva. Even in the adults of the genus they are however flat in contrast with the raised submedian papillae. The two circular spots marked 2 and 3 are situated on the internal face of the left lip, (2) in the base of a flagellum.

The anus is a narrow slit.

The rudimentary vulva (?) a transverse slit-like depression in the cuticle, is situated somewhat behind the midpoint of the body.

The rings of the cuticle are highly irregular.

The oesophagus is divided into two sections: (1) Anterior shorter section—muscular and with lumen lined with cuticle; the anterior end somewhat broader than the remainder and forming the floor of the interlabial space. The nerve ring surrounds this portion. (2) Posterior longer section somewhat narrowed anteriorly, but uniform in diameter for the greater part of its length. Histological structure shows a parenchymatous appearance. The lumen is not lined by cuticle.

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[1] See Annandale, *Rec. Ind. Mus.* III, p. 283.

The intestine is dilated where it receives the oesophagus.

The rudimentary gonads extend from the junction of the oesophagus and intestine to the anal canal, and lie ventral and to the side of the intestine.

Systematic position.—After considering the structure of the head and of the oesophagus little doubt remains that we are dealing with a *Physaloptera*. The two lateral lips with their teeth and papillae are characteristic. The division of the oesophagus into an anterior muscular and a posterior glandular section also occurs in this genus,—compare *Physaloptera clausa*, Rud. (Dujardin, p. 85).

The adult doubtless inhabits a snake or bird.

The only adult *Physaloptera* recorded from an amphibian is *Physaloptera amphibia*, v Lin., which inhabits the oesophagus and stomach of *Rana macrodon*, Kuhl., in the island of Luzon (v. Linstow (13), p. 15).

8. **Ascaris**, sp. Larvae (L. 33, 36).

(Pl. xxii, figs. 52, 53, 54.)

Larvae (L. 33 and 36)[1] from the peritoneal cavity of *Wallago attoo*, Bl. Schn. and *Callichrous pabda*, Ham. Buch.: Lucknow and Calcutta. numerous specimens encysted. For details of measurements refer to table VIII, columns 36 and 33 (page 191).

The head (figs 52, 53), bears three lips of which the dorsal and right subventral are less prominent than the left subventral. The latter is apparently used as a boring organ and carries a thickened cap of cuticle which is either sharply conical or more rounded and surmounted by a nipple-like projection. The surface between the lips is formed by the body wall and not by the anterior extremity of the oesophagus as in L. 15. No cephalic papillae observed. The head is separated from the body by a slight constriction, ·033 mm. from the anterior extremity, and behind this constriction the cuticle shows a succession of rings for a distance varying from ·18 to ·646 from the head.

The tail is represented in fig. 54. There is no definite caudal appendage.

Oesophagus:—The anterior end is sharpened by portions cut out opposite the three lips. Oesophageal and intestinal diverticula are present, the former ·731 mm. long, the latter ·935 mm.

9. **Ascaris**, sp. Larvae (L. 15).

(Pl. xxii, figs. 55, 56.)

Two specimens from the peritoneal cavity of *Wallago attoo*, Bl. Schn. They were free, moveable and extended, not encysted and coiled up.

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[1] Numbers preceded by an L. are serial numbers of the specimens.

The measurements are given in table VIII, col. 15 (see page 191).

T.L. 25 and 30 mm. One sp. (i. 30 mm.) showed rudiments of ♀ organs, the second gave no indication of sex. They taper very slowly and uniformly from the middle to the head, which is truncated; the posterior half is of fairly uniform diameter and the posterior end tapers more abruptly than the anterior.

The head bears two short conical horns—dorsal and ventral, composed partly of thickened cuticle, but also resting on a raised pulpa. From each horn two fillets of thickened cuticle curve, one on either side, to meet in the midlateral lines. These fillets form the anterior margin, a ring of thickened cuticle which surrounds the head. On this ring are situated four submedian papillae, two submedian dorsal, two submedian ventral. Between the horns the anterior end of the body of the oesophagus projects in front of the fillets.

Intestinal and oesophageal diverticula are present, the latter long and narrow. Both the oesophagus and its diverticulum are of a black-grey colour.

One specimen contains developing sexual organs, vulva and single gonad tube, which latter lies on the left side of the intestine.

The tail is conical, but its shape varies according to the state of contraction or relaxation of a circular band of muscle which surrounds the body at the level of the anus.

Probably the larva of an *Ascaris* belonging to Schneider's group C. or D.

10. **Larva undiagnosed. (L. 30).**

(Pl. xxii, figs. 57–60. Pl. xxiii, figs. 61, 62.)

A single specimen obtained from the intestine of *Wallago attoo*, Bl. Schn. Lucknow. It exhibits only the rudiments of sexual organs. Length 4·67 mm. For measurements see table VIII, column 30 (page 191). It narrows fairly abruptly toward the head (fig. 57), more gradually toward the tail. The head is of a flattened dome-shape with a rounded funnel-shaped mouth (fig. 58) and two conical horn-like processes—one dorsal, one ventral.

The lateral lines (figs. 61, 62) are broad and divided into two sections longitudinally, each occupies about $\frac{1}{8}$th of the circumference of the body; musculature is meromyarian. Transverse rings appear to be artificial.

The postanal region (fig. 60) is short and conical, and bears a small caudal appendage. The anterior lip of the anus is very prominent and broad, and measures half the length of the tail.

The oesophagus (fig. 51) occupies the region measuring ·56 mm. from the head. It is contorted and without a bulb.

The intestine presents nothing of note. Neither oesophageal nor intestinal diverticula are present.

In the posterior oesophageal region a peculiar spine lies embedded in the right side of the body wall, extending from the dorsal line to the right lateral line, the sharp point lying in the latter, the base in the former (fig. 57).

The pore of the ventral gland is situated ·27 mm. from the head in the ventral line, and the gland extends from this point backward to about 2 mm. from the head (figs. 57, 59, 61, 62). It consists of a bulky hyaline body, somewhat of a yellow colour in unstained preparations. It is closely applied to the ventral surface of the intestine and oesophagus, and the anterior portion is divided into several lobes. A thread-like duct traverses the entire organ, but in the portion which was cut in sections this 'duct' did not exhibit a patent lumen.

Two narrow cellular cords applied to the posterior end of the ventral gland probably represent the rudiment of the gonads.

It is not possible to diagnose this larva more exactly than as belonging to the meromyaria.

11. **Larva undiagnosed.** (L. 14).

(Pl. xxiii, figs. 63–65.)

Two immature worms from the stomach of *Wallago attoo*, which cannot be referred with certainty to any genus, from the same locality.

The measurements are given in table IX (page 192).

There are no lips (fig 63). The mouth is circular and leads into a barrel-shaped buccal cavity. The walls of this cavity are cuticularised, brown in colour, thinnest in front, thickening to the equator (*a*), then again becoming somewhat thinner with a thickened ring at the posterior extremity (*b*).

The cuticle of the body covering shows annular markings on its outer surface, of irregular breadth (·0017–·0034 mm.) on the anterior half of the body, more regular (·0017 mm.) on the posterior half.

The anus (figs. 64, 65) opens in a broad transverse cleft ·0374 mm. from the base of the caudal spurs, and ·0544 mm. from the tip of the tail.

The caudal spurs (figs. 64, 65) are two in number, subventral, conical in shape, and equal in size to the tail.

Internal structure.—The oesophagus (fig. 63) is simple and without a bulb. At its commencement it is twisted. It possesses the usual triradiate lumen, its substance is hyaline in appearance and devoid of distinct muscular fibres

The intestine is divided into two sections, the first with finely granular walls and a straight lumen, the second and longer section with curved transverse markings.

These larvae cannot be referred with certainty to any genus. The oesophagus is the organ which shows the greatest constancy in the transition from larval to adult life, and in this respect the larvae which we are considering resemble the Filariae. The two prominent characters which these organisms possess, namely the barrel-shaped buccal capsule and the caudal spurs, are not of great systematic importance since the former may well be lost during one of the moultings and the latter are doubtless converted into caudal papillae such as occur in widely separated genera, *e.g. Filaria* (*F. papillosa*, Rud.) and *Dacnitis* (*D. callichroi*, mihi), *Cucullanus* (*C. elegans*, Zed.).

The mouth capsule might point to genera:

(1) **Angiostoma**, Duj. No species of this genus have been recorded from fishes, the larvae might however belong to a species parasitic in limax, *e.g.*, *A. limacis*, Duj. The shape of the oesophagus however renders this identification unjustifiable (compare larvae of *A. macrostomum*, V. Linstow (6) p. 325, see also Neuhaus (17), p. 653).

(2) **Cucullanus.** There is however no longitudinal striation as in the larva of *C. elegans* figured in Schneider (19) Pl. xxvi, fig. 10. The oesophagus of *Cucullanus* is also characteristically divided into two sections.

(3) **Leptodera**, Schneider (=*Leptodera*, Duj. *Angiostoma*, Duj. and *Rhabditis*, Duj., ex parte). The oesophagus is furnished with one or two dilatations (Schneider (19) p. 156).

(4) **Dacnitis.** The buccal capsule might alter to form the cuticular collar of this genus, but the oesophagus is again quite different in form.

12. **Oncholaimus indicus**, v. Linstow.

(Pl. xxiii, figs. 66–70.)

This species was described for the first time by v. Linstow in 1907 (*Rec. Ind. Mus.*, Vol. I, p. 45). The specimens at the disposal of this distinguished observer do not appear to have shown clearly certain important characters of the head. Consequently a redescription will not be out of place.

The species occurs among filamentous algae and sponges in pools of brackish water at Port Canning in Lower Bengal and also in a canal of brackish water on the outskirts of Calcutta.

Measurements	♀ (1)	♀ (2)	♂
Total length ..	2·07	2·55	2·43
Max breadth ..	·059	·068	·05
Buccal cavity, length ..	·034	·037	—
Oesophagus ,, ..	·357	·374	·357
Head-Vulva ..	1·035	1·326	--
Vulva-tail	1·035	1·224	—
Anus-tip of tail ..	·129	·125	—
Tail appendage, length ..	·085	·076	·085
Uterine egg, length ..	·272	—	—

General shape (fig. 66). Tapers very gradually to both ends. The head is truncated. Shortly behind the anus the body narrows (figs. 69, 70) in a club-shaped manner to form the tail which bears a thin appendix-like termination. This thin portion of the tail is of almost uniform diameter, and is somewhat crooked toward the ventral surface.

Head (figs. 67, 68). Mouth wide, surrounded by six leaf-like semicircular lips, each bearing a sharp flat spine-like process. The lips are situated two in the lateral lines, two subdorsally, two subventrally. They can be folded in over the mouth, closing it, or extended to lie parallel with the length of the body. No setae on head in either sex.

Buccal cavity. Cylindrical, lined with stout chitinous membrane. It contains three teeth—one large right subventral and two smaller, one dorsal, one left lateral, the smaller teeth lie somewhat posterior to the large one, all three in front of the middle of the length of the buccal cavity.

The oesophagus (fig. 66) is muscular and club-shaped with a small segment, also muscular, at its posterior extremity, distinctly separated from the main mass. This small segment projects into the lumen of the intestine.

Nerve ring not very distinct, ·0017 from anterior extremity. The circumoesophageal ganglionic collar is well marked. Pore of ventral gland (?) opposite nerve ring even in adult female. The tail bears a few setae at its tip.

Female.—Vulva at the mid point of the body-length. Gonad tubes two—anterior and posterior, each bent on itself and divided into ovary and uterus.

Male.—There are a few hairs on the oesophageal region of the body, and a row of 9-10 setae on either side of the anogenital aperture (fig. 69). Two sabre-shaped spicules with a hollow conical accessory piece are present.

This species is closely allied to *Oncholaimus fuscus*, Bast. (1) from the English Channel and North Sea. It possesses in common with the latter species (1) the head bearing six mobile lips, and (2) the peculiar appendix-like termination of the tail. It differs from *O. fuscus* in size: ♂ 2·4 mm. contrasted with 6·5 mm. in *O. fuscus*, ♀ 2·5 mm. contrasted with 7 mm. (De Man. 15). The writer has not observed the tubular organ described by De Man in *O. fuscus.*

Tables of Measurements.

TABLE I.

Oxysoma macintoshii, n. sp., from *Rana tigrina*.

Cobb's Formula.

	9/1/♀	10/1/♀	9/2/2	10 1 ♂	10/2/♂
T.L.	2·414	2·55	2·261	*1·48	·999
Br. Hd. / Hd.—Hd.	1·07 / 0	1·16 / 0	1·14 / 0	—	2·6 / 0
Br. at N.R. / Hd.—N.R.	3·2 / 6·6	2·61 / 6·2	3·1 / 6·5	—	6·5
Br. at end oesoph. / Hd.—end oesoph.	5·36 / 17·5	3·62 / 18·3	4·4 / 19·6	—	8·6 / 28·8
Br. at vulva or middle / Hd.—V. or middle	7·7 / 49·6	4·4 / 49·6	5·72 / 48·8	—	9·3 / 50
Br. at Anus. / Hd.—Anus.	4 / 80·7	2·8 / 83	2·7 / 88	—	3·3 / 84·5

	L9/1/♀	L10/1/♀	9/2/2	L10/1/♂	10/2/♂
T.L.	2·414	2·55	2·261	*1·48	·999
Mx. Br.	·185	·111	·1295	·0851	·0925
Mx. Br. / T.L.	1 / 13·05	1 / 23	1 / 18·2	*1 / 17·4	1 / 10·8
Br. at Hd. Ant.	·0259	·0296	·0259	*·037	·0259
Br. Body Ant.	—	·0555	—	—	·0518
Length of Hd.	—	·0444	—	—	—
Br. at N.R.	·0777	·0666	·0703	—	·0646
Hd.—N.R.	·1591	·1591	·148	—	—
B. at end Bulb.	·1295	·0925	·0999	·0777	·0851
Hd.—end Bulb.	·4218	·4588	·444	·37	·2857
Br. at Vulva or middle	·185	·111	·1295	·0925	·0925
Hd.—Vulva	1·19	1·241	1·105	—	—
Br. at Anus.	·0962	·0703	·0629	·0333	·0333
Hd.—Anus.	1·938	2·074	1·989	1·276	·8366
Anus—Tail	·476	·476	—	·2035	·1924
Post anal L. / T.L.	1 / 5·07	1 / 5·35	—	*1 / 7·3	1 / 5·19
Oes. T.L. ...	·425	·4421	·425	·2479	·2627
Oes. T.L. / T.L.	1 / 5·6	1 / 5·8	—	*1 / 5·3	1 / 3·8
Oes. Bulb. L.	·085	·0851	·085	·0555	·0518
Oes. Ant. Br.	·0296	·0333	·0333	·0257	·0259
Oes. Mid. Br.	·037	·0333	·037	—	·0259
Oes. Post. Br.	·0259	·0259	·0185	—	—
Oes. Bulb. Br.	·0999	·0814	·0814	·0518	·0518
Oes. Bulb. Br. / Oes. T.L.	1 / 4·25	1 / 5·43	1 / 5·22	1 / 5·4	1 / 5·07

* Corrected by addition for invagination.

Vulv.—Tail ...	1·224	1·309	1·156	...	—	
Hd.—Vulv. / Vulv.—Tail ...	1/1·029	1/1·05	1/1·04		..	—
L. Memb. Br. / Body Br. ...	—	—	—	Br. Spicule Ant.	·0119	--
Uterine Egg. L. ...	·0814	·0962	·0925	,, ,, Md.	·0136	
,, ,, Br. ...	·0407	·0407	·0518	,, ,, Post.	·0102	—
Spicule L. ...	—	—	—		·2295	·1785
Hd.—Ventr. Pore. ...	—	·3145	—	...	... —	—

TABLE Ia.

Oxysoma macintoshii, n. sp., from *Bufo stomaticus*.

Cobb's Formula.

	♀♀ 2/1/2	2/1/3	2/1/1			♂ 1/1
T.L. ...	2·48	2·78	1·901	...	..	1·017
Br.—Hd / Hd.—Hd. ...	1·79/0	1·59/0	1·36/0	...		1·85/0
Br. at N.R. / Hd.—N.R. ...	4·4/5·66	5·4/7·6	5/6·8	...	...	5·92/9·52
Br. at end oesoph. / Hd.—end oesoph. ...	6·7/16	6·9/13·5	7·4/18	.	..	11·1/20·35
Br. at Vulva or middle / Hd.—Vulva or middle	7·62/46·6	8·5/46·4	8·17/43·6			12·58/50·
Br. at Anus. / Hd.—Anus. ...	5·1/83·6	4·9/82·8	5/77	..	...	6·4/80·61

	♀	2/1/2	2/1/3	2/1/1	2/3/1	2/3/3	...	♂ 1/1
T.L. ...	2·32	2·48	2·78	1·901*	2·445*	2·658	.	1·017
Mx. Br. ...	—	·187	·238	·1554	·221	·255		·1258
Mx. Br. / T.L. ...		1/13·2	1/11·6	1/12·2	1/11·06	1/10·4	...	1/8·08
Br. at Head Ant. end ...	—	·0444	·0444	·0259	·0222	·0481	...	·0185
,, Body Ant. end ...	—	·0777	·0777	·0518	·0555	·0851	...	·0444
Length head ...	·034	·0444	·0444	·037	·0333	·0481	..	·0444
Br. at N. R. ...	—	·111	·1517	·0962	—	—	...	·0592
Hd—N. R. ...	—	·1406	·2035	·1295	—	—	...	·0592
Br. at end oesoph. ...	—	·1665	·1924	·1406	·148	·1961	...	·111
Hd—end oesoph. ...	—	·3996	·3774	·3441	·37	·425	.	·2035
Br. at V. or middle ...	·204	·1924	·238	·1554	·2035	·255	..	·1258
Hd—V. ...	1·07	1·156	·1291	·828	1·17	1·128	...	...
Br. at Anus. ...	—	·1295	·1369	·0962	·1036	·1295	...	·0444
Hd—Anus. ...	—	2·073	2·302	1·476	2·061	2·182	...	·8061
Anus.—Tail ...	·408	·407	·544	·425	·3848	·476	...	·2109
Post anal L. / T.L. ...	1/[illegible]7	1/6	1/51	1/4·47	1/6·36	1/5·59	...	1/4·8
Oes. T.L.† ...	·34	—	·442	·362	·3145	—	...	·2405
Oes. T.L. / T.L. ...	1/7	—	1/6·2	1/5·2	1/7·5	—	...	1/4·2
Oes. Bulb. L. ...	—	—	·0999	·074	·0814	—	...	·0481
Oes. Ant. Br. ...	—	·0555	·0592	·0333	·0333	·0481	...	·0222

* Corrected by addition for invagination. † Including bulb.

Oes. middle Br. ...	—	·0444	·0444	·0333	·037	·0444	...	·0259
,, bulb. ,, ...	—	·1184	·1221	·0962	·0851	·1295	...	·0518
Oes. Mx. Br. bulb. / Oes. T.L. ...	—	—	1/3·6	1/3·7	1/3·7	—	...	1/4·6
Vulva—Tail ...	1·258	1·326	1·495	1·073	1·275	1·53	...	—
Hd—Vulv. / V.—Tail ...	1/1·17	1/1·16	1/1·16	1/1·29	1/1·09	1/1·3	..	—
Uterine Egg. L. ...	—	·0925	·0925	—	·0814	—	...	—
,, ,, Br. ...	—	·0625	·0666	—	—	—	...	—
Spicule L.	—	—	—	—	—	—	...	·2035

TABLE II.

Oxysoma kachugae, n. sp.

T. L. ...	13·68
Mx. Br. ...	·612
Mx. B. / T. L. ...	1/22·3
Head L. ...	·102
Hd. Mx. Br. ...	·204
Hd.—Oes. Comm.	·074
Hd.—Bulb end...	1·989
Body Br. behind Hd. ...	·17
Body Br. at end Bulb ...	·425
Hd.—V. ...	8·49
V.—T. ...	5·19
Hd.—V. / V.—T. ...	1/·64 (·5/3·2)
Br. at V. ...	·544
Hd.—Anus ...	12·09
Anus—Tail ...	·59

Post anal / T. L. ...	1/8·6
Br. at Anus ...	·306
Oes. Pt. 1, L.	·074
Oes. pigmented part L. ...	1·416
Bulb L. ...	·425
Oes. T. L. ...	1·915
Oes. T. L. / T. L. ...	1/7·1
Oes. Br. Ant.	·119
Oes. pigmented part Br. ...	·153
Bulb Br. ...	·255
Br. Bulb / Oes. T. L. ...	1/7·5
Hd.-Vent. pore	1·275
Cuticular striae ant. ...	·0037
Cuticular striae post. ...	·0037

Cobb's Formula.

Br. at comm. oes. / Hd.—comm. oes.	1·5/·54
Br. at end oes. / Hd.—end oes.	3·1/14·6
Br. at Vulva / Hd.—Vulva ...	4/62·4
Br. at Anus / Hd.—Anus ...	2·2/88·9

TABLE III.

Heterakis macronis, n. sp.

Cobb's Formulae.

Measurements expressed in units = $\frac{1}{100}$ T. L.

	i ♀	ii ♂	iii ♂
T. L.	mm. 8·5	7·31	7·5
Br. of Hd. / Hd.—Hd.	0·6/0	0·55/0	0·54/0.
Br. at Nerve Ring / Hd.—Nerve Ring	1·4/5	1·4/4·4	1·3/4·3
Br. at end oesoph. / Hd.—end oesoph.	1·8/9	2/10·7	2/11·3
Br. at Vulva or middle of body / Hd.—Vulva or middle of body ...	1·3/63	1·3/50	1·43/50·
Br. at Anus / Hd.—Anus	0·65/97	0·86/97·6	0·8/98·

	♀♀ i	iv	viii	♂♂ ii	iii	v	vi
T. L. ...	8·5	7·82	6·596	7·31	7·5	7·412	3·65
Mx. Br. ...	·153	·1406	·129	·148	·148	—	—
Mx. Br./T. L. ...	1/55	1/56	1/51·1	1/50	1/51	—	—
Br. at Head ...	·0518	·0518	·055	·0407	·0407	—	—
Br. at Nerve Ring ...	·1184	·1036	·0962		·0962	—	—
Dist. N. R. to Hd. ...	·425		·314	·323	·323	—	—
Br. at end oes. ...	·153	·1406	·155	·148	·148	—	—
End Oes.—Hd. ...	·765	·765	·748	·782	·85	—	—
Br. at Vulva or middle ♂ ...	·11	·1073	·1147	·0962	·1073	—	—
Hd.—Vulva ...	5·44	5·1	4·428	3·65	3·7	—	—
Lateral Membr. Mx. Br. ...		·0666	·0555			·0481	—
L. M. Mx. Br./Br. body same plane ...	—	1/2·1	1/2·6	—	—	1/2·3	—
Br. at Anus ...	·055	·044	·059	·059	·059	—	—
Hd.—Anus ...	8·245	7·561	6·37	7·125	7·33	—	—
Anus—Tail ...	·255	·259	·221	·185	·17	—	—
Post anal L./T. L. ...	1/33	1/30·2	1/29	1/39	1/44	—	—
Oes. L. ...	·765	·765	·731	·782	·85	—	—
Oes. L./T. L. ...	1/11	1/10	1/9	1/4·3	1/9	—	—
Oes. Mx. Br. ...	·055	·074	·074	·077	·0703	—	—
Oes. Min. Br. ...	·037	·037	·0326	·029	·0296	—	—
Mx. Br. Oes./Oes. Min. Br. ...	1/1·5	1/2	—	1/2·6	1/2·4	—	—
Hd.—Vulva ...	5·44	5·1	4·428	—	—	—	—
Vulva—Tail ...	2·89	2·29	2·167	—	—	—	—
Hd.—Vulva/Vulva—Tail ...	2/1	2·2/1	—	—	—	—	—
Uterine Egg. L. ...	·051	·0629	·0518	—	—	—	—
,, ,, Br. ...	·037	·037	·037	—	—	—	—
Bursa L. ...	—	—	—	·444	·435	—	—
,, Mx. Br. ...	—	—	—	—	·0952	—	—
Sucker—Tail ...	—	—	—	·462	·41	—	—
Spicules L. ...	—	—	—	—	—	—	·0765
Hd.—Ant. end ♂ gonad ...	—	—	—	—	2·72	—	1·105

TABLE IV.

Cobb's Formula.

Dacnitis callichroi.

	♀ i	♀ ii
T. L. ...	6·63	7·225
Br. at mouth ...	·15/0	
Br. at end of oesoph./Hd.—end of oesoph. ...	5·13/11·5	4·/10·1
Br. at Vulva or middle/Hd.—Vulva or middle ..	5·4/60	5·9/56·6
Br. at Anus/Hd.—Anus ...	1·54/95·9	1·8/97·

	i	ii	*D: foveolata.* R. Plymouth.
T. L.	6·63	7·22	6·12
Mx. Br.	·391	·425	
Mx. Br. / T. L.	1/17	1/17	
Br. at Term. oes.	·34	·289	
Hd.—Term. oes.	·765	·731	
Br. at Vulva or middle	·357	·425	
Hd.—Vulva...	3·96	4·08	
Lat. Membr.	0	0	
Br. at Anus	·102	·129	
Hd.—Anus	6·46	7·02	
Anus—Tail	·17	·203	
Post anal L. / T. L.	1/39	1/35·5	
Oes. L.	·748	·765	·935
Oes. L. / T. L.	1/9	1/9·4	1/6·5
Oes. Ant. Mx. Br.	·187	·17	·1887
Oes. Min. Br.	·102	·085	·0814
Oes. Post. Mx. Br.	·17	·17	·1332
Oes. Post. Mx. Br. / Oes. L.	1/4·4	1/4·5	1/7
Hd.—Vulva	3·96	4·08	
Vulva—Tail	2·72	3·14	
Hd.—Vulva / Vulva—Tail	1·4/1	1·3/1	
Uterine Egg. L. without shell	·0851	·555, ·048	
,, ,, Br.	·0555	·029, ·037	
Cuticular Striae Ant.	·002	·002	
,, Post.	·0012		

TABLE V.

Spiroptera denticulata, R.

Var. *minor*, var. nov.

	i	ii
T. L.	1·87	1·88
Mx. B. (at 2nd ring) ...	0·68	0·68
Mx. B. / T. L. ...	1/27	1/27
Oral cone L.	·0136	—
Br. Ant. margin oral cone	—	·0204
Hd.—end Pharynx. ...	·0306	·0476
Br. Body at end Ph. ...	·068	·068
Hd.—end oesoph. ...	·1275	·204
Br. Body at end oesoph. ...	·0544	·0612
Br. at middle... ...	·0561	·068
Br. at Anus	·034	·034
Hd.—Anus	1·81	1·81
Anus—Tail	·059	·068

	i	ii
Length of Spine of 2nd circle	·023	—
Lateral line Br. at Head ...	·0068	·0068
Lateral line Br. middle of Body	·0085	—
Oes. max. diam. ...	·0204	—
Oes. mim. diam. ...	·034	—
Hd.—Ant. end gonad ..	·703	—
Testicular Region L. ...	·555	—
Vesicul Semin. L.	·185	—
Duct. Ejaculat L. ...	·481	—
Spicule R. Length ...	·0799	·0935
Do. Br.	·0038	·0034
Sp. Left length ...	·442	·4441

Post anal L. / T. L.	...	1/31·7	1/27	Sp. Left Br.	·0038 ·0068
1st Ring L. ...	...	·017	—	Sp. Left Terminal joint L....	— ·0153
2nd ,, ,, ...	...	·0136			
3rd ,, ,, ...	...	·0102	—		
Middle Rings L.	...	·007	—		

	i	ii	
Br. Hd. / Hd.—Hd. ...	—	1·1/0	Cobb's Formula.
Br. at end Ph. / Hd.—end Ph.	3·8/1·7	3·8/2·6	
Br. at end oes. / Hd.—end oes.	3/7	3·4/11·3	
Br. at middle / Hd.—middle.	3/50	3·8/50	
Br. at Anus / Hd.—Anus	1·88/97	1·88/97	

Table VI.

Atractis kachugae, n. sp.

	Immat. ♀ 41/1/1	Mature. ♀ 41/1/3	♀ 41/4	Mature. ♂ 41/1
T. L. ...	2·17	2·63	3·06	2·24
Mx. Br. ...	·044	·055	·077	—
Mx. Br. / T. L. ...	—	—	—	—
Hd.—Br. ...	—	—	·0333	—
Hd. Comm. Oes.	—	·011	·011	·01
Hd.—end oes. 2.	·349	·391	·459	·377
Br. body at end oes. 2	·044	·0555	·0629	·044
Br. at middle ...	·04	·0518	·077	·0408
Hd.—V. ...	—	1·95	2·23	—
V.—T. ...	—	·68	·833	—
Hd.—V. / V.—T. ...	—	1/·34	1/·37	—
Br. at middle at V.	—	·0407	·059	·0408
Hd.—Anus ...	1·67	2·07	2·329	1·866
Br. at Anus ...	·029	·033	·044	·037
An.—T. ...	·493	·56	·731	·374
Post anal / T. L. ...	1/4·4	1/4·7	1/4·2	1/6·3
Oes. 1 L. ...	·15	·16	·185	·17
Oes. 1 Br. ...	·018	·022	·029	·018
Bulb. 1 Br. ...	·029	·033	·04	·027
Oes. 2 L. ...	·199	·22	·255	·207
Oes. 2 Br. ...	·018	·025	·029	·018
Bulb. 2 Br. ...	·037	·048	·055	·039
Oes. T. L. / T. L. ...	1/6·2	1/6·9	1/6·8	1/6
Hd.—begin. of gonad	1·21	—	·969	·68
Spicule R. length	—	—	—	·0925
,, breadth	—	—	—	·0042
,, left length	—	—	—	·187
,, ,, Br.	—	—	—	·005

$\frac{\text{Br. at begin. oes.}}{\text{Hd.—begin. oes.}}$	$\frac{1}{0}$	—	Cobb's Formula.
$\frac{\text{Br. at end oes.}}{\text{Hd.—end oes.}}$	$\frac{2}{15}$	$\frac{2}{17{\cdot}1}$	
$\frac{\text{Br. at middle}}{\text{Hd.—middle}}$	$\frac{2{\cdot}4}{50}$	$\frac{1{\cdot}8}{50}$	
$\frac{\text{Br. at V.}}{\text{Hd.—V.}}$	$\frac{2}{74}$	—	
$\frac{\text{Br. at. anus}}{\text{Hd.—anus}}$	$\frac{1{\cdot}33}{77{\cdot}3}$	$\frac{1{\cdot}3}{84{\cdot}5}$	

TABLE VII.

Encysted Embryo from bladder of *Bufo stomaticus*.

T. L.	1·739
Mx. Br.	·1184
$\frac{\text{Mx. Br.}}{\text{T. L.}}$	$\frac{1}{14{\cdot}7}$
Br. at Hd.	·0814
Lips length	·0185
Br. at end oes. 1	·1184
Tip of lip—end of oes. 1	·148
Br. at end oes. 2	·1184
Tip lip - end of oes. 2	·74
Br. at Anus	·0555
Tip of lip—Anus	1·665
Anus—Tail	·074
$\frac{\text{Post anal L.}}{\text{T. L.}}$	$\frac{1}{23{\cdot}5}$
Oes. 1 length	·1295
Oes. 1 Mx. Br.	·0407
Oes 1 Min. Br.	·0274
$\frac{\text{Oes. 1 Mx. Br.}}{\text{Oes. 1 L.}}$	$\frac{1}{3}$
Tip of lip—N. R.	·103
Oes. 2 length	·592
Oes. 2 Mx. Br.	·0777
$\frac{\text{Oes. 2 Min. Br.}}{\text{Oes. 2 L.}}$	$\frac{1}{7{\cdot}5}$
Anal canal L.	·0629
Lat. Line Min. Br.	·0085
Lat. Line Mx. Br.	·0153
Tip lip—Rud. V.	·888
V.—T.	·851
$\frac{\text{Hd.—V.}}{\text{V.—T.}}$	$\frac{1}{{\cdot}96}$

$\frac{\text{Hd.—Br.}}{\text{Hd.—Hd.}}$	$\frac{4{\cdot}7}{0}$	Cobb's Formula.
$\frac{\text{Br. at end oes. 1}}{\text{Hd.—oes. 1 end}}$	$\frac{6{\cdot}9}{8{\cdot}7}$	
$\frac{\text{Br. at end oes. 2}}{\text{Hd.—end oes. 2}}$	$\frac{6{\cdot}9}{43{\cdot}5}$	
$\frac{\text{Br. at Vulva}}{\text{Hd.—Vulva}}$	$\frac{6{\cdot}9}{52}$	
$\frac{\text{Br. at Anus}}{\text{Hd.—Anus}}$	$\frac{3{\cdot}2}{98}$	

TABLE VIII.

Larvae from *Wallago attoo* and *Callichrous pabda.*

	15/i	15/ii		36/i	36/ii	33/1	33/2	33/i	33/ii	33/iii	33/iv	33/vi		30
T. L.	30	25		23·5	26	19	14·4	18	15	18	15	22		4·67
Mx. B.	·595	·544		·595	·527		·425	·518	·425	·442	·374	·595		·272
Mx. Br. / T. L.	1/50	1/46		1/39	1/50		1/34	1/31	1/36	1/49	1/40	1/37		1/17·3
Hd.—Br.	·148	—		·11	·085	·081								·059
Hd.—junct. oes. and intest.	2·5	3·65	Hd.—post end oes. divert. Br. at above.	2·46	2·7	—	—	Hd.—junct. oes. and intest. Br. at above	1·56	—	—	—		—
Br. at this level	·476	·34		·425	·34	—	—		·298	—	—	—		—
Hd.—V.	13	—		—	—	—	—	—		—	—	—		—
V.—T.	17	—		—	—	—	—	—		—	—	—		—
H.—V. / V.—T.	1/1·3	—		—	—		—	—			—	—		—
Br. at V.	·595	—			—	—	—	—				—		—
Hd.—An.	29·83	24·9		21·37	25·85	18·84	13·28	—		—	—	—		3·93
An.—T.	·17	·085		·129	·153	·153	·119	·08	·085		·014	·153		·074
Post An. / T. L.	1/176	1/300		1/184		1/120	1/120	—	—	—	—			1/63
Br. at A.	·153	·134		·136	·136	·153			·096	—	—			·074
Oes. L.	2·5	3·65		—	—	—			—					—
,, Min. Br.	—	·136		—				—	—			—		—
,, Mx. Br.	—	·187		—	—		—	·077						·063
Oes. L. and Div. / T. L.	1/2·8	1/3		—		—	—	—	—	—	—	—		—
Oes. and Oes. Div. L.	10·5	8·35				—	—	—	2·29	—	—	—		
Intest. Div. L.	1·36	—					—	—	—					—
Ringed area fr. Hd.	—			·333	·333	·646	—	·18	·238	·222	·24	—	Ant. Anal lip, length	·037
Hd.—Vent. pore	—			—	—	—	—	—	—	—	—	—		·564
Lat. line br. at middle	·037	—		—	—	—		—	—	—	—	—		·088

TABLE IX.

Larvae from Stomach of *Wallago attoo.* (L. 14).

	14/1
T. L. ...	... ·578
Mx. Br.	... ·034
Mx. Br. / T. L.	... $\frac{1}{17}$
Mouth Br.	... ·0068
Head Br.	... ·0119
Buccal Caps. L.	... ·0374
,, Mx. Br.	... .017
,, Br. Post	... ·0102
Body Br. at end of Bucc. capsule	... ·0298
Hd.—end Oesph.	... ·1955
Oes. Mx. Br.	... ·0136
Body Br. at end Oesoph.	... ·0357
Body Br. at middle	·034
Hd.—Anus	... ·524
Anus—Tail	... ·0544

Postanal L. / T. L.	... $\frac{1}{9·7}$
Body Br. at Anus	·6238
Spurs L.	... ·017
Cuticular Rings Ant. Br.	... ·0034
,, ,, Post Br.	·0017

Br. Head / Hd.—Hd.	... $\frac{2}{0}$	Cobb's Formula.
Br. at end capsule / Hd.—end capsule	... $\frac{5·2}{6·5}$	
Br. at end of oeso. / Hd.—end of oeso.	... $\frac{6·2}{34}$	
Br. at middle / Hd.—middle	... $\frac{6}{50}$	
Br. at Anus / Hd.—Anus	... $\frac{4·1}{91·9}$	

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(1) Bastian—Monograph of the Anguillulidae. Trans. Linn. Soc. xxv, 1866.

(2) Diesing—Syst. Helminth. *At. dactylura* and *hystrix*, R. II, pp. 151 and 188.

(3) Dujardin—Hist. Nat. des Helminthes.

(4) Gendre—Proc. verb. Soc. Linn. 63. *Atractis fasciolata*, p. 30.

(5) Leidy—Proc. Acad. Philadelphia, 1890, *Atractis opeatura*, n. sp.

(6) v. Linstow—Arch. mikroskop. Anat., 39, p. 325, *larvae of Angiostomum.*

(7) v. Linstow—Arch. f. Naturgeschichte, 72, p. 256, 1906. *Oxysoma contortum*, n. sp.

(8) v. Linstow—Arch. f. Naturgesch, 52, p. 113. *O. brevicaudatum.*

(9) v. Linstow—Arch. f. Naturgesch, 1890, p. 171. *Oxysoma terdentatum.*

(10) v. Linstow—Arch. f. Mikr. Anat. 62, p. 114, *O. tuberculatum* fr. *Megalophrys montana.*

(11) v. Linstow—Centralbl. f. Bakter. Orig. v. 53. *At. perarmata.*

(12) v. Linstow—Centralbl f. Bakter. Orig. v. 31. *At. cruciata*, p. 29.

(13) v. Linstow—Mitth. Mus. Berlin v. I. *Physaloptera amphibia*, p. 15.

(14) v. Linstow—Recds. Ind. Mus. Vol. I, p. 45. *Onch. indicus.*

(14A) v. Linstow—Spolia Zeylanica, Vol. III.

(15) De Man.—Freilebende Nordsee Nematoden.

(16) Molin—Sitz. K. Akad. Wien. v. 38, p. 27. *Dacnitis rotundata.*
(16A) Sitz. K. Akad. Wien. v. 38, p 25. *Spiroptera papillata* fr. *Leuciscus cavedanus and Spir. acuminata.*
(17) Neuhaus—Jena. Zeitschr. Vol. 37, 1903, p. 653. *Post-embryonal dev.* of *Rhabditis nigrovenosa.*
(18) Railliet—Traite de Zoologie Médicale et Agricole.
(19) Schneider, A.—Monographie der Nematoden.

Reference Letters in Tables.

Br.—Breadth.
Comm.—Commencement.
Diam.—Diameter.
Hd.—Head.
L.—Length.
Mx. Br.—Maximum breadth.
N. R.—Nerve ring.
Pt.—Part.
T.—Tail.
T L.—Total length.
V.—Vulva.

The numbers at the head of the vertical columns refer to the serial numbers of the specimens.

Reference Letters in Plates.

A.—Anus. a.g.g.—anogenital gland. B.—bursa. b.c.—buccal cavity. C.—collar. can.—canaliculus. c.g.c.—cavity of gonocoel. c.m.—circular muscle. cl.—cloaca. cu. i.—inner margin of cushion. D—dorsal. D. ej.—ductus ejaculatorius. D.l.—dorsal lip. D.t.—dorsal tooth. du.—duct of gland. E.b.m.—edge of bursal membrane. Em—embryo in utero. f.m.—free margin. Intes.—intestine. L—larva. L.l.—lateral line. L. lp.—lateral line lip. n.r.—nerve ring. oes.—oesophagus. oes. b.—oesophageal bulb. ov.—ovary. P.—papilla. Per. p.—perianal papilla. Post.—posterior. Pr. p.—preanal papilla. R.c.—root column. Re.—rectum. R.m.—retractor muscle. R.sv.l.—right subventral lip. R.sv.t.—right subventral tooth. sd.t.—subdorsal tooth. sd.l.—subdorsal lip. sm.l.—submedian lip. sp.—spicule. sph.—sphincter. su.—sucker. s.v.—seminal vesicle. T.—testis. To.—tooth. ut.—uterus. v.—ventral. v.g.—ventral gland. v.p.—ventral pore.

EXPLANATION OF PLATE XVIII.

Oxysoma macintoshii, sp. nov.

FIG. 1.—♀. × 75.

,, 2.—♀ outline of tail. × 75 (2/1/3).

,, 3.—Head of ♀ in profile. × 750 (2/1/2).

,, 4.—♂. × 75 (10/2/).

,, 5.—Head of ♂ × 750 (12/2/).

,, 6.—Tail of ♂ showing postanal papillae, papillae numbered from behind forward. × 310 (10/2/).

,, 7.—Anogenital aperture of ♂ showing bursa, peri- and preanal papillae. × 750. (10/2/). The papillae are numbered from behind forward in continuity with the postanal series.

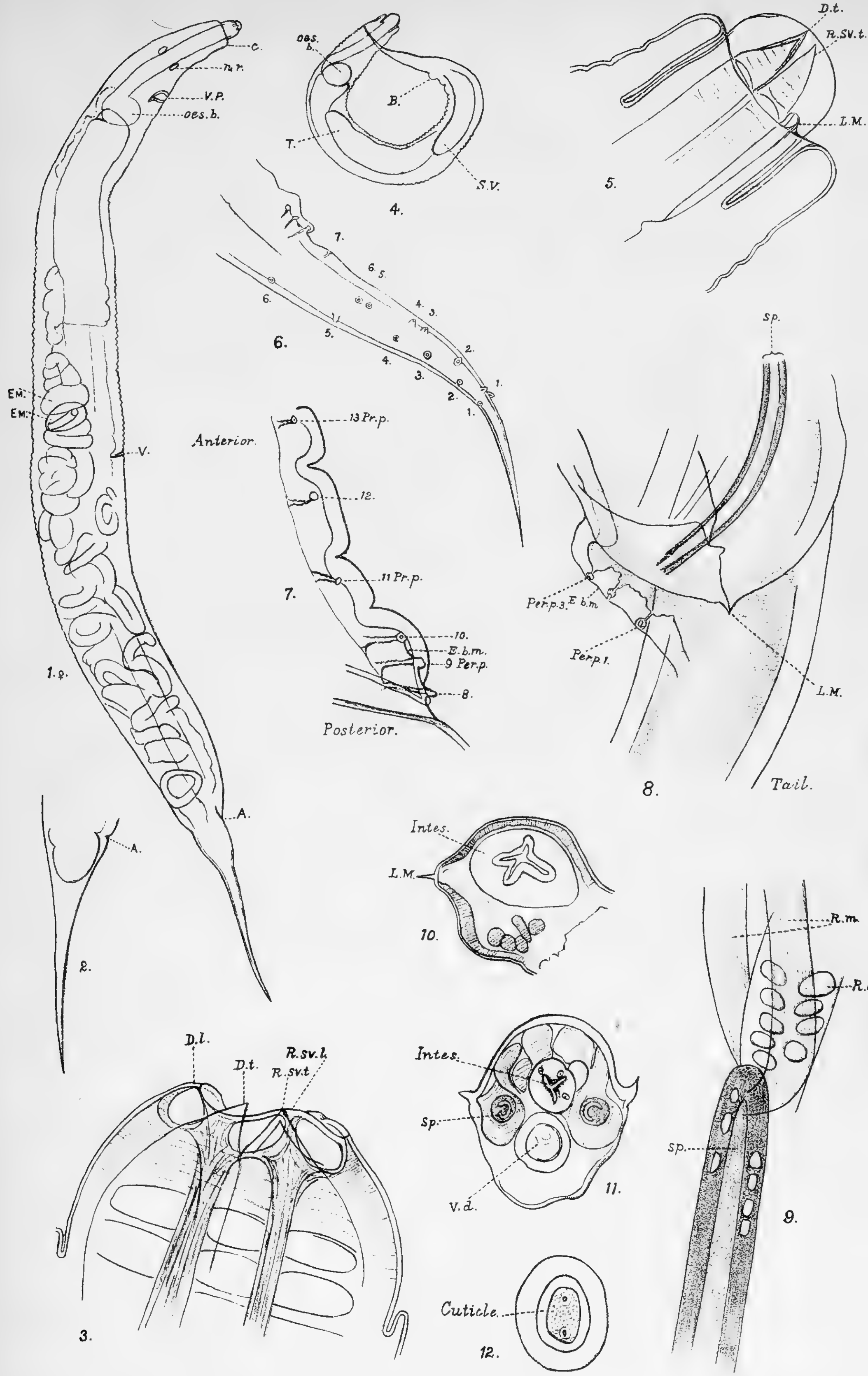
,, 8.—Posterior end of body and anterior end of tail of ♂, showing bursa and left spicule. × 750. (1/1/).

,, 9.—Head of right spicule. × 750. (10/1/).

,, 10.—♂. Transverse section at a level shortly behind oesophageal bulb. × 325.

,, 11.—♂. Transverse section at a level shortly in front of the anus. Showing vas deferens and spicules (the spicules at this level are incomplete cylinders). × 325.

,, 12.—♂. Transverse section through spicule at a more posterior level than fig. 11. × 1500.



F.H. Stewart, del.

A. Chowdhary, lith.

INDIAN NEMATODES.

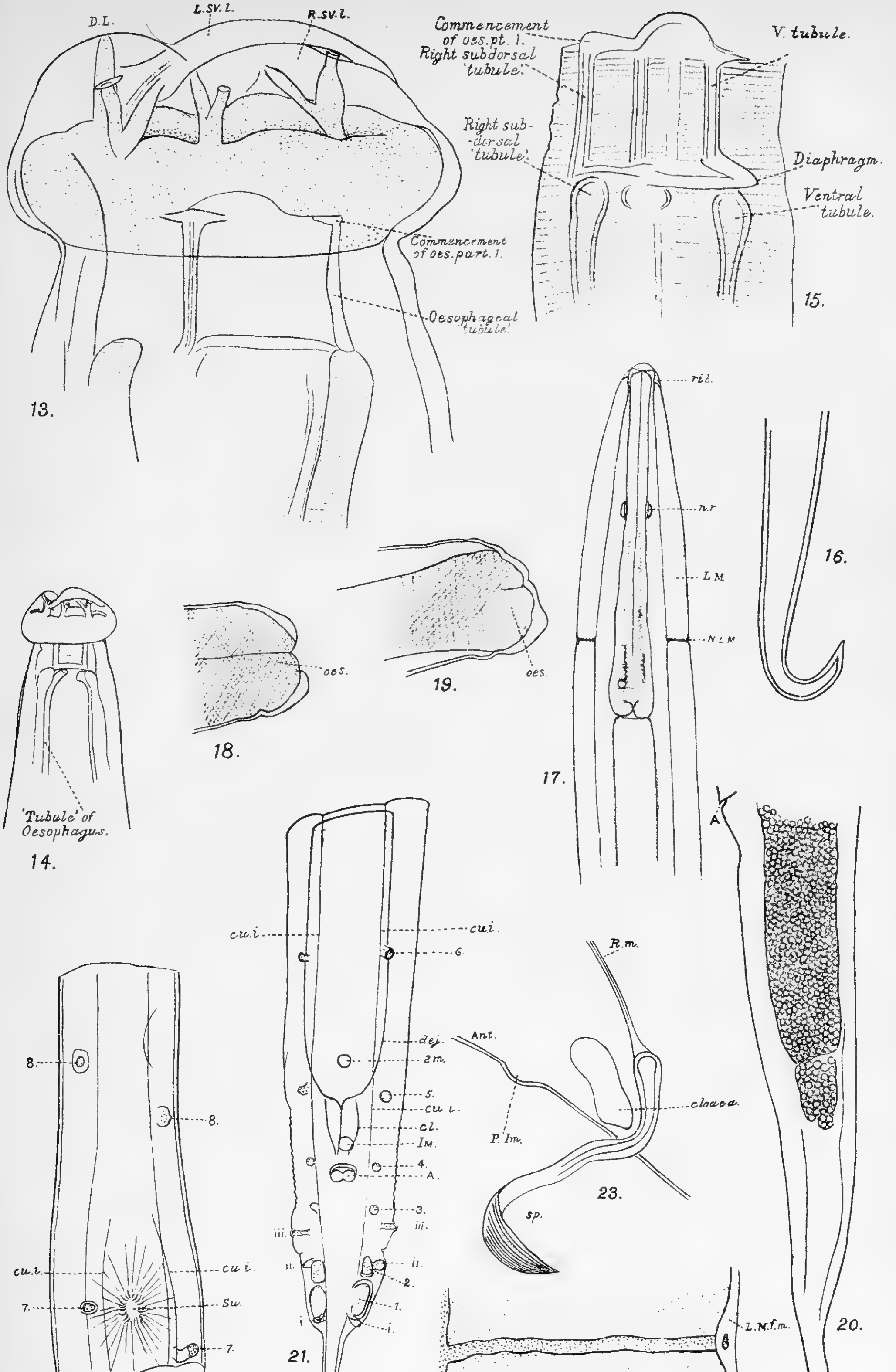
EXPLANATION OF PLATE XIX.

Oxysoma kachugae, sp. nov.

FIG. 13.—♀. Head in profile seen from the right side. × 325.
,, 14—♀. Head in profile seen from right side. × 75.
,, 15.—♀. Junction of first and second part of the oesophagus showing tubules of oesophageal lumen.
,, 16.—♀. Outline of end of tail. × 75.

Heterakis macronis, sp. nov.

FIG. 17.—♀. Anterior extremity seen in the sagittal plane. × 75 (26-viii).
,, 18.—♀. Head in profile seen in focal plane of the mouth. × 325.
,, 19.—♀. Head in profile seen in focal plane to the right of the mouth. × 325.
,, 20.—♀. Tail seen from the left. × 325 (26-i).
,, 21.—♂. Tail seen from the ventral surface. × $216\frac{2}{3}$. (26-iii). The upper end of this figure should be continuous with the lower end of figure 22. i–iii—the sublateral papillae, 1–8, the subventral papillae, 1m. and 2m. the median ventral papillae.
,, 22.—♂. Tail continuation of fig. 21.
,, 23.—♂. Anogenital aperture seen from the left side, with left spicule extended. × 750 (26-vi).
,, 24.—The nerve of the lateral membrane. × 750 (26-viii). The attachment of the lateral membrane to the lateral line is on the left of the figure.



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A. Chowdhary, lith.

INDIAN NEMATODES.

EXPLANATION OF PLATE XX.

Heterakis macronis, sp. nov.

FIG. 25.—♂. Transverse section middle of body. × 433⅓ (Series 1, slide 1). Shows the body of the ventral gland.

,, 26.—♂. Transverse section behind fig. 25. × 433⅓. (Series 1, slide 2/4/). Shows the processes of the ventral gland and the ascending (t. 1.) and descending (t. 2) limbs of the testis.

,, 27.—♂. Transverse section behind fig. 26. × 433⅓. (Series 1, slide 2, end). Shows the processes of the ventral gland coming into close relationship with the lateral lines.

,, 28.—♂. Transverse section behind fig. 27. × 433⅓. (Series 1, slide 3/2/). Shows the processes of the ventral gland near their termination, in the substance of the lateral lines.

,, 28*a*.—♂. Transverse section through the lateral line behind fig. 28. × 1500. (Series 1, slide 2/3/ end). Shows the end of a ventral gland process, with its canaliculus which possesses a well-marked wall.

,, 29.—♂. Transverse section behind fig. 28. × 433⅓. (Series 1, slide 3/4/ mid). Shows a canaliculus in the lateral line.

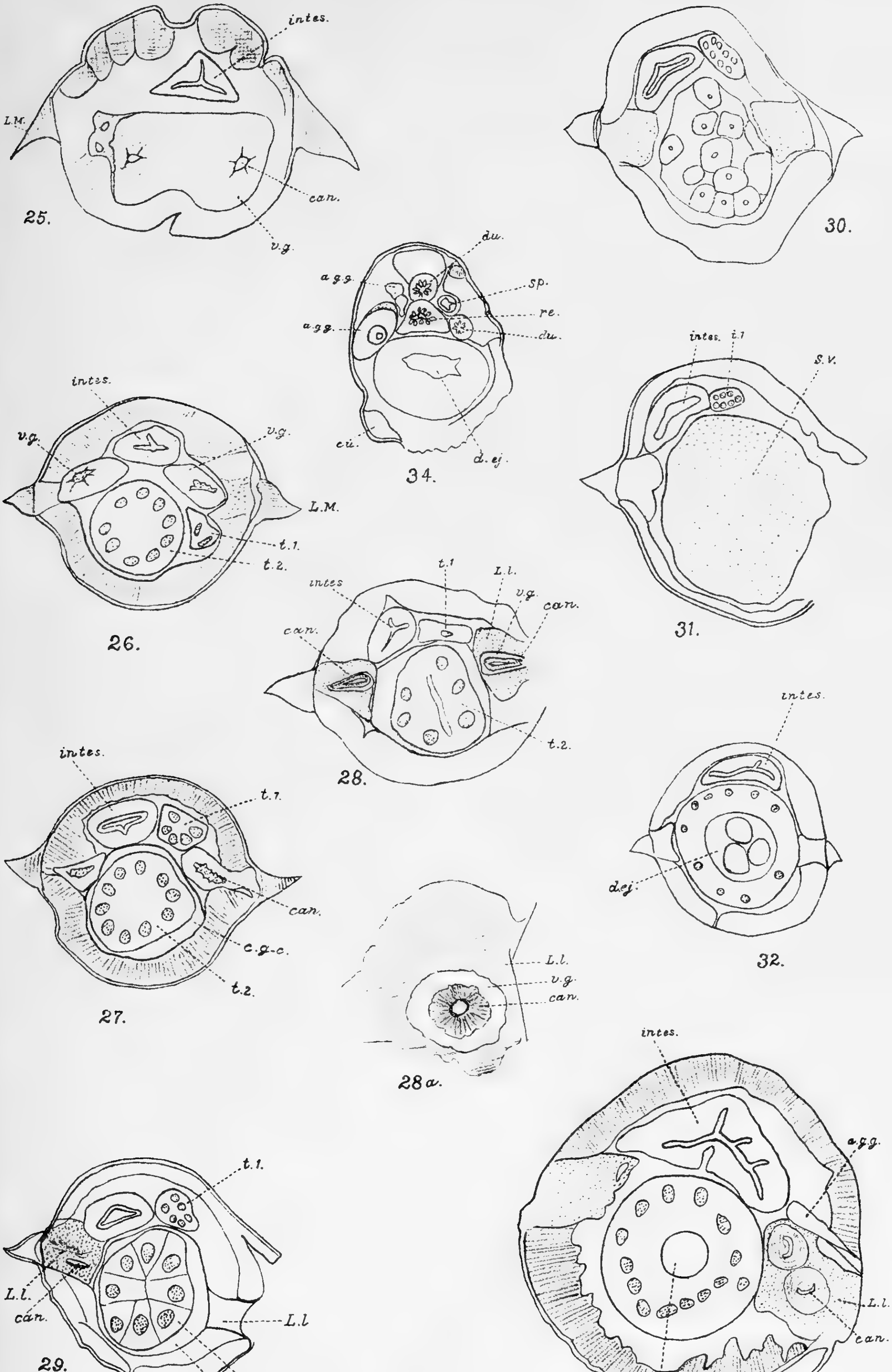
,, 30.—♂. Transverse section behind fig. 29. × 433⅓. (Series 1, slide 4/2/). At the transition from testis to seminal vesicle.

,, 31.—♂. Transverse section behind fig. 30. × 433⅓. (Series 1, slide 4/4/). Through the seminal vesicle.

,, 32.—♂. Transverse section behind fig. 31. × 433⅓. (Series 1, slide 5/2/⅔). Through the ductus ejaculatorius.

,, 33.—♂. Transverse section behind fig. 32. × 1000. (Series 1, slide 5/3/). Shows canaliculi in the lateral line and the anogenital glands.

,, 34.—♂. Transverse section through tail behind fig. 33, and slightly in front of the anogenital aperture. × 433⅓. Shows the base of one spicule, the anogenital glands with their ducts, the cushion of the bursa. (Series 1, slide 6).



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INDIAN NEMATODES.

EXPLANATION OF PLATE XXI.

Dacnitis callichroi, sp. nov.

FIG. 35.—♀. Anterior extremity. × 75 (L. 19, ii).
,, 36.—♀. Head. × 325. Seen from nearly sagittal plane. (L. 19, i).
,, 37.—♀. Head. × 216⅔. From the right side.
,, 38.—♀. Tail from ventral surface. × 216⅔ (L. 19, ii).

Dacnitis foveolata, R.

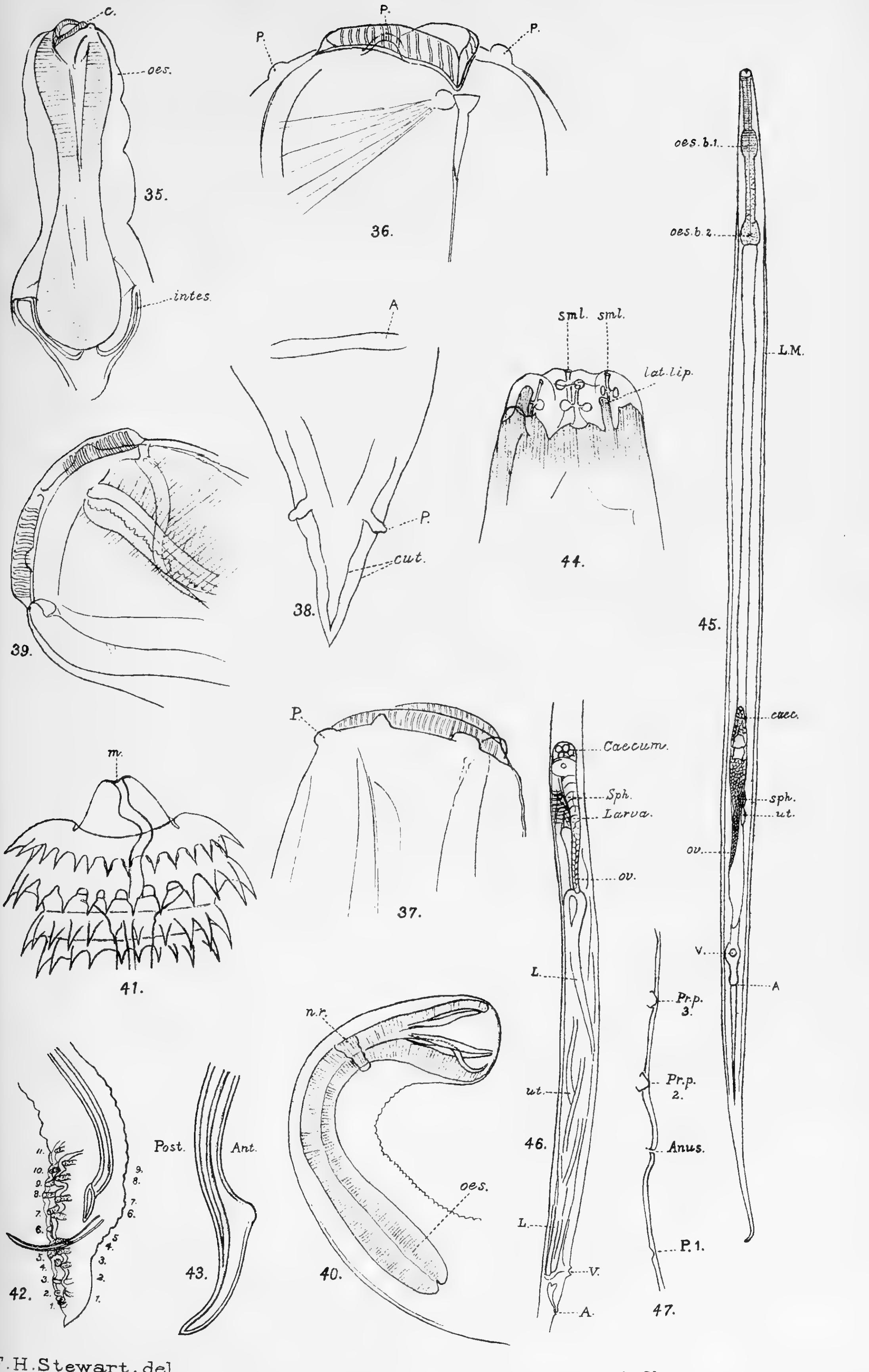
FIG. 39.—Adult ♀. Head. From the left side. × 216⅔. (Plymouth: fr. *Pleuronectes platessae*).
,, 40.—Adult ♀. Anterior extremity. × 325. (Plymouth: fr. *P. platessae*).

Spiroptera denticulata, R. var. *minor*, n. var.

FIG. 41.—♂. Anterior extremity. × 500.
,, 42.—♂. Tail. × 216⅔.
,, 43.—♂. End of left spicule seen from right side. × 750.

Atractis kachugae, sp. nov.

FIG. 44.—♀. Head. × 1000. (41/2/).
,, 45.—♀. × 75 (41/2/ ×) from ventral surface.
,, 46.—♀. Reproductive organs. × 75.
,, 47.—♂. Outline of anogenital region showing papillae. × 750. (41/1/) from right side.



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A. Chowdhary, lith.

INDIAN NEMATODES.

EXPLANATION OF PLATE XXII.

Atractis kachugae, sp. nov.

FIG. 48.—♂. Anogenital region and spicules from the right side × 750. (41/1/).

,, 49.—♂. Outline of tail from right side. × 150. (41/1).

Physaloptera, sp.

Larva from *Bufo stomaticus*.

FIG. 50.—× 75.

,, 51.—Head. × 750, seen from the left side.

Ascaris, sp.

Larva (L. 33 and 36).

Encysted in the peritoneum of *Wallago attoo*, Bl. Schn

FIG. 52.—Head. × $216\frac{2}{3}$.

,, 53.—Head seen from the right side. × $216\frac{2}{3}$. (33. ii.).

,, 54.—Outline of tail from the right side. × $216\frac{2}{3}$.

Ascaris, sp.

Larva (L. 15).

Free in the peritoneum of *Wallago attoo*.

FIG. 55.—Outline of head. × $216\frac{2}{3}$. Seen from the right side obliquely slightly from D.

,, 56.—Outline of tail seen from the right side. × $216\frac{2}{3}$.

Larva (L. 30).

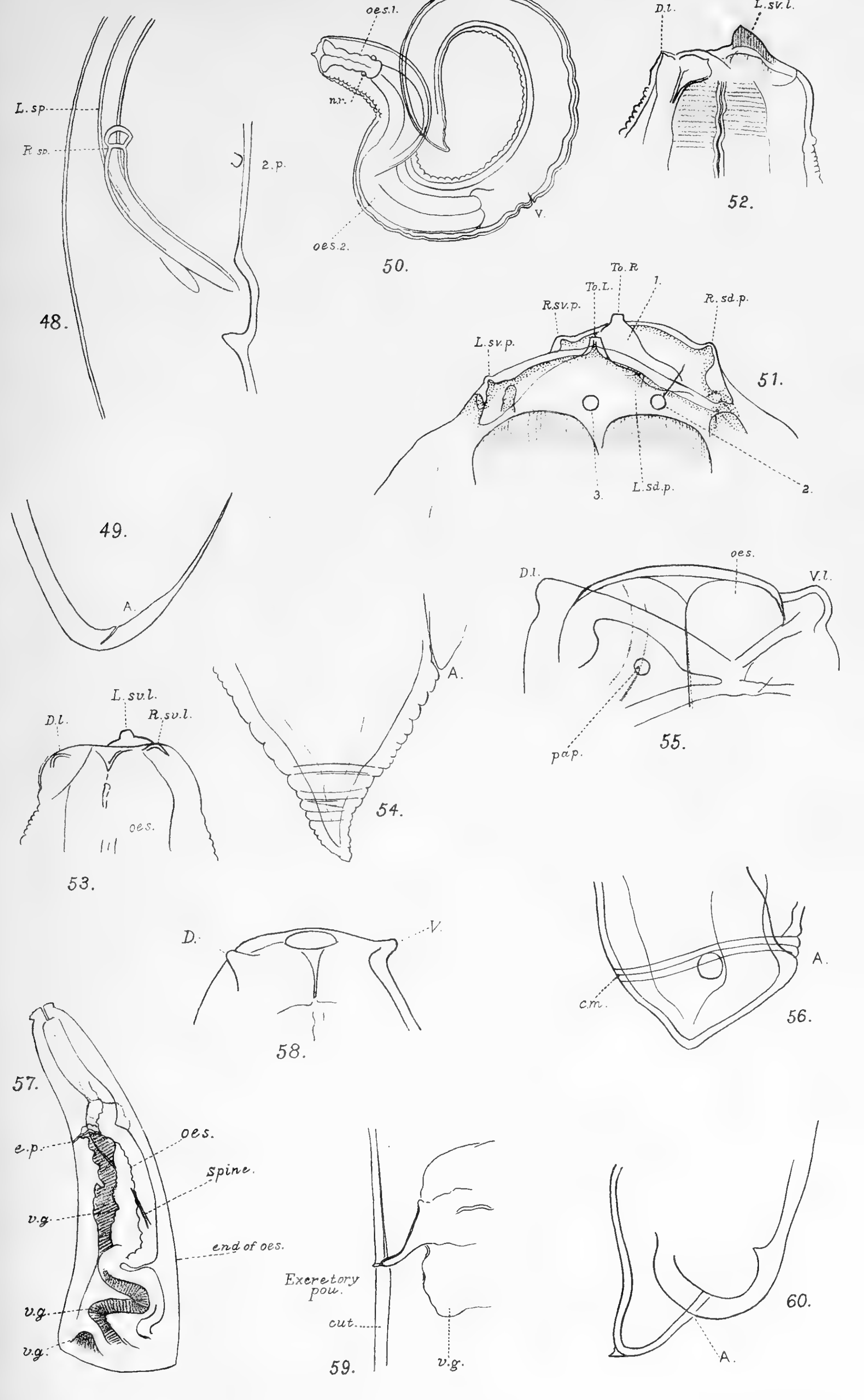
From intestine of *Wallago attoo*, Bl. Schn.

FIG. 57.—Anterior portion of body. × 75.

,, 58.—Head. × 1500.

,, 59.—Opening of ventral gland. × 325.

,, 60.—Tail. × 325.



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INDIAN NEMATODES.

EXPLANATION OF PLATE XXIII.

Larva (L. 30) from intestine of *Wallago attoo*, Bl. Schn.

FIG. 61.—Transverse section, 1 mm. from head.

,, 62.—Transverse section, 2 mm. from head.

Larva (L. 14), from stomach of *Wallago attoo*, Bl. Schn.

,, 63.—Head. × 1500.

,, 64.—Tail from ventral surface. × 1500.

,, 65.—Tail from left side. × 1000.

Oncholaimus indicus, v. Linstow.

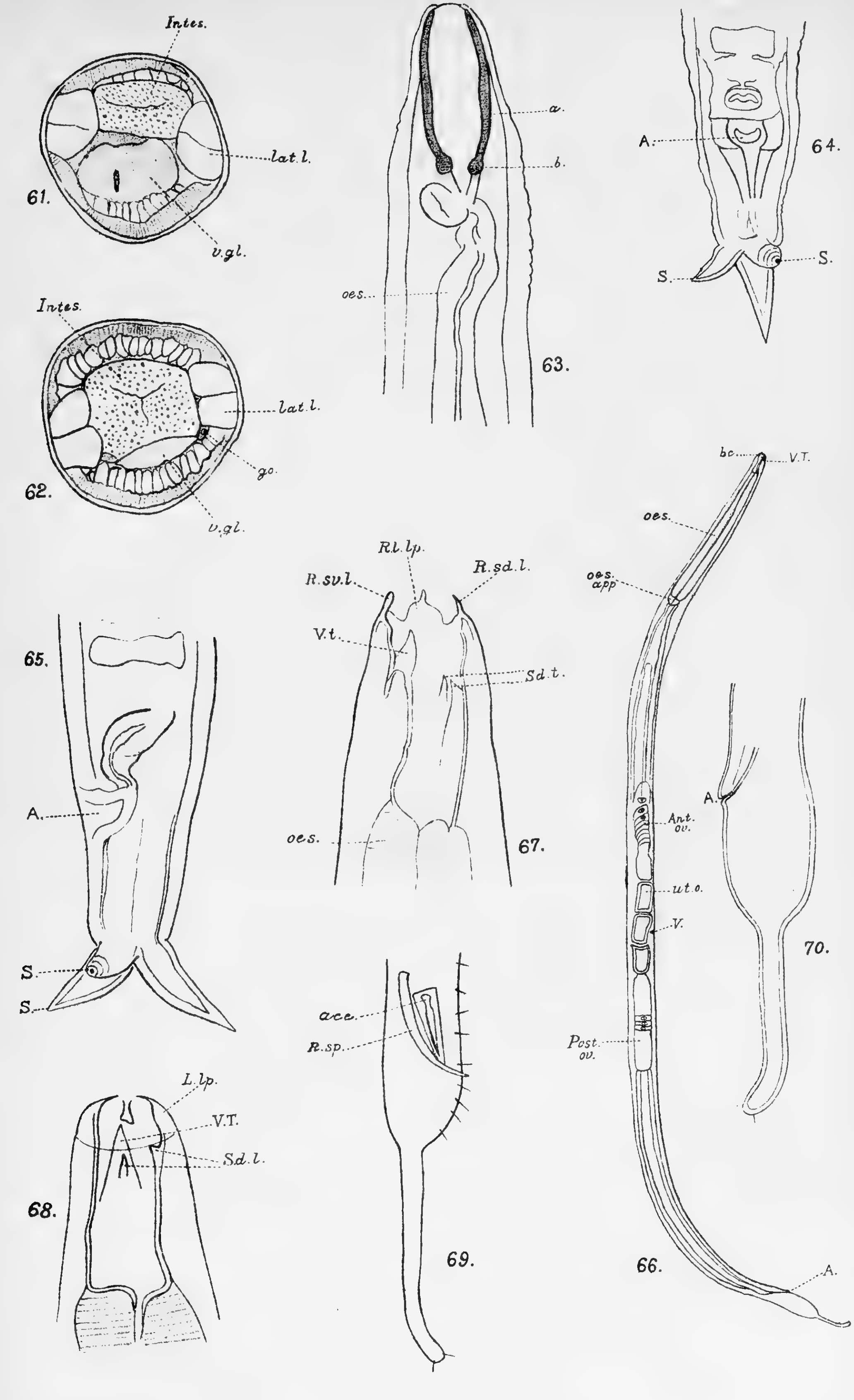
FIG. 66.—♀ from right dorsolateral aspect. × 150.

,, 67.—♀. Head from the left side. × 1000. The lips are protruded.

,, 68.—♂. Head seen from ventral aspect. × 1000. The lips are folded in.

,, 69.—♂. Tail from right side. ×. $433\frac{1}{3}$.

,, 70.—♀. Tail from left side. × $216\frac{2}{3}$.



F. H. Stewart, del.

A. Chowdhary, lith.

INDIAN NEMATODES.

X. STUDIES IN INDIAN HELMINTHOLOGY, No. II.

By F. H. STEWART, *M.A., D.Sc., M.B., Capt., I.M.S.,*
Hon. Assistant, Indian Museum.

THE ANATOMY OF *POLYSTOMUM KACHUGAE*, SP. NOV., WITH NOTES ON THE GENUS *POLYSTOMUM*.

Polystomum kachugae, sp. n.

(Plates xxvi—xxix.)

Two specimens were found in the urinary bladder of a water tortoise (*Kachuga lineata*, Gray) at Lucknow. They were fixed in boiling alcohol, 70%: one specimen was stained with borax-carmine and mounted entire, the other after being stained with the same stain and sketched in oil of cloves was cut into serial sections. I am indebted to my friend Major Walton, I.M.S., for the opportunity of obtaining the specimens at the Medical College, Lucknow, and to Dr. Annandale for the identification of the tortoise.

The body of this new Polystome measures 6·5 mm. in length and 2 mm. in breadth at the level of greatest breadth. It is bluntly pointed at the head, becoming broader in the first 2 mm; the second 2 mm. of length correspond with the greatest breadth. There is a slight but sudden narrowing 1·8 mm. from the posterior extremity. The cotylophore is 1·33 mm. in breadth, the part of the body immediately preceding it is 1·3 mm.

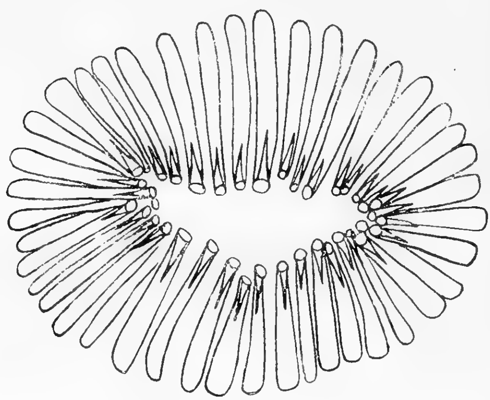
The mouth is subterminal and flattened, of crescent shape when looked at from the ventral surface. The dorsal lip projects downward into the mouth (Pl. xxvii, fig. 2). Eye spots are not present. Four longitudinal lines of nuclei occur on the ventral surface, outlining the sheaths of the ventral nerve cords. The aperture of the genital atrium is situated 1·15 mm. from the anterior extremity.

The cotylophore bears six cup-shaped suckers (Pl. xxvi, fig. 1) the largest of which measures ·4 mm. in diameter. Each sucker projects freely from the surface. The wall of the organ is seen in sections (Pl. xxix, fig. 18) to consist of an outer layer of ectoderm (o.e.), a loose fibrous layer (f.l.), an outer cuticular layer (o.c.l.), a muscular layer (m.l.), an inner cuticular layer (i.c.l.), and an inner ectodermal layer (i.e.l.). The cup formed by the outer cuticular, muscular, and inner cuticular layers is perforated at the base, retractor muscles being attached to the margins of the perforations.

The inner and outer cuticular layers completely enclose the muscular layer, becoming continuous with one another at the mouth of the cup and at the perforation at the base. The fibres of the muscular layer radiate from the centre of the sucker cup, in such a manner that when they contract (acting from the outer cuticular layer as a fixed surface) they enlarge the cavity of the cup and thereby produce a vacuum. This action is aided by the retractor muscles attached to the perforation.

The cotylophore bears two pairs of hooks situated between the posterior pair of suckers (Pl. xxvi, fig. 1). One pair is large and sabre-shaped, 0·9 mm. in length, the points curved boldly forward (h.1.). Plate xxix, fig. 18 exhibits the base of such a hook in transverse section. The hooks of the second pair are short, 0·166 mm. in length, fine and simply curved (Pl. xxvi, fig. 1, h.2).

Ant.



1.

Post.

FIG. 1.—The circlet of atrial hooks as seen from the ventral surface, × 650.

Alimentary System.—The flattened mouth leads into the first pharynx—a spherical muscular bulb (Pl. xxvi, fig. 1. Pl. xxvii, 2, 3, and 4, ph.1) which possesses walls of great thickness and a comparatively narrow lumen. The second pharynx (Pl. xxvi, fig. 1. Pl. xxvii, 5 and 6, ph.2) is identical in shape with the first, and lies dorsal and posterior to it. From the second pharynx a narrow, short and muscular oesophagus leads into the intestine (Pl. xxvi, fig. 1. xxviii, 7, 8. xxix, 14, 17. int.) an organ of the customary two-limbed type. The limbs are unbranched and devoid of anastomoses. They extend backward into the region of the cotylophore.

The Skin.—The ectoderm exhibits structure only in a few sections (Pl. xxvii, fig. 5). In these it appears to consist of a high palisade like epithelium. Nuclei are not visible except in the covering of the outer wall of the suckers (Pl. xxix, fig. 18) where minute point-like nuclei occur. The ectoderm rests on a fibrillar basement membrane, beneath which lies the loose connective tissue in which the organs of the body are embedded.

Nervous System.—The central nervous system is composed of a ring surrounding the second pharynx. The dorsal portion of this ring lies at the junction of the first with the second pharynx (Pl. xxvii, fig. 4) and contains six to eight large ganglion cells. The ventral portion of the ring lies somewhat further back (Pl. xxvii, fig. 6). The lateral portions (Pl. xxvii, fig. 5) give off stout nerves to the margins of the body. Two dorsal, two lateral, and two ventral longitudinal nerve cords are present. (Pl. xxix, fig. 14. d.n.c., l.n.c., v.n.c., and Pl. xxvi, fig. 1 v.n.c.)

Reproductive System.—In regard to the reproductive system, the two specimens at the disposal of the present writer are as

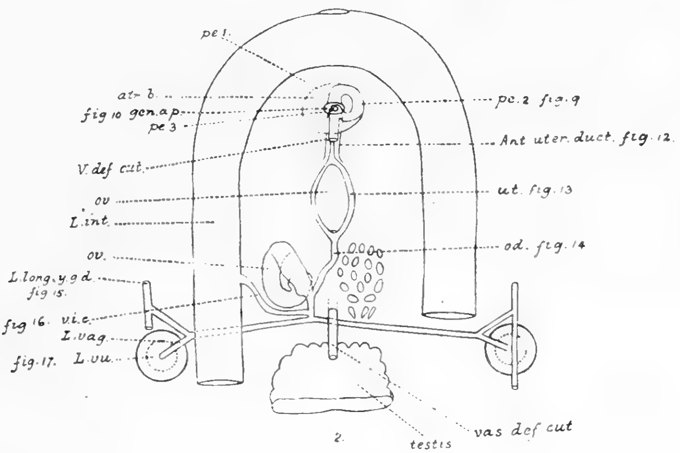
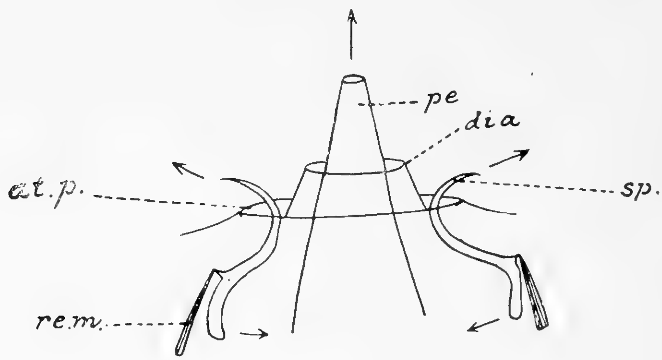


FIG. 2.—Diagram of the reproductive organs as seen from the dorsal surface in specimen No. 2. A portion of the vas deferens is assumed to have been removed to show the underlying female organs. Portions only of the longitudinal yolk ducts are figured.

mirror images the one of the other. The ovary is situated on the right side in specimen No. 1 which is represented in figure 1 of Plate xxvi and on the left side in the second specimen from which the drawings of sections have been made. In the following description the condition of the second specimen is taken as the model.

The male organs.—The testis is a broad, flat and lobulated organ (Pl. xxvi, fig. 1 te.) 2·2 mm. in length and 1 mm. in breadth, lying in the median third of the body directly under the ventral epithelium. The vas deferens (Pl. xxviii, fig. 13. Pl. xxix, figs. 14-16 v.d. and text-fig. 2) after gaining the dorsal segment of the body runs forward in the midline. When it approaches within a short distance of the genital atrium it expands somewhat to form a seminal vesicle (Pl. xxviii, figs. 8, 9, 10, 12 s.v.)

which ends in the centre of the surface of the atrial bulb. In this situation it joins the penis, a short, protrusible and muscular tube which curves outward and to the right, and then inward and backward to open into the cavity of the genital atrium (Text-fig. 3 pe. and Pl. xxviii, figs. 9 and 10 pe.). This cavity is enclosed in a muscular bulb (Pl. xxvi, fig. 1. Pl. xxviii, 9, 10 and 12. Text fig. 3 at. b.) and is divided by a diaphragm into a dorsal male atrium and a flattened ventral female atrium. The male atrium opens into the female atrium, and this in turn opens to the exterior through the atrial pore. The penis projects freely into the cavity of the male atrium (Pl. xxviii, fig. 9 pe. 1). The diaphragm is armed with a circle of forty spines which when viewed from the ventral surface appear to be straight truncated rods with recurved fine points (text-fig. 2) but when looked at from the side are seen to be S-shaped hooks (Pl. xxviii, fig. 11) sharp-pointed at the projecting extremity, and having a raised



3.

FIG. 3.—Diagram to explain the action of the atrial spines and the valvular action of the diaphragm on protrusion of the penis. See text.

point on the outer aspect at the junction of the basal and median thirds for the attachment of muscle fibres. The penis can doubtless be extruded through the atrial pore and would carry the diaphragm along with it. This protrusion would separate the points of the hooks and the circlet would embed itself firmly in any tissues with which it came into contact (text-fig. 3). Self-impregnation would be prevented by the impaction of the cone formed by the protruded diaphragm in the atrial pore, the female atrium being closed completely during the protrusion of the penis.

The female organs.—(Text-figure 2). The ovary (Pl. xxvi, fig. 1 and Pl. xxix, figs. 14-16 ov.) is situated 1·7 mm. from the anterior extremity. It is a curved sausage-shaped organ, the curve forming all but a complete circle. The fundus is somewhat bulbous. The ovary leads into the oviduct, a narrow canal which runs forward to the uterus (Pl. xxix, figs. 14 and 15 od.). The latter organ

(Pl. xxviii, fig. 13) is of oval form, 0·3 mm. in length and contains a single ovum encased in an eggshell of golden colour. From the uterus the anterior uterine duct leads into the female atrium, on the ventral aspect, as has been explained above, of the atrial circlet of hooks. The two vaginae (text-fig. 3 and Pl. xxix, figs. 16 and 17 vag.) lead out of the oviduct, and pass outward and slightly backward to the vulvae. Each vulva is an open cup situated close to one of the lateral margins, on the ventral surface, and 2 mm. from the anterior extremity. The mouth of the cup is only slightly contracted and has a diameter which measures 0·045 mm. The greatest breadth of the interior of the cup measures 0·068 mm. The wall of the vulva is devoid of cell-outlines and of nuclei and thus resembles the ectoderm with which it is continuous. It is traversed by fine branching fissures which contain a darkly staining material. The vulva opens into the vagina through fissures of this nature. The darkly staining material is neither sperm nor yolk. The vulval capsule is surrounded by pear-shaped cells which possess finely granular protoplasm and large nuclei, but do not contain any obvious secretion.

The main longitudinal ducts of the yolk glands open into the vaginae close to the vulvae (Pl. xxix, fig. 17, text-fig 3. y.g.d.). The glands extend from the level of the posterior border of the second pharynx as far backward as the anterior margin of the cotylophore. They are found immediately beneath the basement membrane on the dorsal and lateral aspects of the body, and on those portions of the ventral aspect which are not occupied by the reproductive organs. The cells of the yolk glands contain (1) granules which stain pink with carmine, and (2) golden yellow globules. The latter are more numerous than the former. The colour of the globules is identical with that of the eggshell. The granules may be of yolk, but the present writer has not been able to compare them with the contents of the uterine egg, owing to the imperviousness of the eggshell to stains and paraffin. As these glands are morphologically the same as the glands described as yolk glands in other species of *Polystomum*, the name is retained, although they appear also to function as shell glands.

Another group of glandular cells is found at the same transverse level as the ovary, but on the opposite side of the midline. They appear to be connected with the corresponding vagina, but their function is obscure. The protoplasm of these cells is filled with irregular granules.

The vitello-intestinal canal (text-fig. 2. Pl. xxix, fig. 15 v.i.c) leads from the oviduct to the left intestinal branch. The present writer did not find spermatozoa in any part of the female ducts. Yolk cells bearing granules and globules were found in the oviduct and in the left ramus of the gut near to the opening of the vitello-instestinal canal.

The Excretory System. A main longitudinal duct is present on either side of the body, situated 0·187 mm. from the lateral margin. It measures 0·238 mm. in diameter and possesses a fibrous wall.

Each duct opens into an excretory vesicle (Pl. xxvi, fig. I. and Pl. xxviii, 7 ex. ves.), a large spherical space situated amongst the yolk glands, 1 to 1·2 mm. distant from the anterior extremity. The wall of the vesicle is composed of fine fibrous tissue and the vesicle opens on the dorsal surface by a fine pore (Pl. xxviii, fig. 7 ex.p.).

Summary of the Literature concerning the Genus **Polystomum.**

Seven species of Polystoma are known at the present day, viz:—

(1) *Polystomum integerrimum*, Rud. in *Rana temporaria*, urinary bladder.

(2) *Polystomum ocellatum*, Rud. in *Emys lutraria*, Bp., fauces.

(3) *Polystomum oblongum*, Wright, 1888, in *Sternothaerus odoratus*, Gray, urinary bladder.

(4) *Polystomum coronatum*, Leidy, 1888, in *Cistudo carolina*, Gray, nares, pharynx.

(5) *Polystomum hassalli*, Goto, 1900, in *Kinosternon pennsylvannicum*, urinary bladder.

(6) *Polystomum* sp. (=*P. oblongum*, Leidy 1888, not *P. oblongum*, Wright, 1884) Goto 1900, in *Pseudemys rugosa*, urinary bladder.

(7) *Polystomum kachugae*, sp. nov., in *Kachuga lineata* (Gray), urinary bladder.

Comparison of species.

(1) **Polystomum integerrimum,** Rud. (Literature Nos. 1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 16, 17, 18 19, 20, 21, 22, 23, 24, 26, 27, 28).

This species is distinguished from the other members of the genus by the branched character of the intestinal rami, the branches anastomosing across the midline; in the remaining species the two rami do not give off branches.

(2) **Polystomum ocellatum,** Rud. (Literature Nos. 5, 7, 16, 20, 22, 24).

Summary of No. 24 Lit. v Willemoes Suhm.—Zeitsch. f. Wissensch. Zool., vol. 22, pp. 29—39, that portion which deals with the anatomy of *Polystomum ocellatum*. The author's description is based on the work of von Siebold (20a). "Der Schildkrotenschmarotzer ist im ausgedehnten Zustande 1½ Linien lang, ½ Linie breit . . . . . In seiner Körperform ähnelt er durchaus dem Polystoma der Frosche . . . . Am vorderen Leibesende zwischen Pharynx und Geschlechtsöffnung bemerkt mann jederseits eine warzenförmige Hervorragung . . . . ich beobachtete sie jedesmal, sowie dass das Thier sie willkürlich aus—und einziehen könne . . . . Was die Napfe der Haftscheibe betrifft, so weichen sie won denen des P. integerrimum dadurch ab, dass sie von einem festen Ringe, wahrscheinlich chitiniger Substanz umgeben sind, der in felder abgetheilt ist, deren jedes 2-3 Löcher zeigt. . . . . Zwischen den beiden untersten (Saugnapfen) finden sich zwei grössere, mit den spitzen nach unten stehende, von einander abgewandte Haken.'' Von Siebold found small hooklets between the large hooks "noch am erwachsenen thier in wechselender Zahl .... Augenflecke ... Est ist .. anzunehmen dass sie das Thier in der Jugend besitze, im Alter aber verliere.... Auf eimen Mundnapf mit quergestellter öffnung folgt ein muskulöser, birnförmiger Schlundkopf, ein kurzer Oesophagus und ein Darm der in zwei Schenkel auslauft und keine weitere Verzweigungen abgiebt." .. The genital pore lies "an der bauchfläche, unterhalb der stelle, wo die Darmschenkel sich spalten. Er bildet hier förmlich einen Napf. Im Cirrus liegen kleine Häkchen deren Zahl sich auf 40 belauft. ... Von den weiblichen Genitalien ist der am meisten in die Augen fallende Keimstock .. unregelmässing viereckig. Er liegt im vorderen Theile des Körpers. Die beide Dotterstöcke, grosse, gelappte Organe, welche am Rücken liegen, füllen den ganzen Raum vom Mundsaugnapf bis an die Saugscheibe aus. Ihre Ausführungsgänge vereinigen sich zum Dottergang, der, nachdem er mit dem Keimgang zusammengeflossen ist sich in den Vaginalcanal fortsetzt, wo er eine Anzahl einzelliger Drösen (deren Summe die Schalendröse ausmacht) aufnimm. An der Stelle wo diese einmönden, ist eine kleine Höhle (Ootype, van Beneden), die sich in den Eileiter oder Vaginalcanal fortsetzt. Dieser verlauft in einigen Windungen zum Porus genitalis und mundet hinter der mannlichen Öffnung in die Geschlechtskloake aus.''

We gather from the foregoing description that the most noteworthy point of distinction between the species *ocellatum* and *kachugae* lies in the position of the vulvae and possibly in the form of these organs. In *P. ocellatum* they lie between the pharynx and the genital aperture, in *P. kachugae* at a considerable distance behind the genital aperture It is possible that the pit-like form of the organs in *P. kachugae* is due to the retraction of a pair of pad-like vulvae as described by Willemoes Suhm.

The shell gland described by von Siebold is clearly the same morphologically as the innominate gland of *P. kachugae*. It is not clear on what grounds the function of shell-formation has been attributed to the gland and it may be that the function has been taken for granted without sufficient proof, not only in the case of this gland but of the "yolk-gland" also.

(3) **Polystomum oblongum,** Wright, 1884. (Lit. Nos. 13, 25). The succeeding notes are extracted from No. 25. "Body oblong, mouth on the ventral surface of the rounded anterior end. Pharynx bowl-shaped. Intestinal caeca without anastomoses or branches. Generative outlets in front of the line of the lateral vaginae. Cirrus coronet of sixteen alternately small and large sabre-shaped pieces. Viviparous. Length up to 2·5 mm., breadth 1·5 mm. Egg greenish 0·235 mm. by 0·195. Larvae ocellate 0·5 mm. in length. The caudal lamina is somewhat narrower than the greatest width of the body and is shorter than it is broad.'' Six small hooks, 0·15 mm. in length, situated between the two anterior suckers, in pairs. Four small and two large hooks

between the posterior suckers, the small hooks between the large hooks. The large hooks measure 0·15 mm. "and have a proportionately deeper notch than those of *P. integerrimum*."

Comparing the foregoing description with our species from *Kachuga lineata*, it will be seen that the two species differ in that *P. kachugae* possesses a cirrus coronet of forty equal, instead of sixteen unequal pieces, and in that it measures more than twice the length of *P. oblongum*, whereas the egg measures only half the length of that of *P. oblongum*. The number of the cotylophore hooks also is different.

Professor Wright continues—"The mouth is transversely oval, and is surrounded by a well-marked sucker......It leads immediately into a bowl-shaped pharynx, the walls of which possess merely weak circular fibres, and from this the simple intestinal caeca arch backwards directly."

This oral sucker appears to correspond with the first pharynx of *P. kachugae*, the weak bowl-shaped pharynx with the strong globular second pharynx of *P. kachugae*.

The testis of *P. oblongum* is a small solid sausage-shaped gland differing greatly from the flat lobulated testis of *P. kachugae*.

In *P. oblongum* two lateral cushions are present situated each in a depression, as in *P. kachugae*, which communicate with vaginae leading to the centre of the body. "A third canal originating from an oval body with brown contents (shell gland?) situated on the left side of the middle line, likewise was observed to take the same direction. The ovary is situated on the front of the testis on the right side of the body." The shell gland may correspond with the innominate gland of *P. kachugae*.

(4) **Polystomum coronatum**, Leidy, 1888. (Lit. No. 13). A parasite of *Cistudo carolina*, Gray. Three specimens were found in the throat, one in the nose. "These pertain to a different species from" *P. oblongum*, Leidy, 1888 (not the true *P. oblongum*, Wright, 1884) "and may prove to be the *P. ocellatum* found in a similar position in the European turtle, *Emys europea*.......... Body when elongated lanceolate. Caudal disk wider than the body, cordiform with three pairs of bothria and with the body attached between the anterior two pairs; changeable in form to oblong, circular, or quadrate; with three pairs of minute hooks between the anterior pairs of the bothria and with a larger pair and two smaller pairs between the last pair of bothria. Genital aperture with a circular or a transverse oval coronet of thirty-two hooks of equal length. No eyes visible. Length elongated from 4·6 mm., contracting to about half the length and widening proportionately".

Polystomum kachugae accordingly differs from this species in the following points of anatomy,—the caudal disk is narrower, not wider than the body, does not bear hooks between the anterior pair of suckers, bears one pair of large and one of small hooks between the posterior pair of suckers. The genital aperture is furnished with forty hooks, not thirty-two.

(5) **Polystomum hassalli**, Goto 1898 (Lit. No. 10). From the urinary bladder of *Kinosternon pennsylvanicum*, in Bowie, Prince George county, Md.

"Total length of the body 1·5 mm. Body proper ovate. Adhesive disk hexagonal, the hemispherical suckers occupying the angles of the hexagon and each with a minute hook in the centre, with three pairs of hooks between the most anterior pair of suckers and two pairs between the most posterior; these hooks and those in the suckers being all of the same form and measuring 0·033 mm. in length. The larger hooks between the most posterior suckers bifurcated towards the base, without any lateral process, measuring 0·125 mm. in length."

Polystomum hassalli is therefore four times as long as *P. kachugae*, possesses five pairs of small cotylophore hooks in place of one, and a hooklet in each sucker which does not exist in *P. kachugae*.

Goto describes the alimentary system of his species as follows:—"Anterior sucker large, oesophagus wanting, intestine bifurcated, tubular, without lateral branches, the two legs ending independently at the front end of the adhesive disk." The mouth of *P. kachugae* is not surrounded by a sucker: it is possible that Goto refers to a structure of the same nature as the first pharynx of *P. kachugae*.

"Common genital pore" (in *P. hassalli*) "lying midway between the front end of the body and the front end of the adhesive disk. I counted fifteen penis spines which are straight and bear a wing-like process at the middle and are 0·028 mm. long, but as their number in other species is always even, I think that there are sixteen in the present species." The distance of the atrial pore from the anterior extremity of the body in *P. kachugae* is about one-fifth of the distance of the anterior end of the cotylophore from the same point.

The ovary of *P. hassalli* lies as in *P. kachugae* sometimes in the right half of the body, sometimes in the left half. The vaginal openings are lateral, without papillae, midway between the front and hind extremities of the body proper; the two vaginal canals are directed almost straight across the body and meet in the median line. In *P. kachugae* on the contrary the vaginal openings are situated at the junction of the anterior and middle thirds of the body proper. The genito-intestinal canals of *P. hassalli* lie slightly behind the vaginae, in *P. kachugae* slightly in front of them.

(6) **Polystomum** sp. (*P. oblongum*, Leidy, 1888, not the true *P. oblongum*, Wright, 1884) (Lit. Nos. 13 and 10). From the urinary bladder of *Pseudemys rugosa*.

This species is partially described from an imperfect specimen by Goto, but it is not named on account of the inadequacy of the description.

It possesses sixteen equal penis spines measuring 0·66 mm. in length (in contrast to the unequal spines in Wright's species) and one hook in each sucker. The remaining hooks of the cotylophore had been lost.

LIST OF THE LITERATURE OF THE GENUS *POLYSTOMUM*, RUD.

(1) Baer, Nov. Acta. Akad. C.C.L. tom. 13.2., pl. 32.—P. integerrimum.

(2) Beneden v. und Hesse, Rech., pp. 84-87.—P. integerrimum.

(3) Braun, Schrift der Berliner Ges. Naturforsch. Fr. tom. 10, p. 58, pl. 3.—P. integerrimum.

(4) Bremser, Icon. Helminth., pl. 10, figs. 25 and 26.—P. integerrimum.

(5) Diesing, Syst. Helminth. tom. 1, p. 413.—P. ocellatum.

(6) Diesing, Syst. Helminth. tom. 1, p. 412.—P. integerrimum.

(7) Dujardin, Hist. Nat. des Helminthes, p. 320.—P. integerrimum, p. 319.—P. ocellatum.

(8) Fröhlich, Naturforsch., 25, p. 103.—P. integerrimum.

(9) Gmelin, Syst Nat., p. 3056.—P. integerrimum.

(10) Goto, Journ. Col. Japan, 12, 1900, p. 276.—P. hassalli Goto, and P. sp. ?(=P. oblongum Leidy, 1888, not P. oblongum Wright, 1884.)

(11) Ijima, Zool. Anz. hft. 7. 1884, pp. 635—639.—P. integerrimum.

(12) Leuckart, Parasit. des Mensch. 2 Aufl. 1. 2, pp. 1, 9, and 70.—P. integerrimum.

(13) Leidy, Proc. Acad. Nat. Sci. Philad. 1888, p. 127.—P. coronatum Leidy and P. oblongum Wright.

(14) Linstow, v. Compend. der Helm., pp. 177 and 198, Litt.

(15) Linstow, v. Nachtrag, pp. 61 and 69, Litt.

(16) Lühe, Süsswasser Fauna Deutschlands, 17, p. 8.—P. ocellatum and integerrimum.

(17) Pagenstecher, Trematoden, etc., p. 47, tab. 6.—P. integerrimum.

(18) Roesel, Hist. Ranarum, p. 24.—P. integerrimum.

(19) Rudolphi Entozoor. Hist. tom. 2. 1, p. 451, pl. 6.—P. integerrimum.

(20) Rudolphi, Synopsis, p. 125.—P. integerrimum, and p. 436.—P. ocellatum.

(20*a*) Siebold, v., Zeitschr. f. Wiss. Zool. bd. 1, p. 362.—P. ocellatum.

(21) Stieda, Reichert und du Bois Reymond's Arch. f. Anat. 1870, p. 660.—P. integerrimum.

(22) Willemoes Suhm, v., Arch. des Sci. Phys. et Nat. 1872, p. 99.—P. integerrimum, p. 106.—P. ocellatum.

(23) Willemoes Suhm, v., Nach. v. d. k. Med. Ges. d. Wiss. Gottingen, 1871, No. 7.—P. integerrimum.

(24) Willemoes Suhm, v., Zeitschr. f. Wiss. Zool. Bd. 22, pp. 29-39. taf. 1 and 2.—P. integerrimum and P. ocellatum.

(25) Wright, Contributions to American Helm., pp. 12-15, pl. 1. (Procs. of the Canadian Inst. Toronto, n.s., vol. 1, 1884, pp. 63 66.)—P. oblongum.

(26) Zeder, Nachtr, p. 203, pl. 4.—P. integerrimum.

(27) Zeller, Zeitschr. f. Wiss. Zool. bd. 22, pp. 1-21, pl. 1 and 2.—P integerrimum.

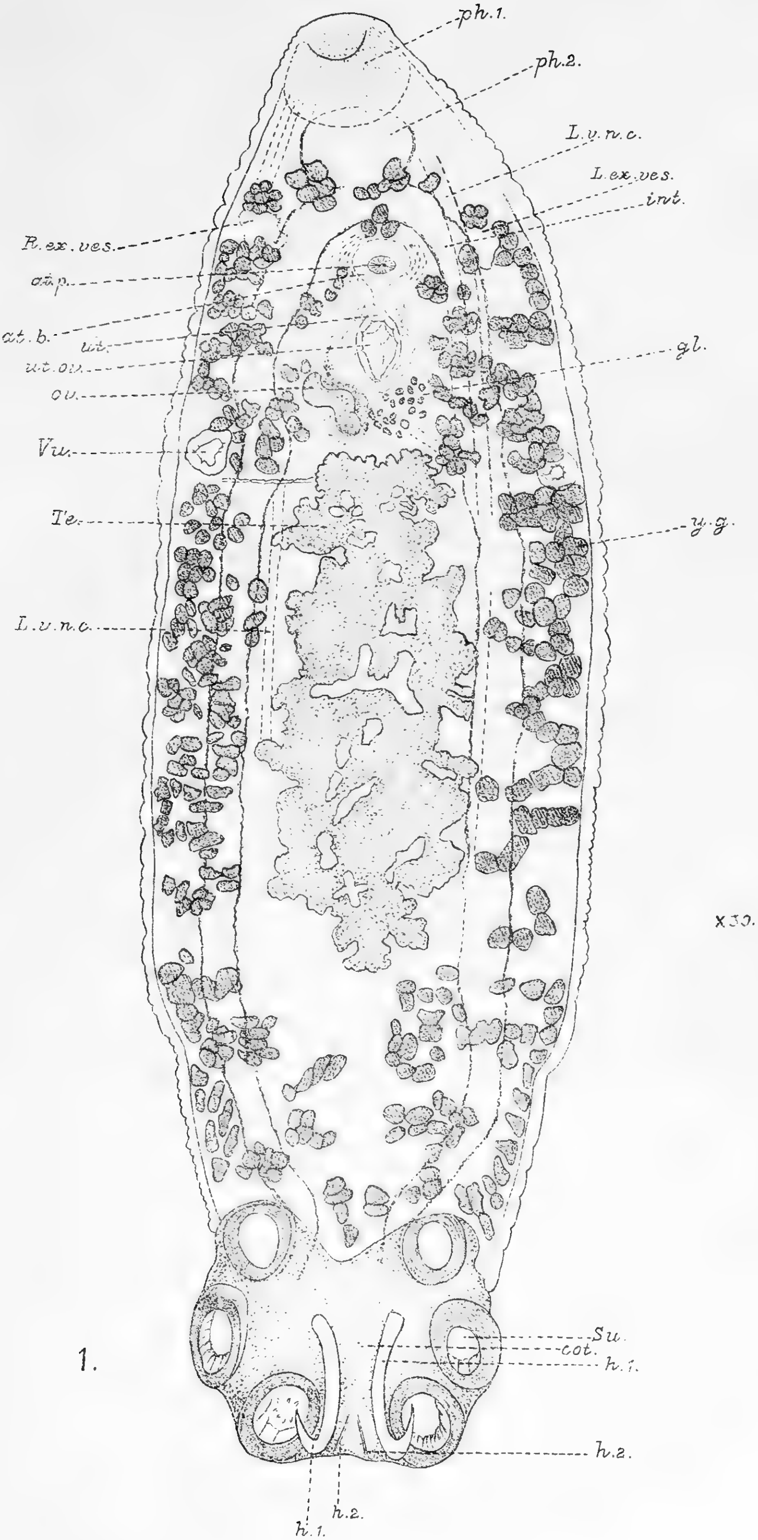
(28) Zeller, Zeitschr. f. Wiss. Zool. bd. 27, pp. 238-275, pl. 17 and 18.—P. integerrimum.

List of Reference Letters in Text-Figures and Plates.

Ant.—anterior; Ant.ut.d.—anterior uterine duct; ♂ at.—male atrium; ♀ at.—female atrium; at.b.—atrial bulb; at. p.— atrial pore.; b.m.—basement membrane; cav.—cavity; c.t.n.—connective tissue nucleus; cot.—cotylophore; d.—dorsal; d.g.—dorsal ganglion; dia.—diaphragm; d. lp.—dorsal lip; d.n.c.—dorsal nerve cord; ep. col.—columnar epithelium; ex. d.—excretory duct; ex. p.—excretory pore; ex. ves.—excretory vesicle; f.l.—fibrous layer; g.c.—ganglion cell; gen. em.—genital eminence; gl.—gland innominate; h.—hook; i.c.l. inner cuticular layer; i.e.—inner ectoderm of the sucker; int.—intestine; int. tr.—transverse portion of the intestine; L.—left; l.n.—lateral nerve; l.n.c.—lateral nerve cord; l.y.g.d.—longitudinal yolk gland duct; m.l.—muscular layer; mus.—muscle; o.c.—oral cavity; o.c.l.—outer cuticular layer; od.—oviduct; o.e.—outer ectoderm of the sucker; ov.—ovary; ov. fund.—ovarian fundus; par. n.—parenchyme nucleus; pe.—penis; ph.—pharynx; R.—right; sp.—spicule; su.—sucker; s.v.—seminal vesicle; te.—testis; ut.—uterus; ut. ov.—uterine ovum: v.—ventral; vac.—vacuole; vag.—vagina; v.d.—vas deferens; v.i.c.—vitello-intestinal canal; v.n.c.—ventral nerve cord; v.n. co.—ventral nerve commissure; vu.—vulva; vu. c.—vulvar cells; y. d.—yolk duct; y.g.—yolk gland.

EXPLANATION OF PLATE XXVI.

FIG. 1.—*Polystomum kachugae* sp. n. Specimen No. 1 from the ventral surface. × 30.



1.

F. H. Stewart, del.

A. C. Chowdhary, lith.

POLYSTOMUM KACHUGAE. sp. nov.

EXPLANATION OF PLATE XXVII.

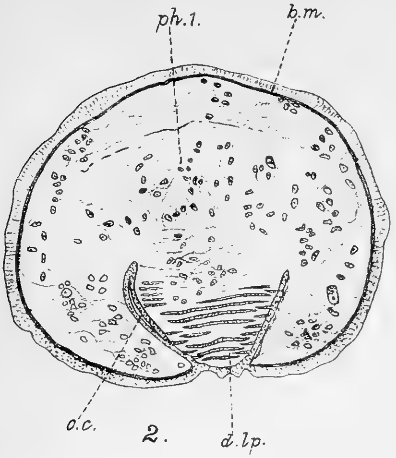
FIG. 2.—Specimen No. 2. Transverse section through the mouth. $\times$ 100.

FIG. 3.—Transverse section through the first pharynx $\times$ 100. (1 2/$\frac{1}{3}$.)

FIG. 4.—Transverse section through the first pharynx and dorsal ganglion. $\times$ 100. (1/2/$\frac{2}{3}$.)

FIG. 5.—Transverse section through the second pharynx and lateral nerve commissure. $\times$ 100. (1/3/$\frac{1}{2}$)

FIG. 6.—Transverse section through the posterior portion of the second pharynx and ventral nerve commissure. $\times 68\frac{2}{3}$. (1/3/$\frac{3}{4}$)



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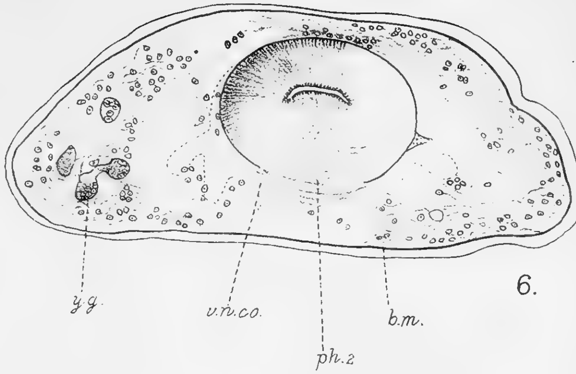

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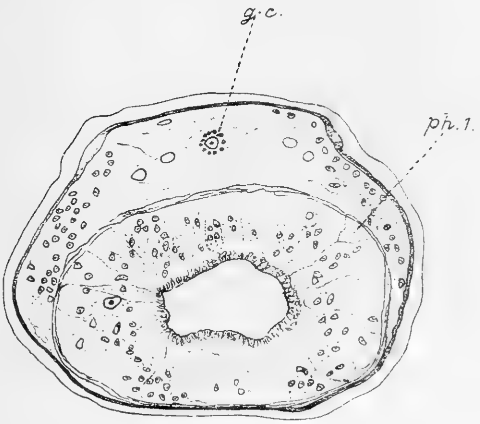

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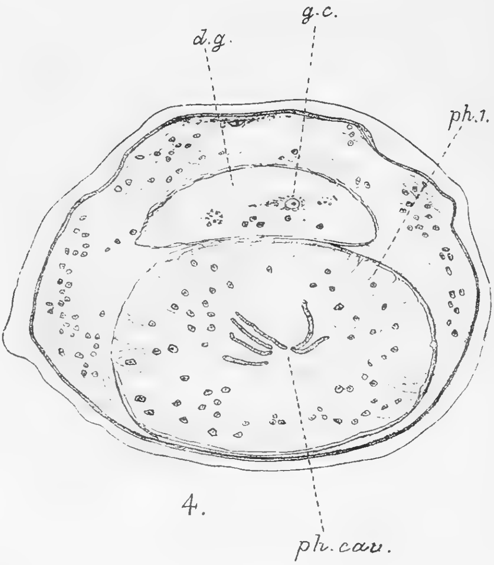

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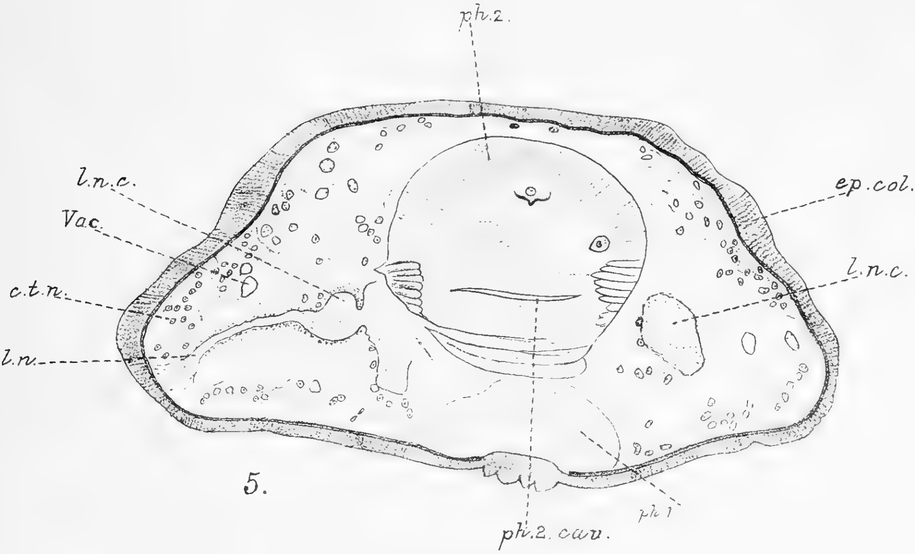


5.

F. H. Stewart, del. A. C. Chowdhary, lith.

POLYSTOMUM KACHUGAE. sp. nov.

EXPLANATION OF PLATE XXVIII.

FIG. 7.—Transverse section through the transverse intestine and excretory vesicles. $\times 68\frac{2}{3}$. (1/5/8.)

FIG. 8.—Left half of a transverse section in front of the atrium showing the excretory duct and left branch of the intestine. $\times$ 100. (1/5/ end.)

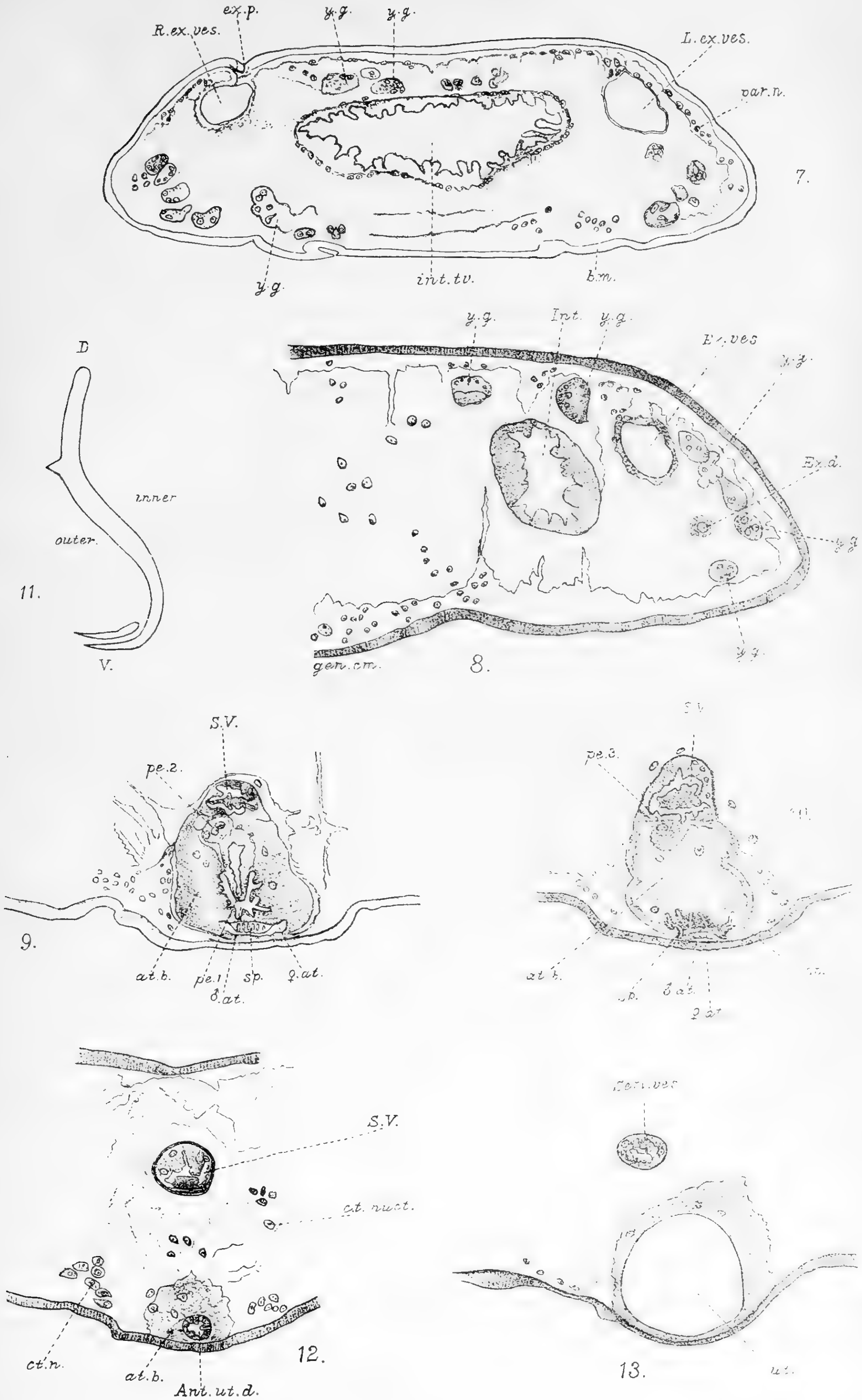
FIG. 9.—Portion of a transverse section through the atrial bulb in front of the atrial pore, showing the terminal portion of the penis in longitudinal section, and the male and female atria.

FIG. 10.—Portion of a transverse section at the level of the centre of the circlet of atrial spines. Shows the atrial bulb with the male and female atria, and the opening of the seminal vesicle into the canal of the penis. $\times$ 100. (2/1/ end.)

FIG. 11.—A spine of the atrial circlet, with the point of a second spine, from the same section as fig. 10. $\times$ 1000.

FIG. 12.—Portion of a transverse section immediately in front of the uterus, showing the seminal vesicle and anterior uterine duct. $\times$ 100.

FIG. 13.—Portion of a transverse section at the level of the uterus showing uterus and the seminal vesicle. $\times$ 100. (2/3/$\frac{1}{2}$.)



F. H. Stewart, del. A. C. Chowdhary, lith.

POLYSTOMUM KACHUGAE. sp. nov.

EXPLANATION OF PLATE XXIX.

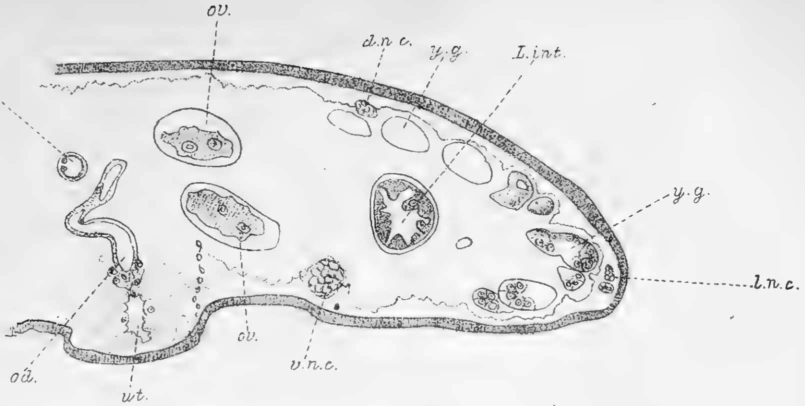
FIG. 14.—Left half of a transverse section at the posterior end of the uterus, showing oviduct, ovary, vas deferens, and three nerve cords. $\times$ 68⅔. (2/4/½.)

FIG. 15.—Left half of a transverse section showing the junction of the vitello-intestinal canal with the left branch of the intestine. $\times$ 68⅔. (2/5/2.)

FIG. 16.—Left half of a transverse section showing the junction of the vitello-intestinal canal with the oviduct. Also shows the innominate gland lying opposite to the ovary. $\times$ 68⅔. (2/5/½.)

FIG. 17.—Left third of a transverse section at the level of the vulva, showing the junction of the vagina with the vulva and with the lateral yolk duct. $\times$ 68⅔. (3/1/⅓.)

FIG. 18. Left half of a transverse section through the cotylophore at the level of the second sucker. $\times$ 68⅔.



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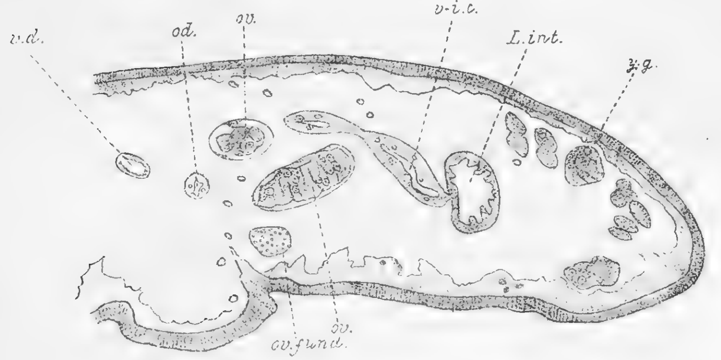

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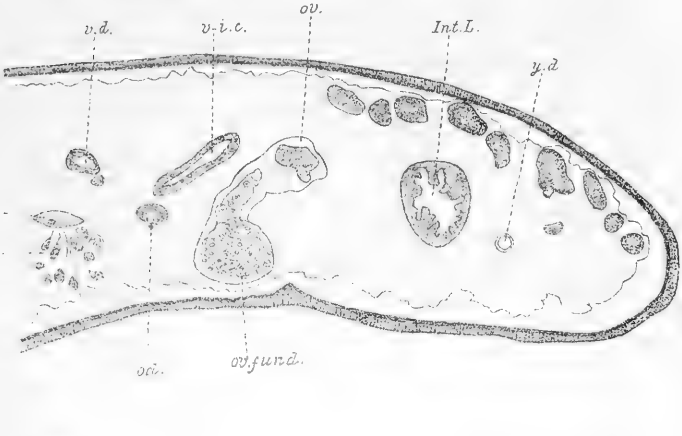

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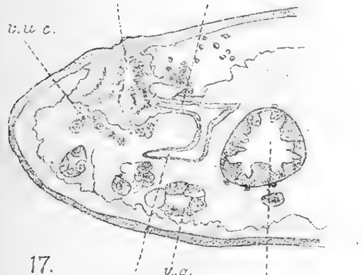

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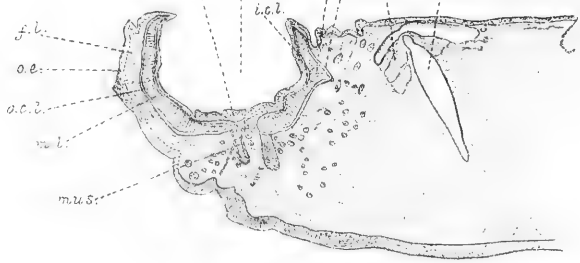

18.

F.H.Stewart, del. A.C.Chowdhary, lith.

POLYSTOMUM KACHUGAE. sp. nov.

XI. ON SOME NEW TERRESTRIAL ISOPODS FROM THE ANDAMAN ISLANDS AND SOUTHERN INDIA.

By WALTER E. COLLINGE, *M.Sc., F.L.S., F.E.S.*

(Plates xxiv and xxv.)

Amongst a collection of Asiatic Terrestrial Isopoda placed in my hands by Dr. Annandale for identification, there are two tubes, containing twenty-one specimens, collected in the Andaman Islands and S. India. They include three species, *viz.*, a new species of *Philoscia*, Latr., of which there are only two imperfect examples, a new species of *Paraperiscyphis*, Stebbing, and a new species of *Cubaris*, Brandt.

Gen. **Philoscia**, Latr.

Philoscia, sp.

The two examples from roots of ferns from Port Blair, 28-viii-08, No. 8571/10 (*H. Weskin*) are too imperfect to describe. I have received the same species from various parts of India and Burma.

Gen. **Paraperiscyphis**, Stebbing.

1911. *Paraperiscyphis,* Stebbing, Rec. Ind. Mus., vol. vi, p. 184.

Paraperiscyphis stebbingi, n. sp.

(Pl. xxiv, figs. 1-10.)

Body (fig. 1) oblong oval, dorsal face strongly convex, with numerous rounded tubercles. Cephalon small, flanked laterally by the lateral plates of the 1st segment of the mesosome. Ventrally carinate. Eyes sub-dorsal and well-developed. Antennulae small, 3-jointed, situated between the ventral carination of the cephalon and the base of antennae. Antennae (figs. 1, 2) moderately stout with 2-jointed flagellum, the first joint longer than the second. Mandibles (fig. 3), the outer cutting edge has three stout teeth and a blunt process on the inner side. 1st maxillae (figs. 4 and 5) have the outer lobe oblong and somewhat triangular in shape, distally terminating in seven incurved spines, on the outer margin there are a number of long, simple, hair-like setae. Inner lobe small and narrow, situated basally. 2nd maxillae (fig. 6) slender, terminating distally in two setose plumes. The segments of the mesosome are strongly convex, lateral plates of 1st segment angularly produced backward, those of the 2nd, 3rd, and 4th less so, all tuberculated. Pronotum of 1st, 2nd and 3rd segments strongly pronounced. Maxillipedes (fig. 7) broad, the inner plate with numerous short simple setae, the outer palp terminates in three teeth consisting of a series of minute spinous processes (fig. 8); basally there is a raised portion minutely studded with small setae. Thoracic appendages fringed with numerous spines, 2nd appendages having on the apical border of the fifth joint two with obtuse plumose apices (fig. 9). Uropods (fig. 10), basal plate large, extending beyond telson, expanded and plate-like laterally; outer margin subcrenate, fringed with hair-like setae and tuberculated; exopodite on the inner margin, endopodite longer than exopodite and situated at the top of the inner margin of the basal plate, both covered with fine setae and extending slightly beyond the basal plate. Telson obtusely triangular, tuberculated.

Colour (in alcohol) a uniform dark brown. Length 17·5 mm.

Habitat.—Anamalai hills, Madras Pres., S. India, 4,000 feet, 22-i-1912, No. 8612/10 (*T. B. Fletcher*).

I have pleasure in associating the name of the Rev. T. R. R. Stebbing, F.R.S., with this interesting species.

The genus *Paraperiscyphis* was founded by Stebbing (6) for another S. Indian species *P. travancorensis*, Stebbing, which is separated from *Periscyphis*, Gerstaecker, by the following characters: "In the second antennae the first joint of the flagellum is not longer than the second; the telsonic segment is very obtusely triangular, not narrowly produced at the apex; the inner branch of the uropods is attached not to a projection of the peduncle's base, but to a notch far down the inner margin, while still further down is attached the outer branch, not especially small, both branches extending beyond the peduncle, and the peduncle itself extending beyond the telsonic segment."

All the above characters hold good in the species I am here about to describe, excepting the first, viz., the first joint of the flagellum in the antennae *is longer than the second*, otherwise there can be no question but that the present species finds its proper place in this genus.

The foundation of the genus *Paraperiscyphis* makes it necessary to re-consider the diagnostic characters of the genus *Periscyphis*, Gerstaecker, who described it in 1873 (5). The diagnosis is as follows:—

"*Periscyphis*, nov. gen."

(Trib. Armadillini.)

"Antennae 7 articulatae, articulis duobus apicalibus elongatis, gracilibus, ultimo setifero. Caput margine frontali nullo, supra oculos utrinque leviter carinatum. Annulus corporis primus margine laterali antice tantum reflexo. Annulus postabdominalis sextus subito angustatus et triquetro acuminatus. Pedes spurii ultimi paris articulo terminali parvo styliformi in apice articuli basalis lati, extus rotundati inserto."

In 1901 (4) Budde-Lund gave a further description as he restricted it, but in my opinion, he had not true species of *Periscyphis* before him, but those of an allied though totally different genus. Unfortunately this author does not seem at all clear regarding the limits of the genus, for although it was known to him in 1885, in his *Crustacea Isopoda Terrestria* (1, p. 293) he describes two Isopods from Egypt, which he placed in a new genus *Cercocytonus* (*convexus* and *albescens*), but later he referred these to *Periscyphis, em.* Budde-Lund (4). In the same paper he expresses the opinion that the species he had previously brought into the genus *Periscyphis*, Gerst. (4, p. 10) are not all rightly placed, some seeming to be more akin to the genus *Synarmadillo*, Dollfus. It is quite certain that many of the species described by Budde-Lund cannot remain in the genus *Periscyphis* as defined by Gerstaecker. The two *P. convexus* and *P. albescens* are probably not true *Periscyphis*, Gerst. *s. str.*, and as the genus *Periscyphis*, Budde-Lund, is simply an emended description of *Cercocytonus*, Budde-Lund, they must be referred to that genus. The mouth-parts, on which this author placed such great reliance, are so totally different from those in *Periscyphis*, that they almost alone would be sufficient to separate them.

There are numerous other species which have been referred by Budde-Lund (3) and other authors to this genus which seem to me wrongly placed.

Gen. **Cubaris**, Brandt.

Cubaris fragilis, n. sp.

(Pl. xxv, figs. 1-10.)

Body oblong oval with the lateral margins of all the segments angulate and overlapping one another; finely punctated and with rows of longitudinal tubercles at each side of mid-dorsal line. Cephalon (fig. 2) narrow, almost straight in front with small triangular lateral lobes; median lobe absent. Eyes subdorsal, fairly large. Antennae (fig. 3) short, first four joints tuberculated, flagellum two-jointed, distal joint two and a half times longer than proximal joint. Mandibles (fig. 4), outer cutting edge with trifid blunt tooth, with flattened one on the inner side. 1st maxillae (figs. 5, 6). Outer lobe oblong, pointed proximally, terminating distally in nine incurved spines; short, simple, hair-like setae on the outer margin; inner lobe distally terminating in a rounded lobe with two setaceous tufts on the inner side. 2nd maxillae small and plate-like. The segments of the mesosome strongly convex, with three to seven raised longitudinal tubercles on each side of the mid-dorsal line, finely punctated, the lateral plates of 1-5 well separated and slightly revolute. Maxillipeds (fig. 7), outer palp with two teeth, inner plate with single spine. Thoracic appendages (fig. 8) robust and provided with short blunt spines on the inner border. Uropods (fig. 9), basal plate somewhat triangular in shape, not extending beyond the telson; exopodite small and on the inner margin, endopodite large and situated at the top of the inner margin of the basal plate and not extending beyond the basal plate. Telson (fig. 10) contracted laterally, posterior margin almost straight.

Habitat.—From roots of ferns from Port Blair, Andamans, 28-viii-08, No. 8571/10 (*H. Weskin*).

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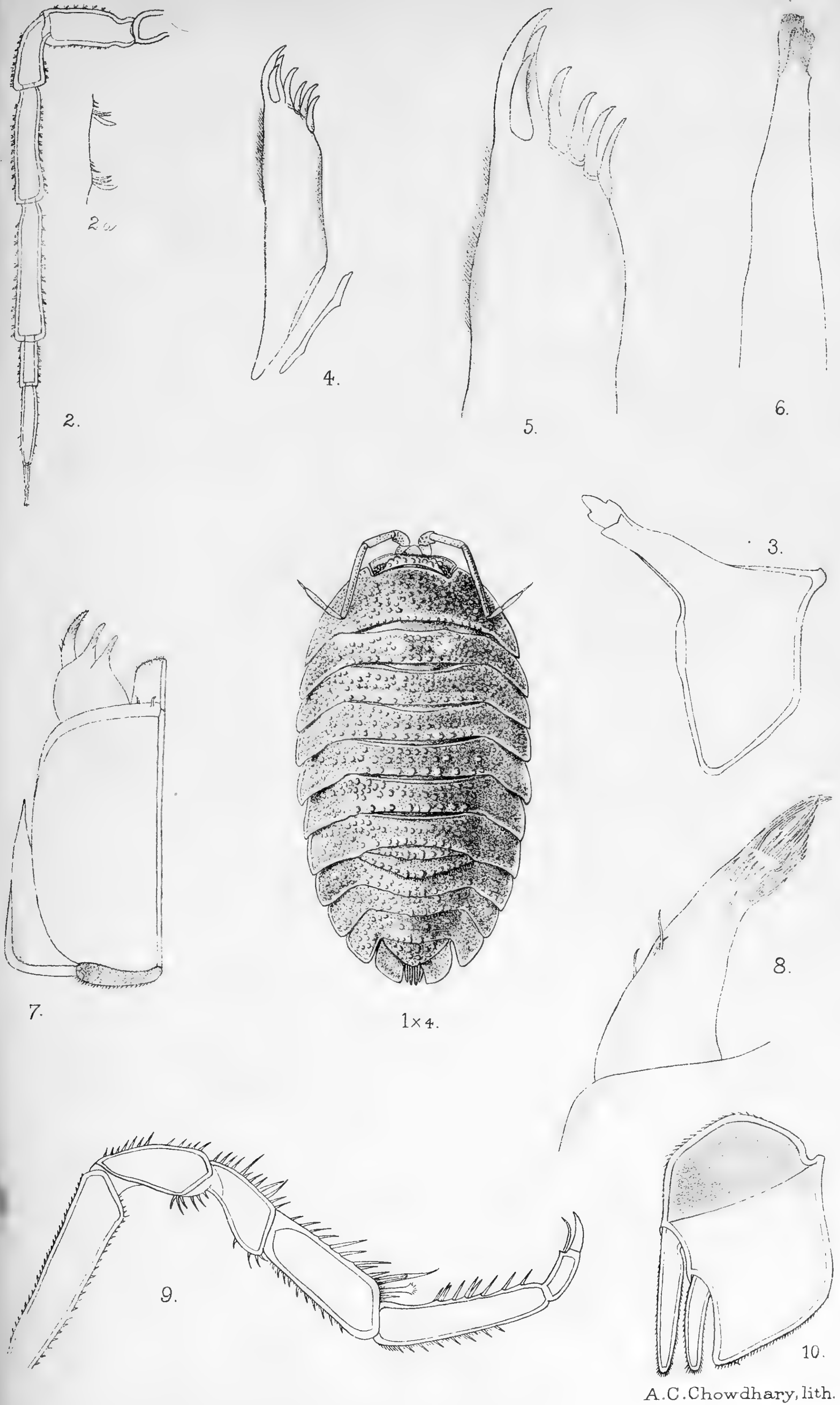
EXPLANATION OF PLATE XXIV.

Paraperiscyphis stebbingi, n. sp.

FIG. 1. Dorsal view, × 4.
,, 2. Antenna. *2a* Hair-like setae enlarged.
,, 3. Mandibles.
,, 4. First maxilla.
,, 5. Distal portion of same enlarged.
,, 6. Second maxilla.
,, 7. Maxillipede from right side.
,, 8. Enlargement of distal spine.
,, 9. Second thoracic appendage.
,, 10. Uropod.



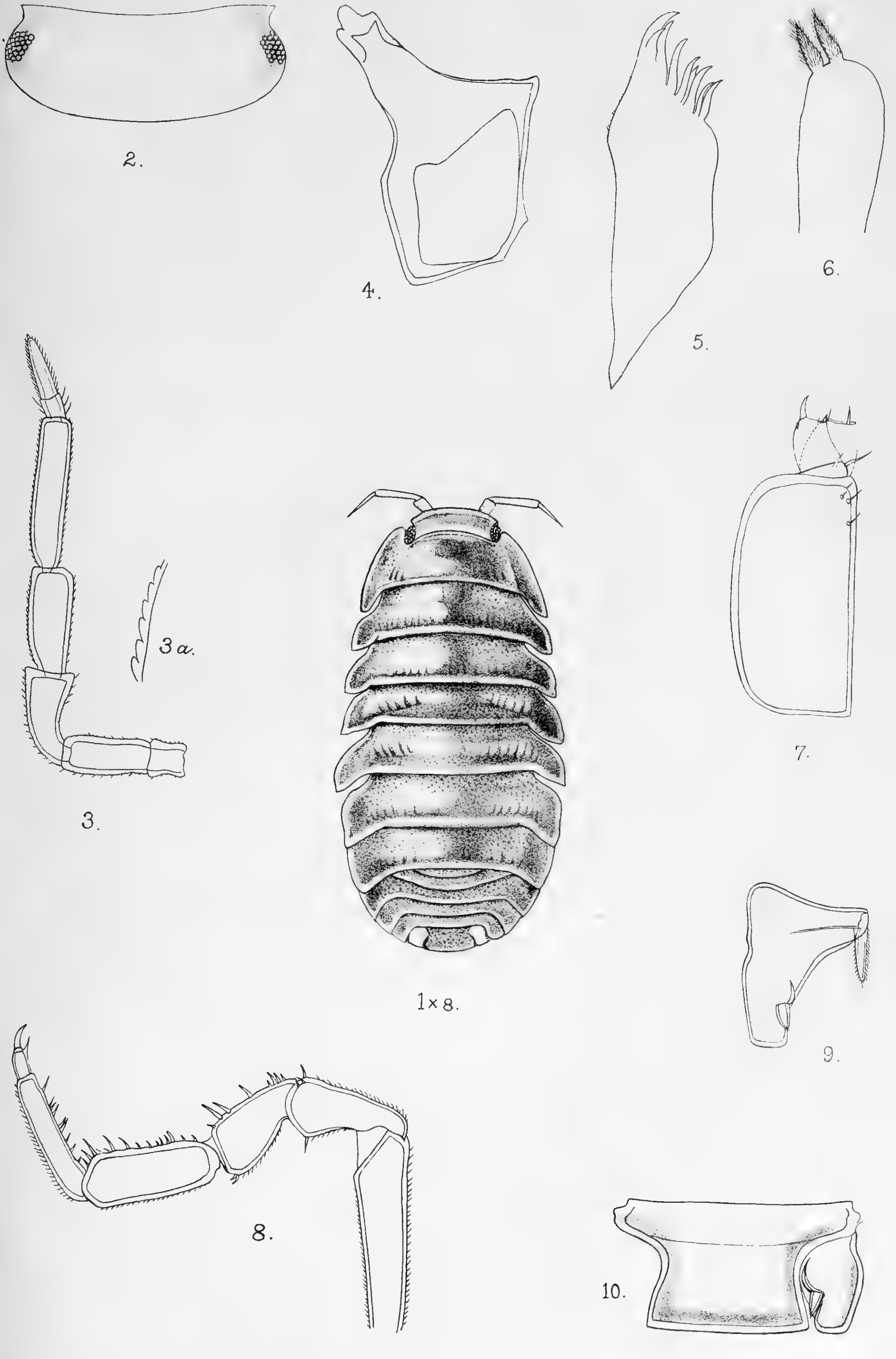
A. C. Chowdhary, lith.

PARAPERISCYPHIS STEBBINGI, n. sp.

EXPLANATION OF PLATE XXV.

Cubaris fragilis, n. sp.

FIG. 1. Dorsal view, × 8.
,, 2. Cephalon seen from above.
,, 3. Antenna.
,, 3*a*. Portion of meropodite enlarged.
,, 4. Mandibles.
,, 5. First maxilla, outer lobe.
,, 6. First maxilla, inner lobe.
,, 7. Maxillipede.
,, 8. Second thoracic appendage.
,, 9. Uropod.
,, 10. Telson.



CUBARIS FRAGILIS, n. sp.

A. C. Chowdhary, lith.

MISCELLANEA.

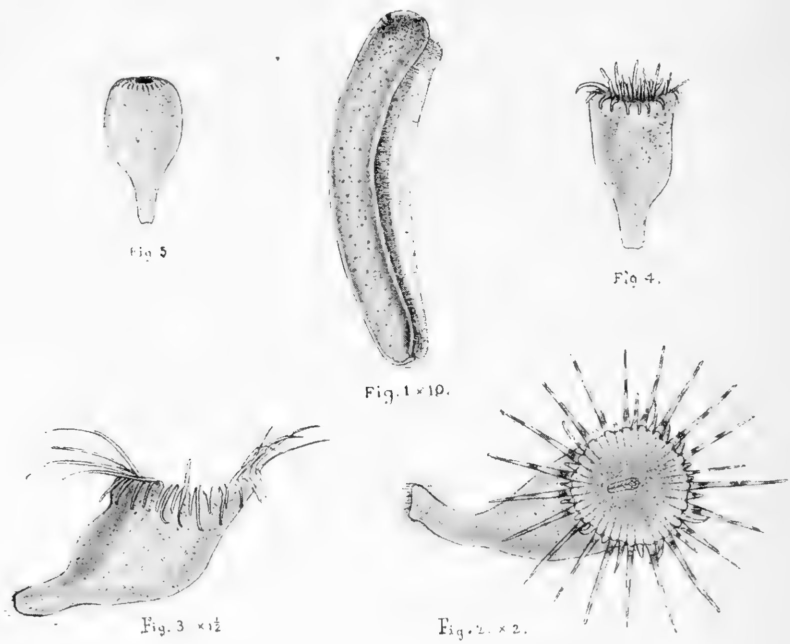
COELENTERATES.

NOTE ON THE GENUS *Anactinia*.—In 1909, there appeared in this Journal, Vol. III, pages 157–162, a paper by Dr. Annandale, under the heading "A pelagic sea-anemone without tentacles." The paper concluded by establishing a new genus and new species *Anactinia pelagica*, for the reception of the animal described therein. Dr. Pax in his reference to the paper in the *Zoologisches Zentralblatt*, Vol. XVII, 1910, pp. 299–300, regarded the animal as identical with a pelagic larva which he had previously described in 1908, and had no doubt as to the larval nature of *Anactinia*. The specimens described by Dr. Annandale were obtained by him at Puri on the Orissa coast of the Bay of Bengal in February 1909. Similar specimens had been obtained by me in previous years at Madras, in February and March in the tow-net and had attracted my attention, among other features, by their large size; but I took them to be pelagic Cerianthid larvae and did not subject them to any special examination. Since reading Dr. Annandale's paper, however, I began to attach some importance and fresh interest to them; and I have been hoping to subject them to observation especially with the view to determine whether they are really larvae or adults. A couple of specimens obtained last year were kept in sea-water; while one of them gradually dwindled and died, the other after some days metamorphosed into a form with tentacles. This lived for about a month or so and then was unfortunately lost sight of. This year I have obtained several specimens, and am keeping them alive. Already five of them have gone through their metamorphosis and the tentacled forms now rest, on the bottom of the glass. I have also got living a specimen which I got in the tow-net some time in September of last year. This specimen has now got thirty-nine marginal tentacles and is a *Cerianthus* (*sensu lato*). When fully stretched at feeding time, it measures five inches in length without the tentacles, and has a cross-diameter of half an inch; ordinarily when it is not so extended, it measures about three and a half inches in length. A comparison of the external features of this and the other specimens recently obtained from the larvae points to their identity. There can in any case be no doubt that the specimens obtained by Dr. Annandale and myself are larvae, and that the most important character on which the genus is based, *viz.* the absence of tentacles, is a purely larval feature.

I have not yet dissected any of the specimens; but when the necessary literature is received I hope to determine the identity of the animal and to publish a further note along with figures.

K. RAMUNNI MENON.

PRELIMINARY NOTE ON THE METAMORPHOSIS OF *Zoanthella*. —Two species of larvae of Zoanthella and one of Zoanthina occur at Madras. During February-April of last year, I obtained several specimens of one of the Zoanthellas and kept them in sea-water. They fixed themselves to the bottoms of glass vessels and sprouted tentacles and it has been possible to rear them successfully. I have nine of last year's lot living at present, and some of them at the time of writing are more than thirteen months old. The largest specimen measures, when moderately extended, one inch



in length and about half an inch across the peristome from edge to edge. It has now fifty tentacles. The same specimen had thirty tentacles at the end of July, 1913. The tentacles are in two cycles of alternately long and short and in the extended condition are held alternately raised and depressed. In the larger of the remaining specimens, the numbers of tentacles are 42, 44, 46, and 48. The accompanying figures show the animal in various changes of form. The animal is attached by a short peduncle the area of attachment at the end of which is very small; some of the specimens which have accidentally become detached do not fix themselves again. The column is opaque white with a tinge of yellowish brown, the peristome is clearer and translucent with light brown radiating lines and the tentacles are grey to light brown with white tips and have distinct transverse zones of dark brown near the base and a little below the tip and sometimes a similar but fainter and less defined zone in the middle.

The specimens of the other species of Zoanthella and of the species of Zoanthina, of which I obtained a fair number last February, have also gone through their metamorphosis and have become fixed and sprouted tentacles.

As the preparation of my paper on these larvae and their adults will, I fear, take some time, it was thought desirable to publish this very brief preliminary note at once. Quite recently, I came across a reference to the rearing of Zoanthella by Cary in 1911. Till then I was not aware that anybody else had attempted the rearing of these larvae. As far as I am able to gather from Cary's Report, however, (vide *Carnegie Institution of Washington Year Book*, No. 10) no stage with tentacles was obtained by him.

Fig. 1 represents the Zoanthella larva which metamorphosed last year. Fig. 2 shows a tentacled stage with 42 tentacles as seen from the oral side, fully expanded. Fig. 3 represents another specimen fairly expanded, seen from the side. Fig. 4 shows another specimen just opening out. Fig. 5 shows the same specimen with the tentacles retracted and the peristome closed.

PRESIDENCY COLLEGE, MADRAS, K. RAMUNNI MENON.
April, 1914.

ECHINODERMA.

CHANGE OF NAME IN AN INDIAN GENUS OF ECHINOIDEA.—[The following is a translation of a note that appeared in the *Zoologischer Anzeiger* XLIV, No. 4, p. 191 (April, 1914)].

In a memoir which has just appeared (Echinoderma of the Indian Museum, part viii, Echinoidea [I], Calcutta, March, 1914) I have given the name *Eurypneustes* to a new genus of Spatangidae. This name, having already been applied to a fossil form, cannot be maintained: I propose to give the name *Elipneustes* to the new genus.

D. R. KOEHLER,
Professor in the University of Lyons.

CRUSTACEA.

NOTES ON .OME AMPHIPODS COLLECTED ON THE PAMIRS AT AN ALTITUDE OF 15,600 FEET.—In February of the present year, I received from the Indian Museum a tube of Amphipoda for identification, bearing the following label:—

"Reg. No. $\frac{8693}{10}$. From stagnant pool on summit of Killik Pass between Northern Hunza Range and the Taghdumkash Pamir. Altitude, 15,600 feet. Collected by Captain R. W. G. Hingston, I.M.S., 27th July, 1913. These Crustacea were numerous in pools near banks of Killik River."

On examination, the specimens proved to belong to the variable and widely distributed species, *Gammarus pulex*, Linn. The record is interesting, however, in that it marks the highest altitude from which this species has ever been collected, and 5000 feet higher than the previous highest record of 3200 métres (10,500 feet), from which altitude Chevreux ("Études sur la faune du Turkestan. II. Crustacés Amphipodes." *Travaux de la Soc. Imp. d. Nat. St. Pétersbourg*, t. XXXVII, 2, pp. 91–100, 1908) has recorded this species from Lake Tchatyr-Koule in Turkestan.

In the paper quoted, Chevreux records *G. pulex* from the following localities:—

Lake Issyk-Koule (1615 mét. altitude), Gorge de Karakol (2000 mét. altitude), and Lake Tchatyr-Koule (3200 mét. altitude), all in Turkestan; so that its occurrence on the banks of the Killik River, only some 130 miles south of the Gorge de Karakol is not surprising. Chevreux points out that this species is variable in certain of its characters, so that it might be useful to indicate the nature of this variation in the present specimens.

The posterior angle of the epimeral plate of the third segment of the metasome is considerably more produced and pointed than figured in Sars', Crustacea of Norway, Vol. I. Amphipoda. The number of spines on the segments of the urosome shows considerable individual variation. The maximum number observed is two median dorsal and a pair of lateral spines on each side on each of the three segments, but the dorsal pair are absent from the last segment in some of the specimens, and the lateral spines sometimes only number one on one or other of the segments.

The accessory flagellum of the first antennae is only as long as the first two joints of the main flagellum and is composed of two well developed joints of equal size followed by a third rudimentary joint. In this particular, the present specimens agree with those from Lake Tchatyr-Koule mentioned by Chevreux.

The telson has two or three spines and, in most cases, a single seta at the apex of each lobe. The lateral spine of the telson is placed much more distally and at the same time further in from the margin than shown in Sars' figure of the type form.

In all other characters, the present specimens agree very completely with the descriptions and figures given by Sars for the typical form and there is no reason to create a new species for the trivial differences noted above. It seems, however, worth while to place on record the capture of this species at the unusual altitude of 15,600 feet.

W. M. TATTERSALL.

[In addition to the examples mentioned above, there are in the Indian Museum collection specimens of *Gammarus pulex*, kindly determined for us by the Rev. T. R. R. Stebbing, which were obtained by Mr. Coggin Brown at the northern end of Lake Tali Fu (Erh Hai, Shan-kuan) Yunnan, China, at an altitude of about 7000 ft.

We also have the specimens from the Pamirs mentioned by Alcock in his *Report on the Natural History of the Pamir Boundary Commission*, p. 17, 1898].

INSECTS.

"*Xenopsylla nesiotes*": A CORRECTION.—In a previous number of this Journal (*Rec. Ind. Mus.*, Vol. VI, p. 43, 1911) I published a small paper on fleas sent to me for identification by the Indian Museum, and among them I mentioned *Xenopsylla nesiotes.* I regret to mention that this identification was incorrect; the specimens I called *Xenopsylla nesiotes* are really *Xenopsylla astia* (see *Novitates Zoologicae*, Vol. XVIII, p. 117, 1911).

N. CHARLES ROTHSCHILD.

XII. MALLOPHAGA FROM BIRDS (MOSTLY CORVIDAE AND PHASIANIDAE) OF INDIA AND NEIGHBOURING COUNTRIES.

By V. L. KELLOGG *and* J. H. PAINE, *Stanford University, California.*

(Plates xiv, xv.)

At the suggestion of Mr. C. W. Beebe, Curator of Birds in the New York Zoological Park, who visited the Indian Museum of Calcutta in 1910, Superintendent N. Annandale of this Museum sent to us a collection of Mallophaga taken from bird skins of the Museum. These Mallophaga were taken from the skins of crows, jays and pheasants, most of which had been collected in India. Some, however, had come from China, Persia, Tibet, the Malay Peninsula and elsewhere. The specific determinations of the birds may of course be accepted without question, and the localities are given for most of the specimens with admirable definiteness.[1] The determinations of the Mallophagan parasites, together with descriptions of the new species found among them, are presented in this paper.

The collecting of dead parasites from dry bird skins in Museums would, at first sight, seem to be a proceeding attended with a dangerous lack of certainty concerning the relation of parasite and host. A good deal of straggling might be expected. As a matter of fact, this danger is not a serious one. The comparison of host records based on collections made from dried skins with records based on collections from freshly obtained hosts in the field, show that on the whole the records from the dried skins are not misleading. Indeed a great majority of the records in Piaget's " Les Pediculines ", which is the monumental basis for all of our knowledge of the Mallophaga and their host relations, were made on a basis of the examination of skins in European museums. The lack of danger from straggling comes about from the sedentary habits of the parasites themselves and their early death after the host's death.

The collection of Mallophaga described in this paper is of particular interest because it offers a rather intensive study of the parasites of the Indian Corvidae and Phasianidae. The collection of Indian birds in these two families is particularly large in the Indian Museum, and parasites have therefore been taken from many species in the two families and from many individual speci-

[1] Specimens labelled "no history" are, with few exceptions, the skins of birds that have died in captivity in India.—*N. A.*

mens of the host species. It is on the basis of such intensive collections as these that anything like an inclusive knowledge of the relation of the Mallophaga to any given host must be based.

The types of the new species described in this paper are in the Indian Museum, Calcutta.

The writers wish to express their recognition of the courtesy of Superintendent Annandale in permitting them to examine so interesting a Mallophagan collection.

I. MALLOPHAGA FROM PHASIANIDAE.

Nirmus nigromarginatus, Piaget.

One female from *Gallus sonnerati* (no history, India).

Goniocotes indicus, n. sp.

(Plate xiv, fig. 4.)

One male specimen from *Arboricola rufigularis* (Jorpokri, East Himalayas). A bright-coloured, prettily patterned new form with rounded lateral margins and conspicuous, straight, backward-projecting posterior angles on the head. The figure represents the insect as somewhat too dull, the abdomen especially appearing considerably brighter in the specimen. This is a large species for *Goniocotes*.

Description of male: Head rounded, inflated, with broadly rounded front whose sides are somewhat flattened. General colour a rather bright yellow with reddish brown mandibles and markings. Antennal bands pale, continuous around the front, where they are widest, and turning in, as usual, before the antennae, though not much darkened at this point. Six fine hairs on each side on the front, the forward two being submarginal. There is a clearly defined, dome-shaped, semi-transparent space in front of the mandibles. Antennae well developed with second segment longest and fourth shortest; third and last segments about equal, basal second in length and thickened; colour a little paler than head. Triangular projecting area directly before antennae with surface appearing as though finely pitted. Eye large, but slightly protruding with a fairly long hair and large, granular fleck; ocular blotch quite dark with distinct margins. Temples convex in front, concave behind, with posterior angles acute and projecting straight backward nearly half the length of the prothorax and bearing a minute spine. Two long, pustulated hairs on the lateral margins of the temples behind the widest part and a short spine nearer the eye. Marginal bands little coloured, except close to the eye, and completely interrupted for the reception of the marginal hairs. Occiput sinuous, with marginal band, darker at each side, where it forms the ocular blotches. Occipital bands and signature lacking.

Thorax shorter than head and narrower, also slightly darker in general tone with rather broad marginal bands. Prothorax with anterior angles rounded, sides diverging and slightly concave with posterior angles protruding somewhat and bearing a pustulated hair. Posterior margin but slightly concave, bare. Metathorax with rounded angles, especially the anterior, and sides parallel; posterior margin obtusely angled on the abdomen. Two long hairs on each side, rising from a large, prominent, protruding pustule situated midway on the lateral margin; two other shorter ones on each side near the posterior margin, arising from a submarginal pustule at a point about three-fifths the distance from the meson to the side. Legs pale with a number of heavy spines.

Abdomen broadly elliptical, somewhat flattened toward the front and widest at the third segment. First segment much longer than any of those following, with straight, diverging sides, and broad slightly coloured marginal bands. Second to seventh segments with pale marginal bands giving rise to internal appendages, turning inward along the anterior margins and appearing as sharp, transversely linear lateral abdominal blotches dark in colour; these transverse appendages are produced forward into the segment preceding in the form of semicircular, plate-like processes. Segments one to seven with a transverse row of short hairs, limited between the lateral blotches above mentioned, the more lateral ones on segments two to six forming a group of long hairs, varying in number from four on the second to seven on the fourth and fifth; also the usual group of long hairs in each posterior lateral angle, except the first, most of them projecting from the ventral surface. Last segment rounded, entire, with numerous dorsal and ventral hairs. Genitalia prominent, extending nearly the length of the abdomen, with long, sharp appendages.

Measurements:

	♂, Length 2·75mm.	Width.
Head	·83	·83
Prothorax	·23	·57
Metathorax	·34	·74
Abdomen	1·53	1·20

Goniocotes nirmoides, n. sp.

(Plate xiv, figs. 5, 5*a*, 5*b*, 5*c*, and 5*d*.)

Several males and females from *Lophophorus impeyanus* (Zoological Garden, Calcutta). This well-marked form is characterized by the shape of the head, which is short and rounded in front with round, not angulated, temples.

Description of female: Head about as broad as long, subpentagonal in shape with broadly rounded front, flattened on the sides, and converging temples. Antennal bands entire, pale and widened in front with two dorsal hairs near the meson; also six marginal hairs on each side, the third being long. As usual the bands turn inward before the antennae, forming a prominent, partly blackish blotch on either side. Space before the mandibles not so distinct as in many species. Antennae pale with first joint short, equal in length to the adjacent trabecular angles; second segment longest, about as long as the two following together; third and last nearly equal and the fourth but little shorter (fig. 5*a*). Eye prominent with a long hair. Temples with a rounded anterior angle behind the eye, then considerably flattened and converging to the rounded posterior angles, in front of which is a slight emargination giving rise to a long hair (fig. 5*c*); on the anterior angles is a short hair and a little behind this a long one, another short one occurring midway on the flattened sides. Temples slightly darker than frontal or occipital regions of head. Occiput deeply emarginate with dark marginal band and slightly darker blotches at either end.

Thorax much shorter than head, with dark marginal bands. Prothorax with sides rounded and protruding, bearing a pustulated hair. Metathorax but little longer than prothorax, with diverging sides and acute posterior lateral angles bearing a pustule with three long hairs; another pustule with two long hairs a short distance in from these on the slightly convex posterior margin. Metathorax similar to first segment of abdomen. Legs well developed, lighter in colour than body.

Abdomen elliptical with prominent lateral angles and dark, heavily chitinized marginal bands; darkish transverse blotches, leaving a narrow light space on the meson, this space not so apparent in some specimens, however. A series of about six hairs across the middle of each segment, limited to the central portion of the abdomen, and a long hair on the posterior margin near the side on segments three to six; the usual long hairs in the lateral angles, increasing in number and length posteriorly. Last segment truncate, entire.

Male much shorter than the female. Antennae with first joint considerably enlarged, protruding, with numerous long hairs (fig. 5*d*).

Measurements:

	♂, Length 1·69 mm.	Width.		♀ Length 2·06 mm.	Width.
Head	·54	·54	..	·57	·64
Prothorax	·13	·33	..	·16	·34
Metathorax	·17	·50	..	·17	·52
Abdomen	·85	·87	..	1·18	·95

Goniocotes chrysocephalus, Giebel.

Specimens from *Argusianus argus* (Perak, Federated Malay States), *Lophura diardi* (no history, India), *Gennaeus andersoni* (no history), *Gennaeus albicristatus* (Mundali, Garhwal, 8500 ft., W. Himalayas, India), *Phasianus soemmeringi scintillans* (no history).

Goniocotes hologaster, Nitzsch.

Specimens from *Gallus gallus* (Gaya dist., Bihar).

Goniocotes rectangulatus, Nitzsch.

One male from *Pavo nigripennis* (no history, India).

Lipeurus variabilis, Nitzsch.

Specimens from *Gennaeus melanonotus* (Darjiling, Bhutan, India), *Gennaeus swinhoii* (no history), *Argusianus argus* (no history), *Phasianus torquatus* (birds in captivity, Calcutta, India), *Pavo nigripennis* (no history, India); also specimens which can be assigned to *variabilis*, but constitute one or more varieties of the specimens from *Chrysolophus pictus* (China), *Lophura ignita* (Zoological Garden, Calcutta, India), *Pavo nigripennis* (Zoological Garden, Calcutta, India) and a domestic fowl, (Calcutta, India).

Lipeurus rubrofasciatus, Piaget.

One female from *Arboricola rufigularis* (Jorpokri, 7000 ft., E. Himalayas).

Lipeurus intermedius, Piaget.

Male and female from *Pucrasia macrolopha* (Near Simla, W. Himalayas, India).

Goniodes neumannia, n. sp.

(Plate xv, figs. 6, 6*a*, 7 and 7*a*.)

Two males, eighteen females and two young from a single specimen of *Argusianus argus* (no history) and three females from another specimen of the same host from Perak, Federated Malay States. This is a curious new form lying rather between *Lipeurus* and *Goniodes*, and which in some future revision of the Mallophagan genera should probably be made the type of a new genus, but which we shall for the present include in *Goniodes*.

The female of this species is what Taschenberg (*Die Mallophagen*; 1882, pp. 32-34) mistakenly describes as the female of *Goniodes curvicornis*, Nitzsch, on the basis of a single specimen taken by Nitzsch, with a male of *curvicornis*, from "*Argus giganteus*" (which is *Argusianus argus*), and five specimens taken by Ruy, also with a male of *curvicornis*, from a dried skin of the same host. The males of *curvicornis* differ so much from these specimens that Taschenberg says that "males and females of *curvicornis* differ so much from each other that one could scarcely guess their relation if one did not take them from the same host." Our males, however, do unmistakably resemble the females and are entirely different from the males of *curvicornis.* It is simply an unusual coincidence that males of *curvicornis* without females of the same species, and females of another species (our new one) have been taken without the males, but the pheasants are so heavily parasitized, *Argusianus argus* already having four Mallophagan species recorded from it, that the coincidence is not at all an impossible one. Fortunately we have found several females of *G. curvicornis*, together with males, in the present lot. They were taken from *Argusianus argus*, and, as described in this paper under the proper species caption, are unmistakably like the males in species characteristics.

The new species is characterized by its short straight abdomen, which instead of being elliptical or sub-spherical in the male as is usual in *Goniodes*, is parallel-sided in both sexes. The abdomen of the male is not as long as the head and thorax together. The head of the male has shallow, concave temporal margins, and the antennae are very large and bear forked processes on the first segment, and the appendage of the third segment is strongly chitinized, very long and pointed so as to be almost claw-like; the last two segments appear as appendages to the third. The genitalia of the male are large, and in both specimens that we have are exserted. This exsertion is probably unnatural but may, because of the small size of the abdomen and unusual size of the genitalia, be natural. The general colour of both sexes is pale yellow with but few darker red-brown markings.

Description of male: Head sub-quadrilateral with rounded front, sides not expanding, the width across the temples but little exceeding that across the base of the clypeus. Front rather prominent and evenly rounded with a light brownish marginal band, terminating in two antennal blotches; a rather long hair and four short ones on the clypeus on each side The antennae (plate xv, fig. 6*a*) are set in rather deep emarginations; the first joint is very large, as long as all the succeeding together, and bears midway on its posterior margin a most prominent forked appendage bearing a stout spine between the two forks; the second segment is half as long as the first and bears a smaller appendage on its inner margin; the third segment is practically all appendage, is long, curved and claw-like and bears the last two segments of the antenna near its base, having the appearance of an appendage of the third; of these last two the first is very short and the last about half as long as the second; a few short hairs are present. The eye is prominent with an inconspicuous fleck and a short spine. Behind the eye the sides of the head are slightly concave and bear a short spine; on the rounded temples are two long, stout hairs, a short spine behind them and a prickle between, and farther back on the blunt posterior angle is a stout spine. The occiput is concave and the occipital band prominent, forming two pale blotches.

The thorax is longer than the head and broader; colour rather darker than head or abdomen, but with few markings. Prothorax semicircular, with rounded diverging sides and straight posterior margin; posterior lateral angles with a prominent hair. Metathorax longer than the prothorax, triangular-shaped, with broadly rounded anterior angles and convergent sides meeting in an angle on the abdomen; three prominent hairs arise on the anterior angles and a number of shorter ones along the posterior sides. Legs ordinary, pale in colour with a few hairs.

Abdomen pale, short and almost parallel-sided, shorter than head and thorax together. There are but few dorsal hairs. A slightly coloured submarginal band runs the length of the abdomen on each side and is broken at each suture, leaving a clear space in which is a darker, narrow blotch running crosswise. The posterior margin is deeply emarginate and the last segments are compressed on the meson. The genitalia, as before mentioned, are very large, with long rectangular basal portion and two pairs of prominent appendages, the external pair being flattened and blade-like and less chitinized than the other two; the strong muscles reach almost to the thorax.

The female (plate xv, fig. 7), at first sight, seems to be very different from the male, but upon closer observation, it is seen that this difference is caused by the lack, in the female, of the abnormal developments of the male. Compared to the male, the female is almost characterless. The only breaks in the continuity of the outline of the head in this sex are the slight antennal emarginations, the almost imperceptible protrusion of the eyes and the concave occiput. The front extends further forward than in the male and the two long clypeal hairs are replaced by short ones. The antennae (plate xv, fig. 7*a*) are ordinary with the second segment the longest. The hairs that appear on the posterior margin of the metathorax in the male, are apparently lacking in the female. The abdomen is much longer in proportion to the rest of the body than in the male, being longer than the head and thorax together, and is almost parallel-sided, this being a characteristic of the species, as before noted The last segment is entire with four long hairs; no dorsal hairs are visible.

Measurements:

♂, Length[1]	1·7 mm.	Width.	♀, Length 1·95 mm.	Width.
Head	·50	39	·52	·47
Prothorax	·22	·48	·16	·47
Metathorax	·26	·52	·25	·52
Abdomen	·86	·76	1·09	·70
Gentalia, exposed portion.	·37	·19		

[1] Not including genitalia.

Goniodes sectus, n. sp.

(Text-figs. 1 and 2.)

Males and females from *Catreus wallichii* (Garhwal, Darjiling and Kumaon, Himalayas, India). Species with head of male small, flattened in front, with temples rounded and female with conspicuous lateral, temporal angles.

Description of male: Colour golden brown, with thorax darker and with red-brown markings. Head small, rounded, about as broad as long, with flattened, though evenly rounded, front

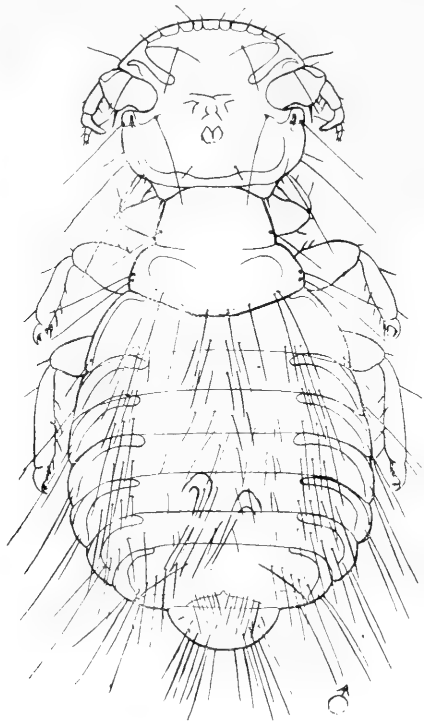


FIG. 1.—*Goniodes sectus*, Kellogg and Paine; Male.

and deep antennal emarginations; clypeus with marginal band widest in the centre and turning in before the antennae to form the long, narrow, red-brown antennal blotches, and with six hairs on each side, of which the second and last are the longest; on the anterior edge of the antennal emarginations is a long hair. Antennae with heavy first segment bearing a prominent protuberance on its posterior margin, from which arises a sharp spine; second segment as long as the third with its appendage, the appendage being quite long and continuous with the segment proper; last two segments about equal, much reduced, appearing as a two-jointed appendage of the third segment. Eye occupying the prominent posterior angle of the antennal emarginations, with an elongate ocular fleck, a long hair, and small, rounded, ocular blotch. Head widest before the antennae and narrowing at once behind the eye, or straight for a short distance as is the case in some specimens (see figure); temples compressed, rounded, terminating in two rounded projections behind, each bearing a spine, and into which the marginal band of the concave occiput does not enter; occipital blotches wanting. Temples with two long hairs, one short one before the others and a prickle behind them; dorsal surface of head with four unusually long hairs, two on the clypeus and one near each ocular blotch; also two short ones on the occiput.

Thorax small, much shorter than head and darker. Prothorax quadrangular with sides straight and slightly divergent, bearing a long hair just before the posterior lateral angles.

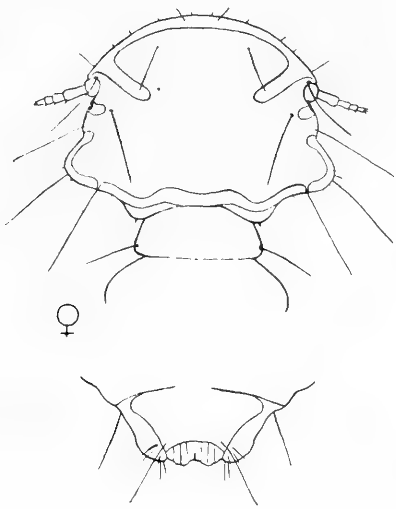


FIG. 2.—*Goniodes sectus*, Kellogg and Paine; Head and last segments of abdomen of female.

Metathorax but little narrower than head, with sides rounding inward anteriorly, each bearing two long hairs, and posterior margin convex on the abdomen bearing eight long hairs, the outer two on each side being paired. Posterior pair of legs with long tibiae.

Abdomen round, in older specimens much more so than is shown in the figure, nearly as broad as long; entire surface a clear golden brown, except the lateral bands which are red-brown; these latter are long and turn in along the anterior margin of each segment. The dorsal hairs arise along the middle of each segment, rather than along the posterior margin as is usual; those hairs near the horizontal portion of the lateral bands are grouped and longer. Last segment rounded, protruding and entire, bearing numerous long hairs and a few short spines. Genitalia slightly chitinized, indistinct even in old specimens.

Female with head widest across the temples, which protrude laterally forming prominent angles; antennae weak, set in shallow emarginations. Abdomen somewhat tapering behind with last segment divided.

Measurements :

♂,	Length 3·24 mm.	Width.	♀,	Length 3·56 mm.	Width.
Head	·96	·97	..	·96	1·34
Prothorax	·28	·69	..	·28	·69
Metathorax	·39	·96	..	·41	·95
Abdomen	1·76	1·83	..	2·28	1·73

Goniodes processus, n. sp.

(Plate xv, figs. 9, 9*a* and 9*b*.)

Two males from *Arboricola rufigularis* (Jorpokri, East Himalayas). A quite distinct form with large head and small thorax.

Description of male: Colour yellowish brown, head and thorax darker with central portion of abdomen quite pale and with dark red-brown markings on head and thorax and lighter lateral abdominal bands.

Head as broad as long, somewhat octagonal with prominent clypeus, flattened in front and on the sides and produced back under the antennae into a well developed hook, or trabecula-like process on each side (plate xv, fig. 9*b*); these processes are visible from above, showing through the first antennal segment. Marginal band broad, pale, ending in long, narrow, antennal blotches which reach inward and backward to the mandibles, the latter being set well back of the antennae and indistinctly visible; six inconspicuous dorsal and marginal hairs on each side of the clypeus, with several others on the ventral side. Antennae with rather short segments, the first being broad, without appendage and set into deep emarginations of the head; second segment about as long as the first is broad, and the third shorter with an appendage given off at almost right angles to the segment; last two segments together, of which the last is the longer, not quite as long as the second; colour of antennae about the same as that of the head. Eye prominent, rounded, with a long hair and small fleck; temples widening but slightly behind the eye, being no wider than the head across the trabecular processes, and then soon narrowing concavely, ending in two sharp, well produced points, between which is included the concave, but slightly sinuous occiput; occipital band and rounded blotches prominent.

Thorax small, a little narrower and but little over half as long as the head. Prothorax very short and narrow, being almost entirely included between the two posterior points of the head; lateral margin with one hair. Metathorax quadrangular, short, not half as long as broad, with parallel sides bearing three hairs on a prominent pustule; posterior margin obtusely angled on the abdomen, with four hairs, in groups of two. Legs pale, little developed.

Abdomen truncate, widest at the second and third segments, with first segment longest and last longest and protruding; lateral bands paler than head markings, turning inward and narrowing along the suture, with a narrow, horizontal blotch at that point; transverse blotches present, though but faintly visible; segments three to seven with two long hairs on the posterior margin on each side at the inner edge of the lateral bands; also a row of fine hairs across the central portion of each segment. Genitalia narrow, reaching nearly to the first segment and well chitinized with small appendages.

Measurements:

	♂, Length 3·08 mm.	Width.
Head	·96	·95
Prothorax	·24	·69
Metathorax	·37	·89
Abdomen	2·60	1·39

Goniodes megaceros, n. sp.

(Plate xv, figs. 8 and 8*a*.)

A single male specimen from *Lophophorus impeyanus* (Zoological Garden, Calcutta). This is a well marked new species, most resembling *G. bicuspidatus* Piaget; but plainly different, having longer processes on the first antennal segment, the metathorax not two-pointed behind, and the abdomen with heavy transverse blotches. In this species we find the highest development of the *Goniodes* male antenna. Colour golden brown, pale or almost transparent in some places, with dark reddish-brown markings, except the transverse abdominal blotches which are more of a chocolate brown.

Description of male: Head broader than long, squarish, with rounded but not prominent front. Clypeus with a long submarginal hair and five very short ones on each side. Marginal band narrow, turning in a short distance before the antennae to form the narrow, darker, antennal blotches; the clypeus at this point is slightly emarginate. The antennae (Plate xv, fig. 8*a*), set in emarginations of only moderate depth, are highly developed even for this genus. The first segment is large, almost as broad as long with a double-pointed appendage occupying the greater part of the posterior margin; this appendage is highly chitinized, the outer prong short and turned inward, the inner one very long, reaching well back on to the temples, narrowing near its extremity though terminating bluntly. Second segment a little shorter than the first and much narrower; third joint and its appendage appears as a single, curved, claw-like segment, with the greatly reduced fourth and fifth segments projecting from the outer margin, appearing as a two-jointed appendage; these last two segments are of about equal length. The third antennal segment and its appendage do not, in this species, appear as such: in fact if one considered this species alone the reason for considering the appendage present at all would not be apparent, but if one would imagine the appendage of the third segment in a form such as *G. processus* (described elsewhere in this paper), which is visibly appendage-like, as enlarged so as to become continuous with the segment proper, and imagine the last two joints as much reduced, he would see just such a form as we are now describing, and see the origin of this type. Below the antenna is a rounded ocular blotch and the clear prominent eye which bears posteriorly a short hair. The temples are quite square and are rather darker coloured than the rest of the head, and the margin, which is bordered by a pale, broken band ending in a narrow blotch behind the eye, bears two long, stout hairs and three short spines. Occiput concave, slightly sinuous, bare.

Thorax much longer than head. Prothorax trapezoidal with sides divergent and bordered by a dark band; posterior angles acute, bearing a long hair; posterior margin indefinite. Metathorax slightly broader than head, triangular, with apex forming a slightly obtuse angle on the abdomen; anterior lateral margins curved, with marginal bands which curve in toward the meson; the coxal bands appear within, parallel to those just mentioned. Each of the rounded lateral angles bears two hairs on a pustule, while on the posterior margin on each side are three submarginal hairs, two together near the lateral angles and one near the meson. Legs pale, ordinary.

The abdomen is shorter than the head and thorax together, is short and rounded, widest at the third segment; on each segment are lateral marginal bands, well chitinized, those behind the first entering into the segment preceding and curving inward. The large, dark, transverse blotches do not meet in the centre, the space left being uncoloured; dorsal hairs occur on the first five segments, confined to the central area, and on these segments, near the inner termination of the lateral marginal bands below the spiracles, arises a group of three or four hairs. The last three segments are compressed, the last entire and not reaching back as far as the one before, nor that one as far as the one before it; there is a fringe of about twenty-two long hairs across the dorsal surface of the last segment and the usual ones in the lateral angles of the other segments. The genitalia are prominent with heavily chitinized rods reaching to the second abdominal segment.

Measurements :

	♂, Length 4·40 mm.	Width
Head	1·33	1·58
Prothorax	·58	1·20
Metathorax	1·00	1·75
Abdomen	2·08	2·46

Goniodes colchicus, Denny.

Many specimens from *Gennaeus albocristatus* (Mundali, Garhwal, 8500 ft. India, Simla, W. Himalayas), and *Gennaeus leucomelanus* (Nepal), *Gennaeus melanonotus* (Bhutan, E. Himalayas), *Phasianus humiae* (Ruby Mines, Burma), *Chrysolophus pictus* (China).

Goniodes dissimilis, Nitzsch.

Many specimens from *Phasianus principalis* (Morghal, Herat, Central Asia), *Phasianus torquata* (birds in captivity, Calcutta, India), *Phasianus soemmerringi scintillans* (no history), *Ithagenis cruentus* (Sikkim, E. Himalayas), *Gallus sonnerati* (Bangalore, S. India), and domestic fowl (Calcutta, India).

Goniodes eurygaster, Piaget.

Many specimens from *Lophophorus impeyanus* (Mussoorie, Kumaon, W. Himalayas; Sikkim, Darjiling, E. Himalayas).

Goniodes latifasciatus, Piaget.

Many specimens from *Lophura ignita* (no history, India), *Polyplectron bicalcaratum* (no history, India), *Acomus erythrophthalmus* (no history, India).

Goniodes curvicornis, Nitzsch.

Numerous males and females from *Argusianus argus* (no history, India).

The females of this species, wrongly described by Taschenberg[1] (see our account, in this paper, of *Goniodes neumannia*, n. sp.) have a broadly elliptical abdomen, broad head, widest at posterior margin with angulated postero-lateral angles. The head is wider than that of the male and not so flattened and has the clypeal margin less flattened and more nearly parabolic in outline. The markings of head and body and the distribution and character of the hairs are like those of the male.

Goniodes cervinicornis, Giebel.

Males and females from *Lophura diardi* (no history, India).

Goniodes bicuspidatus, Piaget.

Numerous males and females from *Tragopan blythi* (Naga, Haka, and Mishmi Hills, Assam), *Tragopan caboti* (China), *Tragopan satyra* (Kumaon, W. Himalayas).

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[1] *Die Mallophagen*, 1882, pp. 32-34.

Goniodes falcicornis, Nitzsch.

Two females from *Pavo nigripennis* (Zoological Garden, Calcutta, India).

Colpocephalum thoracicum, n. sp.

(Text-fig. 3.)

A single female from *Pavo muticus* (Burma). An extremely small species, but from blotches, etc., certainly an adult. But five

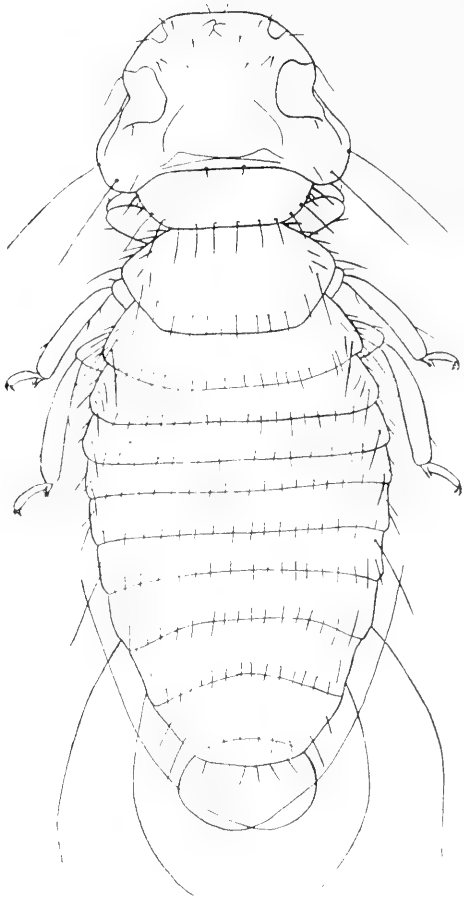


FIG. 3.—*Colpocephalum thoracicum,* Kellogg and Paine; Female.

other species of *Colpocephalum* have been recorded from the *Phasianidae.*

Description of female: Color pale yellow, uneven, in some places transparent, with blackish blotches on head. Head broader than long, widest across the temples; front flattened, straight; sides before the notch-like lateral emarginations slightly rounded, but flattened, with a small dark blotch near the front. Lateral emarginations shallow with anterior angles rounded and surrounded by a large, dark chestnut to black blotch. Temples rounded, with indication of an angle behind, bearing a long marginal hair and, probably, a long surface hair, a distinct pustule being present. Occiput concave, with two short hairs and marginal blotches but little colored. Mandibles small but heavily chitinized; surface of head with a number of short hairs.

Thorax about as long as head. Prothorax short, flattened behind, with ten hairs; there are also two short spines at the sides and a long spine in the anterior angles. Metathorax quite large, hexagonal, broader than long; on the anterior lateral margins are several spines, while behind is a series of about twelve marginal hairs; there are also several lateral surface hairs. Legs pale in color, with narrow tibiae; mesothoracic pair missing in the specimen at hand.

Abdomen elliptical with yellowish transverse bands, interrupted submarginally, leaving a clear space running parallel to the margin of the abdomen; continuations of these transverse bands, laterad of the clear space, form indefinite lateral blotches; lateral blotches on last segment lacking, the median band nearly covering the entire surface. Last segment longer than the preceding, rounded, bearing two extremely long hairs, shown curved forward in the accompanying figure, and several short marginal ones; the two preceding segments also bear a long hair on each side; dorsal hairs on each segment weak.

Measurements:

	♀, Length 1·33 mm.	Width.
Head	·31	·43
Prothorax	·12	·30
Metathorax	·16	·36
Abdomen	·83	·56

Colpocephalum longicaudum, Nitzsch.

Males and females from *Argusianus argus* (no history) and domestic pigeon (Calcutta, India).

Colpocephalum appendiculatum, Nitzsch.

One female from *Argusianus argus* (Perak, Federated Malay States).

Menopon productum, Piaget.

Many specimens from *Acomus erythrophthalmus* (no history), *Acomus pyronotus* (no history, India), *Lophura diardi* (no history, India), *Phasianus seommerringi scintillans* (no history, India), *Phasianus ellioti* (Zoological Garden, Calcutta, India), *Lophura ignita* (Zoological Garden, Calcutta, India), *Gallus sonnerati* (Bangalore, S. India), *Chrysolophus pictus* (China).

Menopon subequale, Piaget.

Males and females from *Acomus erythrophthalmus* (no history), *Gennaeus melanonotus* (Bhutan, E. Himalayas).

Menopon brevipes, Piaget.

Males and females from *Crossoptilon mantchuricum* (no history).

Menopon unicolor, Piaget.

One female from *Phasianus torquatus* (bird in captivity Calcutta, India).

Menopon ventrali, Nitzsch.

Three females from *Argusianus argus* (no history).

Menopon pallidum, Nitzsch.

Males and females from domestic fowl (Calcutta, India).

II. MALLOPHAGA FROM CORVIDAE.

Docophorus thryptocephalus, n. sp.

(Plate xiv, figs. 1 and 1*a*.)

Several males and females from *Graculus graculus* (Chitral and Gilgit, N.W. India). This species resembles *D. atratus*, N., and *D. extraneus*, Piag., but differs from the former in having a shorter clypeus, and broader, more rounded temples, and from the latter in having a narrower clypeus; it also differs from both in having a three-lobed clypeal signature and in the fact that the head is much broader than long. The abdominal blotches are also darker and broader.

Description of female: Head, shape of an equilateral triangle with rounded angles Clypeus narrow, with clear anterior margin slightly convex or irregular. Lateral edges before antennae straight, diverging; antennal bands indefinite, irregular, interrupted at the suture, leaving a small clear space on the margin from which a very long hair arises; before the trabeculae the bands turn inward to join the occipital bands, becoming quite indefinite before they do so, however; that portion of bands near antennae very black A fine hair arises at the anterior termination of the antennal bands, also a hair on the dorsal surface at the middle of the inner edge of the anterior portion before the sutural interruption, and two more arising on the ventral surface and passing the margin behind that point. Signature with three lobes, the centre one pointed, reaching well down on to the mandibles; central and anterior portions of signature pale. Space in front of the mandibles pale, divided by the signature. Trabeculae well developed, reaching beyond first segment of the antennae (fig. 1a) and slightly curved backward. Antennae long, first segment thick and about equal in length to the second; last three about equal in length, each half as long as the second; first segment light in colour with narrow black margins, the three following with dark transverse bands, the last lighter. Eye prominent, clear, with a very long hair on the dorsal surface. Ocular band narrow, curving inward, black near the margin at the anterior edge of the eye. Temples broadly and regularly rounded with a narrow, black, marginal band, interrupted by three pustules from which rise the long marginal hairs, and ending in contact with a black ocular fleck; a fourth marginal hair just below the eye, shorter than the others. Temples of a uniform dark chestnut colour. Occiput almost straight; occipital blotches blackish and occipital bands definite, extending forward, becoming somewhat indefinite before meeting the antennal bands. Occipital signature prominent, pointed in front. Space between occipital bands pale yellowish in colour.

Thorax shorter than head. Prothorax ordinary, with a long hair on the dorsal surface in each posterior lateral angle, arising from a clear pustule. Lateral margins with dark bands connecting with the internal chitinous structures. Metathorax diamond-shaped, with rounded lateral angles and prominent posterior angle. Posterior margin with a series of about eighteen pustulated hairs arising from the edge of the broad submarginal band; this band is interrupted on the meson and is continuous with the narrower lateral marginal bands. Legs well developed, dark in colour, with black markings on the femora and tibiae.

Abdomen elliptical, widest at the fourth segment. Ground colour light, almost transparent in some specimens, with dark chestnut abdominal blotches; blotches rounded, overlapping in front and behind, with the spiracles showing as clear spaces. Dorsal hairs evenly spaced across each segment, the series varying from ten to twenty-four in number. Genital blotch with two large, clear pustules.

Male much smaller than female, with abdomen more rounded. Last segment of abdomen entire.

Measurements:

	♂, Length 1·61 mm.	Width.	♀, Length 2·01 mm.	Width.
Head	·50	·54	·54	·67
Prothorax	·12	·29	·12	·29
Metathorax	·14	·45	·26	·23
Abdomen	·89	·78	1·25	·71

Docophorus atratus, Nitzsch.

Many specimens from *Corvus cornix* (Kashgar, Chinese Turkestan; S. E. Persia), *Corvus splendens* (Calcutta, Guna and Trivandrum, S. India), *Corvus insolens* (Katha and Mergui, Burma), *Corvus macrorhynchus* (Upper Burma; Gilgit, N.W. India), *Corvus corax* (Ladak, Little Tibet), *Corvus corone* (Yarkand, Chinese Turkestan), *Corvus sharpi* (Yarkand), *Corvus umbrinus* (Baluchistan), *Corvus scapulatus* (Abyssinia), and *Corvus danuricus* (Pekin, China).

The specimens from some of these hosts merit being distinguished under varietal names, but we shall not so designate them at present.

Docophorus fulvus, Nitzsch.

Many specimens from *Urocissa flavirostris* (Kashmir; Murree, W. Himalayas; Ghoom, 7500 ft., E. Himalayas), *Dendrocitta rufa* (Cachar, Assam and Calcutta, India), *Dendrocitta himalayensis* (Darjiling; Perak), *Dendrocitta formosae* (N. Formosa), *Garrulus lanceolatus* (Murree, W. Himalayas), *Nucifraga multipunctata* (Gilgit, N.W. India), and *Pica rustica* (Ladak).

Docophorus leontodon, Nitzsch, var. **graculae**, Piaget.

Males and females from *Urocissa occipitalis* (Nepal Valley, E. Himalayas), and *Dendrocitta sinensis* (Foochow, China).

Docophorus crassipes, Nitzsch.

One female from *Pica rustica* (Punjab, India).

Docophorus superciliosus, Nitzsch.

One male and two females from *Graculus graculus* (Little Pamir).

Docophorus platystomus, Nitzsch.

One male from *Corvus cornix* (Gilgit, N.W. India).

Docophorus rotundatus, Piaget.

One male and two females from *Corvus splendens* (Nepal Valley, E. Himalayas).

Docophorus guttatus, Nitzsch.

Males and females from *Corvus monedula* (Gilgit; Yarkand, Chinese Turkestan), and *Corvus macrorhynchus* (Nepal Valley).

Nirmus biguttatus, n. sp.

(Plate xiv, figs. 2, 2*a* and 2*b*.)

Males and females from *Graculus graculus* (Gilgit, Sarhad and Little Pamir, N. W. Frontier of India; Khambajong, Tibet), also from *Nucifraga multipunctata* (Gilgit). Differs from other Corvine Nirmi in heavy chitinization of head and body, showing as heavy, broad, transverse abdominal bands.

Description of male: All coloured portions quite dark with spaces between markings pale or transparent. Head bluntly conical, semi-parabolic before the antennae with sides of front flattened. Antennal bands blackish, continuous around the clypeus, but uncoloured where they meet in front, narrow, turning in before the antennae to form a black-edged blotch on each side. A median, inverted goblet-shaped clear space in front of the mandibles, bounded on each side by narrow, dark, not black, internal bands, losing their colour forward where they meet the transparent portion of the marginal band. Remaining area of head in front of antennae of a uniform, rather dark brown. Four evenly spaced clypeal hairs on each side of the central clear space; another smaller one on the angle before the antennae and two more in front, quite long, extending from the ventral surface. Antennae differing in the two sexes, being a third longer in the male, with the first segment longest and much enlarged; second segment nearly as long and but little shorter than the last two together; fourth and fifth about equal, while the third is a little longer than either of these two; each segment with several short hairs. In the female the second segment is much the longest and the last is longer than either of the two preceding. In both sexes the second, third and fourth joints are more darkly coloured. Antennal bands small, consisting of a small black blotch at the forward edge of each of the prominent eyes; eye with a short hair. Temples somewhat narrowly rounded, not expanded, with sides somewhat flattened; the dark, narrow, marginal bands interrupted on the rounded posterior angle, leaving a small clear space from which arises a long hair; some distance behind this is a minute prickle. In figure 2 the temples appear a little too much rounded, though there appears to be some variation in this respect, especially between the two sexes (fig. 2b). Occiput but slightly concave, bare, pale in colour. Ocular bands but partially visible, not meeting the occiput; space between bands clear, with signature visible, though indefinite.

Thorax much shorter than head. Dark lateral bands on both segments, turning in along their posterior margins, those of the metathorax not meeting on the meson and much heavier than those of the prothorax. Prothorax ordinary, with a long hair in each posterior lateral angle; metathorax longer than prothorax with straight, diverging sides; posterior margin obtusely angled on the abdomen, with a series of about fourteen submarginal hairs. Legs well developed with long, narrow tibiae and blackish markings.

Abdomen elliptical, widest at the third and fourth segments, each segment except the last with a dark blotch on each side, much darker toward the lateral margins with clear spaces for the spiracles on segments one to seven; in some specimens these blotches meet at the centre and in others a median clear space is left. The ventral median blotches are visible from the dorsal surface. The last segment is rounded, protruding, bearing numerous long hairs. Each of the other segments with a transverse series of hairs arising along the posterior margin of the lateral blotches; there are also several long hairs in the posterior lateral angles. Genitalia appearing as a quadrangular plate with thickened margins and short penis and external appendages.

Female longer, more linear than male. Antennae as described above; last segment of abdomen bilobed, with two small blotches (fig. 2a); penultimate segment entirely coloured. In the specimens at hand the space between the blotches is not so clear as in the male, making the blotches appear less definite.

Measurements:

	♂, Leng. 1·62 mm.	Width.	♀, Leng., 1·92 mm.	Width.
Head	·47	·42	·50	·47
Prothorax	·12	·25	·10	·24
Metathorax	.14	·37	·12	·34
Abdomen	·98	·54	1·22	·52

Nirmus olivaceus, Nitzsch.

Many specimens from *Corvus splendens* (Nepal Valley, Trivandrum and Calcutta, India), *Corvus macrohynchus* (Nepal Valley, Ponsee, 3300 ft., Yunnan), *Pica rustica* (Upper Burma), and *Platysmurus leucopterus* (Perak, Federated Malay States).

Nirmus marginalis, Nitzsch.

Many specimens from *Dendrocitta rufa* (Calcutta, India; Cachar and Gowhatty, Assam; Burma), *Dendrocitta himalayensis* (Nepal Valley), and *Urocissa occipitalis* (Maundi, N.W. India; Upper Burma).

Nirmus varius, Nitzsch.

Many specimens from *Corvus monedula* (Yarkand and Gilgit), *Corvus frugilegus* (Gilgit and Herat), *Corvus corax* (Ladak), and *Pica rustica* (Gilgit and Ladak).

Nirmus nigrosignatus, Piaget.

Males and females from *Garrulus leucotes* (Upper Burma).

Nirmus uncinosus, Nitzsch.

Males and females from *Corvus cornix* (Gilgit).

Nirmus punctatus, Nitzsch.

A single female of this characteristic gull- and tern-infesting *Nirmus* is included in the collection as taken from *Dendrocitta rufa*

(Calcutta, India). This is a clear case of straggling, the bird skin from which the parasite was taken having probably been temporarily near the skin or body of some gull or tern.

Nirmus clypeatus, n. sp.

(Plate xiv, figs. 3, 3a and 3b.)

A single male specimen from *Corvus cornix* (Kashgar, E. Turkestan). This species is Lipeuroid in general aspect of head and Nirmoid as to hind body.

Description of male: Head truncate conical, with transparent, expanded clypeus, the latter being the only part of the body without some colour. Portion of head in front of antennae considerably longer than that behind. A hair on the dorsal surface in the rounded anterior lateral angle of the clear portion of the clypeus; a marginal hair at the beginning of this clear portion and two more submarginal ones, one dorsal and one ventral, just behind; another hair on the margin at the distinct suture and a long one on the ventral surface directly mesad; also a hair on the margin some distance above the antennae and a ventral submarginal one midway between it and the suture. Clypeal signature broad, sides nearly parallel, obtusely pointed behind and somewhat paler than the general colour of the head. A light space before the mandibles, enclosed laterally by incurving internal bands. Antennal bands darkest where they turn inward before the antennae, extending forward a little past the origin of the clear portion of the clypeus and interrupted at the suture. Trabeculae acute, slightly shorter than the basal segment of the antennae. Antennae long, filiform, with first joint short, about the same length as the fourth; second segment longest, about as long as the two following together, and the last second in length. Eyes inconspicuous with a long hair. Temples flattened, slightly convex with rounded posterior angles; two hairs and a short prickle before these angles and narrow, black marginal bands extending from the posterior hair forward to the eye. Occiput slightly concave with anterior margin of prothorax showing through. Occipital bands pale, not reaching the occiput; space between bands a little lighter in colour than the temples with occipital signature visible.

Thorax about one-third shorter than head. Prothorax quadrilateral with sides slightly convex. Marginal bands present, turning in before they reach the posterior margin, not meeting on the meson; coxal bands distinct; a short hair in the posterior lateral angles. Metathorax with diverging sides and posterior margin obtusely angled on the abdomen. Three hairs arising from a clear pustule in the posterior lateral angle and two more near them with another small one, as shown in fig. 3b. Legs stout with few hairs.

Abdomen, excluding the first segment, elliptical, elongate, widest at the fourth segment; first segment appearing as a constriction, with sides slightly converging, narrower than metathorax and much shorter than following segment; four hairs near the meson on the first segment, two near the anterior and two near the posterior margin, the latter being the longer. Second segment the longest, second last the shortest. Each segment with a transverse series of hairs, varying from two to four in number, the external one of each series on segments three to six being very long; there are also several hairs in the posterior lateral angles, increasing in length posteriorly. Each segment with a transverse band extending the full length of segments one to six inclusive, and partially divided on the meson, the division being most complete forward and diminishing in extent posteriorly; in the seventh and eighth segments the bands are narrowed and completely divided. Last segment rounded, entire, with numerous marginal, dorsal and ventral hairs and blotch covering segment. Genitalia with long, stout external appendages, equal in length to the anterior portion.

Measurements :

	♂, Length 1·88 mm.	Width.
Head	·50	·29
Prothorax	·11	·21
Metathorax	·16	·29
Abdomen	1·11	·47

Nirmus rufus, Nitzsch.

A single male from *Corvus sharpi* (Yarkand, Chinese Turkestan).

This specimen shows such differences from the description of the type of the species that it should probably be given a varietal name.

Colpocephalum semicinctum, Rudow.

Males and females from *Corvus splendens* (Trivandrum and Calcutta, India), *Corvus insolens* (Mergui, Burma), and *Corvus scapulatus* (Abyssinia).

Menopon insolitum, n. sp.

(Text-fig. 4.)

One male and one female from *Corvus insolens* (Mergui, Burma) This species belongs with Piaget's crow-infesting group, among which are several species with curiously deformed abdominal segments, and with two prominent groups of three or four short spines on the lower side of the first or second abdominal segments. Several of these species are: *M. trinoton*, Piaget, *M. anathorax*, Nitzsch, and *M. mesoleucum*, Nitzsch. The present species differs from these in the form of the metathorax, the posterior margin of which is strongly convex, as well as in the shape of the abdominal segments. This unusual condition of thorax and abdomen is found only in the female.

Description of female: Colour of body yellowish brown with lighter legs and head; thorax and abdomen with numerous short marginal spines. Head much wider than long, pale, almost transparent except for the curved ocular bands, mandibles and marginal occipital band. Front slightly angled on the meson and at the sides, with apparently several short hairs which have been broken off in our specimen, and longer ones before the ocular emarginations; ocular fringe prominent. Temples expanded, widest in front, with three pustules from which the hairs have been

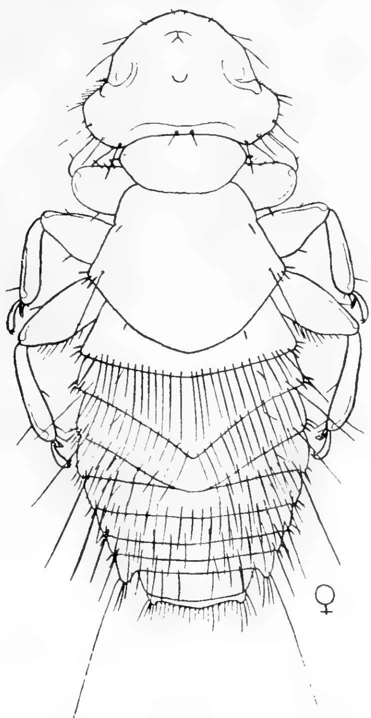


FIG. 4.—*Menopon insolitum*, Kellogg and Paine; Female.

broken, also two short hairs on each side; occiput concave with two short hairs.

Thorax just as wide as the head and as long as the first eight abdominal segments. Prothorax with median lateral angles bearing a short spine; posterior margin obscured, though probably convex. Metathorax, including mesothorax (which is indicated by a slight lateral marginal emargination), large, with posterior margin highly convex on the abdomen; sides almost straight, the posterior lateral angles armed with several short spines and a long submarginal hair. Colour of thorax darker than either head or abdomen, showing several internal bands.

Legs paler, front femora broad, last femora with a group of many short hairs along the posterior margin.

Abdomen shorter than head and thorax together, with sides evenly rounded, widest about midway; last segment truncate, bearing a fringe of fine hairs. Second and third segments strongly angled behind, the second being acute and the third more rounded; sixth and seventh segments short; segments five to eight with backward projecting postero-lateral angles, those of the eighth being quite prominent and each bearing a very long hair; these angles on all segments before the eighth bearing several short spines. Each segment bears a series of hairs across the posterior margin.

The male specimen at hand is very much smaller than the female, is probably not mature, though the genitalia appear well developed. The head is large in proportion to the rest of the body, with ocular bands and marginal occipital band darker than in the female specimen; a prominent, black ocular fleck is also present. The metathorax does not extend back over the abdomen as in the female, and the abdominal segments are ordinary. The abdomen is small, elliptical, with last segment entire, convex. The genitalia bear two well separated processes.

Measurements:

(probably juv.), ♂	Leng. 1·30 mm.	Width.	♀, Leng. 1·59 mm	Width.
Head	·34	·47	·36	·53
Prothorax	·13	·29	·13	·34
Metathorax	·28	·37	·43	·52
Abdomen	·60	·47	·80	·64

Menopon monochromateum, n. sp.

(Text-fig. 5.)

One female from *Garrulus lanceolatus* (Simla, W. Himalayas) and another from *Graculus graculus* (Khambajong, Tibet). A small, almost unicoloured species with unusually distinct black eye flecks and evenly parabolic anterior margin of the head.

Description of female: Ground colour of body yellowish brown, with golden brown markings and pale legs and marginal regions of head. Head much wider than long, semilunar, front with but faint indication of a median angle. Clypeus with two fine hairs, one on each side near the meson and five more, one of which is long, on the sides before the region of the ocular emargination. Ocular emargination almost completely filled by the eye, the latter with a large, distinct, black fleck. Temples narrow, rounded, bearing four long hairs, three of about half the length and several short spines. Occiput concave, apparently bare, with two small, dark, marginal blotches. Colour pale yellowish brown marginally, and darker, more golden near the centre; ocular bands dark, curving inward and forward; mandibles weak.

Thorax narrow, darker than rest of body, with distinct internal bands. Prothorax lenticular, the sides and posterior margin being continuous and rounded and bearing twelve hairs. Metathorax slightly wider, of about equal length, appearing as the first abdominal segment and bearing a submarginal series of about sixteen hairs. Legs pale, with broad femora and narrow tibiae well furnished with hairs.

Abdomen yellowish brown, long, widest near the middle; each segment with a darker, indefinite, transverse band and

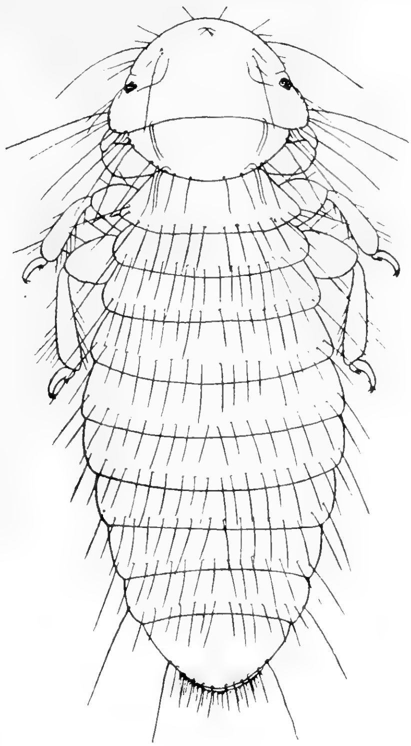


FIG. 5.—*Menopon monochromateum*, Kellogg and Paine; Female.

indefinite, interrupted marginal band. All segments, except the last, of about equal length, the last longer and rounded behind, bearing a fringe of hairs. Each segment with a transverse, submarginal series of hairs, the lateral ones the longest.

Measurements :

	♀, Length 2·03 mm.	Width.
Head	·37	·67
Prothorax	·19	·50
Metathorax	·19	·56
Abdomen	1·40	·83

Menopon nigrum, Kellogg & Paine.

Many specimens from *Corvus splendens* (Nepal Valley, Guna, Trivandrum and Calcutta, India), and *Corvus macrorhynchus* (Foochow, China).

Menopon mesoleucum, Nitzsch.

Males and females from *Corvus cornix* (Kashgar and Gilgit), *Corvus corone* (Yarkand).

Menopon albiceps, Piaget.

One female from *Garrulus sinensis* (Foochow, China).

Menopon meniscus, Piaget.

One female from *Pica rustica* (Shiraz, Persia).

Menopon picae, Denny.

One male from *Graculus graculus* (Khambajong, Tibet).

III. MALLOPHAGA FROM MISCELLANEOUS BIRDS.

Lipeurus secretarius, Giebel.

Numerous males and females from *Vultur monachus* (Dhappa, nr. Calcutta, India).

Lipeurus baculus, Nitzsch.

Many specimens from domestic pigeons (Calcutta, India).

Colpocephalum maculatum, Piaget.

Males and females from *Vultur monachus* (Dhappa).

Menopon breviceps, Piaget.

Four females from a domestic duck (Berhampur, Murshidabad dist., Bengal).

Nitzschia minor, n sp.

(Plate xv, fig. 10).

Males and females from *Cypselus affinis* (Calcutta). This species differs from other *Nitzschias* in having the temples rounded and not expanded nor angulated. It is of small size with no strong markings and does not have a flat clypeal front as in Carriker's *N. latifrons*.

Description of female: Colour pale yellowish brown, head lighter than thorax and abdomen, with no dark markings except ocular flecks and mandibles which are blackish.

Head shape of triangle with corners cut off, broader than long; front very obtusely but distinctly angled, with six or seven long hairs and several shorter ones; the concavity of the margin at point where palpi would project is all but imperceptible and the ocular emarginations are shallow with a conspicuous ocular fringe. Temples rounded, not angulated nor expanded, with five long hairs on each side and two short ones, also two short spines. Occipital margin concave, almost straight in the middle with four long hairs. Ground colour pale tawny with small, black, ocular flecks, blackish mandibles, brownish blotches on each side of the clypeus, and very small, weakly coloured ocular blotches.

Thorax just as long as the head. Prothorax trapezoidal with shortest side behind; sides converging, almost straight, and posterior margin slightly rounded; a long hair and two spines in the anterior angles, a hair on the rounded posterior angles and four on the posterior margin. Line of fusion between the meso- and metathorax plainly visible, marked by lateral emarginations and by a suture; metathorax appearing as the first abdominal segment, with four short spines along the mesothoracic suture, two stout spines in the posterior lateral angles and a row of hairs across the posterior margin. Legs rather long, concolorous with the thorax, the first pair with broad, short femora and the last pair with a patch of many short hairs, invisible from above, on the under side of the femora.

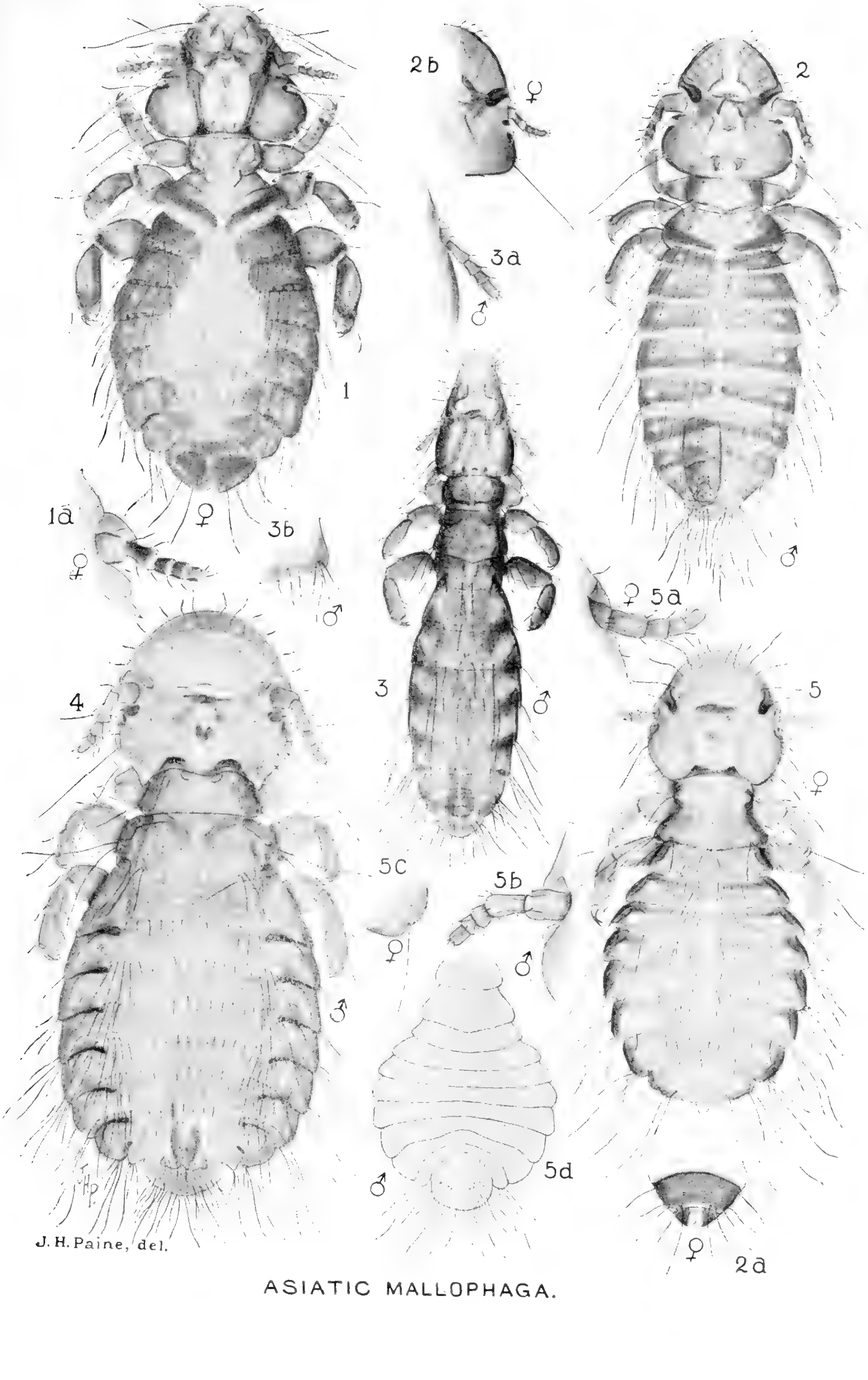
Abdomen elongate, widening to the fourth segment, then rounding evenly to the last which is truncate and bears a fringe of fine hairs; several short spines on the posterior margin of the first three segments near the lateral angles and each segment with a row of hairs across the posterior margin; posterior lateral angles with the usual long hairs. Colour an even yellowish brown with no blotches visible; narrow, transparent, lateral bands are present. Beneath, the sutures are laterally distinct and here is borne on each side a row of from five to eight short spines. In the male the last segment is narrower, more rounded and slightly protruding, not truncate.

Measurements:

	♀, Length 1·92 mm.	Width.	♂, Length 1·75 mm.	Width.
Head	·47	·59	·39	·52
Prothorax	·23	·36	·22	·32
Metathorax	·32	·58	·27	·48
Abdomen	·90	·71	·87	·71

EXPLANATION OF PLATE XIV.

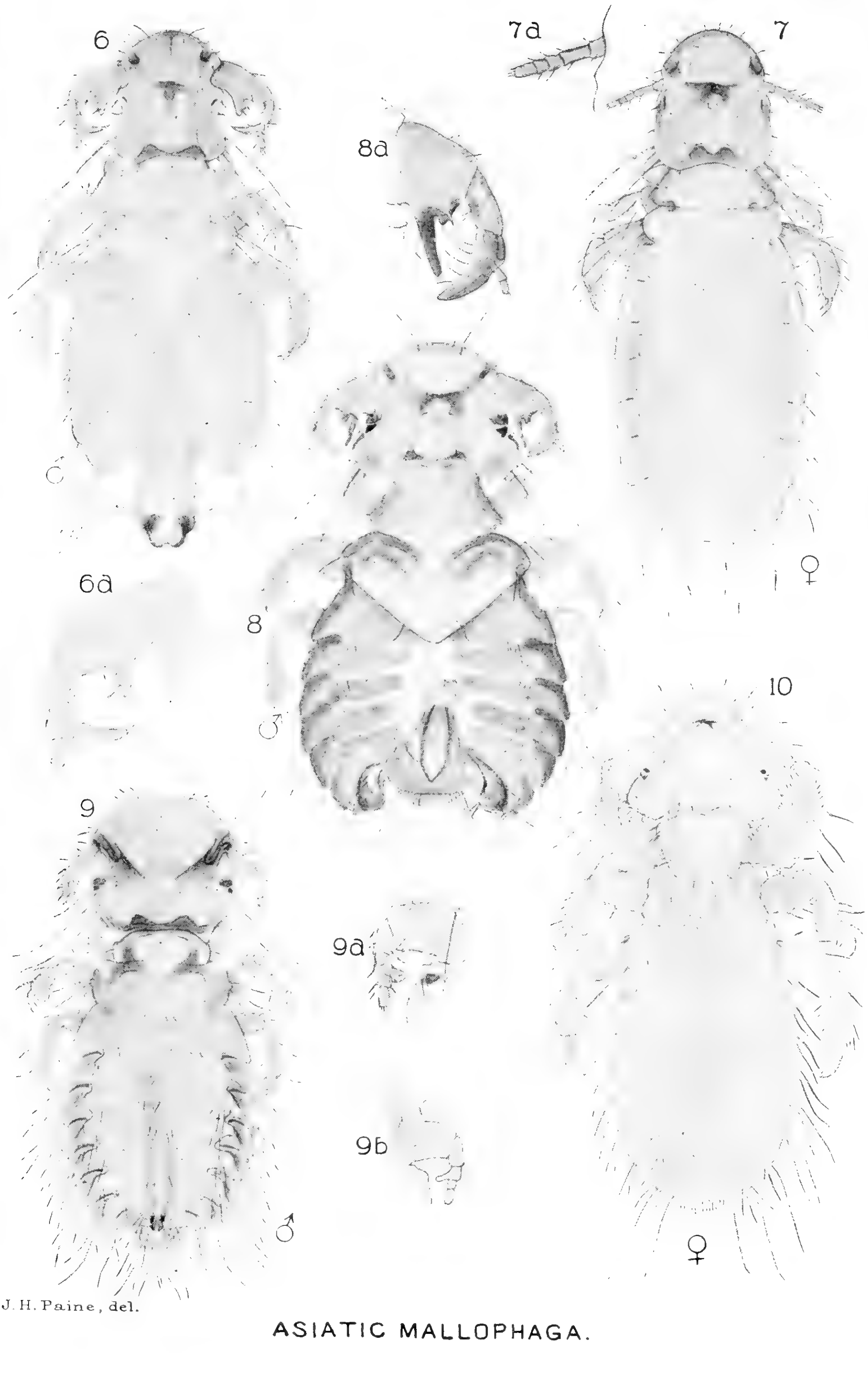
Fig. 1.—*Docophorus thryptocephalus*, K. & P., ♀.
,, 1*a*. Antenna enlarged
,, 2.—*Nirmus biguttatus*, K. & P., ♂.
,, 2*a*. Last segments of female.
,, 2*b*. Antenna of female.
,, 3.—*Nirmus clypeatus*, K. & P., ♂.
,, 3*a*. Antenna enlarged.
,, 3*b*. Arrangement of metathoracic hairs.
,, 4.—*Goniocotes indicus*, K. & P., ♂.
,, 5.—*Goniocotes nirmoides*, K. & P., ♀.
,, 5*a*. Antenna of female enlarged.
,, 5*b*. Antenna of male on same scale as fig 5a.
,, 5*c*. Showing emargination and hair on temple.
,, 5*d*. Thorax and abdomen of male.



ASIATIC MALLOPHAGA.

EXPLANATION OF PLATE XV.

FIG. 6.—*Goniodes neumannia*, K. & P., ♂.
,, 6*a*. Antenna enlarged.
,, 7.—*Goniodes neumannia*, K. & P., ♀.
,, 7*a*. Antenna enlarged.
,, 8.—*Goniodes megaceros*, K. & P., ♂.
,, 8*a*. Antenna enlarged.
,, 9.—*Goniodes processus*, K. & P., ♂.
,, 9*a*. Antenna enlarged.
,, 9*b*. From below, showing process on head.
,, 10. *Nitzschia minor*, K. & P., ♀.



J. H. Paine, del.

ASIATIC MALLOPHAGA.

XIII. REPORT ON A COLLECTION OF FREE-LIVING NEMATODES FROM THE CHILKA LAKE ON THE EAST COAST OF INDIA.

By F. H. STEWART, D.SC.

[The collection on which this paper is based was made in connection with a zoological survey of the Chilka Lake now being undertaken by zoologists attached to the Indian Museum. The lake is a large lagoon connected with the sea by a narrow mouth and containing water that varies greatly in salinity at different places and at different seasons. Full particulars on this and other points will be given in a later paper—N. ANNANDALE.]

Distribution of the genera to which the species described in the following report belong.

(1) GEOGRAPHICAL. The four genera *Oncholaimus*, *Dorylaimus*, *Monhystera*, and *Leptosomatum* are cosmopolitan. Species of *Oncholaimus*, *Monhystera*, and *Leptosomatum* have been recorded from localities ranging from Scandinavia to the Antarctic, while *Dorylaimus* also occurs in the five continents and the Pacific islands.

(2) HABITAT. *Oncholaimus* is almost exclusively a marine genus. The exceptions to this rule recorded up to the present are—*O. rivalis*, Leydig, a doubtful *Oncholaimus* (Lit. 1); *O. thalassophygas*, de Man, which occurs in fresh water and the soil in Holland (Lit. 7); *O. indicus* v. Linstow, in the brackish water of the Ganges delta.

Dorylaimus has been recorded only from fresh water and the soil.

Monhystera is chiefly a freshwater genus. Bastian (Lit. 1) describes two species (*M. disjuncta* and *ambigua*) from the sea, with a doubt, however, as to whether they should truly be classed in the genus. G. Schneider (Lit. 11) describes two species (*M. trabeculosa* and *bipunctata*) from the Baltic. Several species such as *M. microphthalma*, *macrura*, and *agilis*, deMan, inhabit brackish water.

Leptosomatum is entirely marine.

Oncholaimus chilkensis, sp. nov.

(Pl. xxx, figs. 1—4; Pl. xxxi, figs. 15, 17, 18.)

Two tubes; (1) *Indian Museum No. ZEV.* 6237/7. Among filamentous algae at edge of lake: Chilka Lake, Gantasila, Ganjam district, Madras. 19-4-14. Two adult female specimens, mounted in glycerine-jelly-formalin. (2) *Indian Museum No. ZEV.* 6195/7: from *Spongilla* sp., Pigeon Island, Chilka Lake, Orissa. 25-1-14. Two immature specimens, mounted in glycerine-jelly-formalin.

The measurements will be found in Table I.

The head is marked off from the body by a slight but abrupt increase in breadth at the level of the posterior end of the buccal capsule. The maximum breadth is situated at the middle of the body and decreases very slightly and gradually to the anterior end; in the posterior third there is also a slight but gradual decrease to the anus; tail conical from the anus to the commencement of the caudal appendage. Vulva very slightly prominent, close to the middle of the body.

The head bears six lips, mobile as in *O. indicus*. In the four specimens under consideration at present the lips are closed in over the mouth. The lips are situated—two laterally, two subdorsally and two subventrally. Each lip bears a minute papilla on the outer surface. Bristles do not occur on the head. Lateral organs, oval in shape, lying transversely, distant 0·019 mm. from the anterior extremity, length 0·005 mm., breadth 0·0085 mm., anterior border of the oval slightly flattened. Buccal capsule cylindrical with a large right subventral tooth, and two smaller teeth, one dorsal, one left lateral as in *O. indicus*, v. Linst.

No rings on the cuticle. Hairs occur irregularly in the oesophageal region, one marked row in each lateral line in this region. No bristles at the vulva or anus.

Tail simply conical from the anus to the commencement of the caudal appendage, differing therefore from *O. fuscus*, Bast. and *O. indicus*, v. Linst. (*vide* Pls. xxxi, xxxii, figs. 18, 19, 20). The caudal appendage is uniform in diameter and curves ventrally. A very slight annular constriction at the junction of tail and caudal appendage. A single caudal gland tube in front of the caudal appendage.

Oesophagus simple club-shaped, coarsely muscular. Intestine with many black globules.

Nerve ring not observed. Many cells enclosing the oesophagus. No ocelli.

Female gonads of the usual double type, a shell gland interposes between ovarian caecum and uterus as in *O. vulgaris*, Bast.

Contrasting	(1) *O. fuscus*, Bast.	(2) *O. indicus*, v.L.	(3) *O. chilkensis*.
Total length ...	7 mm. ...	2·2 mm. ...	2·2 mm.
Head and body	Separated by a very faint increase of breadth at end of mouth capsule.	Not separated. Fig. 16. ...	Separated by marked increase of breadth. Fig. 17.
Shape of tail ...	Fig. 20. ...	Fig. 19. ...	Fig. 18.
Colour ...	Brown. ...	Grey. ...	Brown.

$$\text{Cobb's Formula, } ♀, \frac{1{\cdot}37 - \times - 2{\cdot}59 - 2{\cdot}74 - 1{\cdot}63.}{1{\cdot}37 - \times - 11{\cdot}9 - 45{\cdot}9 - 95\cdot}$$

Dorylaimus, sp.[1]

(Pl. xxx, figs. 5—7.)

(1) One tube unnumbered: from *Suberites aquae-dulcioris*, Annandale, Gantasila, February 1914, and (2) *Indian Museum No. ZEV.* 6194/7: from *Spongilla* sp., Pigeon Island, Chilka Lake. 25-1-14.

Measurements—Table I.

Head rounded. Body cylindrical (Pl. xxx, fig. 5). Tail short, obtusely rounded. Head region narrower than the rest of the body including the tail.

Head (Pl. xxx, fig. 7), no lips or papillae or bristles; no lateral organs, but a pair of tubular organs in the dorsal and ventral lines distant 0·008 mm. from the head; opening of tubule slightly prominent; tubule runs inward and backward. Buccal capsule not present; quill 0·024 mm. long.

No rings or marks on the cuticle.

Tail short and blunt; in the male one short bristle in front of the anus, and the oblique muscular striation usual in the genus.

Oesophagus divided into anterior and posterior portions of subequal length by a diaphragm. At the junction of the two sections, the anterior section measures 0·022 mm. in diameter, the posterior section 0·026 mm., the radial muscular striation of the second section is more distinct and coarse than that of the first section. The posterior part of the second section is glandular in structure, and measures 0·03 mm. in diameter.

Nerve ring at junction of the two sections of the oesophagus.

Ventral duct or gland not observed.

Male gonads consist of two opposed testes and the vas deferens. Spicules two, very broadly sabre-shaped. No preanal papillae.

Female gonads of usual type. Uterine egg elongated subcylindrical.

Most closely allied to *Dorylaimus intermedius*, de Man: head without lips; tail blunt, very short.

Monhystera uria, sp. nov.

(Pls. xxx and xxxi, figs. 8—10.)

Indian Museum No. ZEV. 6196/7.

From the gelatinous spawn of a Eunicid worm, Rambha, Chilka Lake, Ganjam, edge of the lake. 24-1-14. Six specimens examined, mounted in glycerine-jelly-formalin. Three males, two females, one immature.

Head rounded. Anterior extremity slightly tapered. Greatest diameter near the middle of the body; body attenuated

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[1] Owing to the absence of zoological consulting libraries in the smaller stations of India the present writer is unable to assure himself that this species has not already been described. It has consequently not been named, but the writer hopes to be in a position to supply the omission at an early date.

gradually in the posterior quarter to form a filiform tail. (Pl. xxx, figs. 8 and 9.)

The head bears a low collar of delicate mobile membrane around the mouth. No papillae or bristles. Lateral organs distinct, circular, 0·0038 mm. in diameter; distance of the organs from the head equal to the breadth of the cephalic cone (0·0053 mm.). Oral cavity oval, enclosed between the collar and the anterior end of the oesophagus.

The cuticle bears no rings, marks, or hairs, with the exception of one flagellum on the extremity of the tail.

Lateral lines not distinguishable from muscle fields in preparations of the entire animal.

The tail decreases gradually in diameter from the level of the anus; conical in shape. No bristles, glands, or papillae, with the exception of the single terminal flagellum.

Oesophagus simply club-shaped. No bulbs, division, or definite colouration; no appendix. Intestine as in the genus; no sign of cellular division; charged with black granules superficially. Rectum short.

Nerve ring not observed. No ocelli.

No ventral gland.

Testis commences 0·017 mm. behind the end of the oesophagus and lies on the right side of the intestine. A prostate-like mass present at the junction of the testis and vas deferens. Vas deferens opens immediately in front of the anus through a small almond-shaped body. Two spicules in the wall of the rectum, long, thin, simply curved. Ovary in anterior extremity 0·102 mm. distant from head; ovary and uterus single. Uterus short, sausage-shaped, 0·064 mm. in length, contains spermatozoa only.

The immature specimen (Pl. xxxi, fig. 10) measures 0·357 mm. in length, possesses a distinct tubular buccal cavity with fine chitinous walls and a pointed anterior extremity, which is perforated for the mouth. Oesophagus clothed with a cellular coat. An oval hyaline mass situated posterior to the oesophagus represents the gonads. The intestine is composed of loose fibrillar tissue with some black granules.

The species is most closely allied to *Monhystera dispar*, Bast., in that it bears no ocelli, possesses a gut with black granules, a smooth unringed cuticle; lateral organs not spiral; distance of lateral organ from head equal to breadth of head; distance of vulva to anus greater than anus to tail. It differs from *M. dispar* in the following points:—Total length in *M. dispar* 0·72—1·1 mm.; in *M. uria* 0·54 mm.; $\frac{\text{oesophagus}}{\text{total length}}$:—in *M. dispar* $\frac{1}{4·5—5·5}$ in *M. uria* $\frac{1}{5·8}$; $\frac{\text{tail}}{\text{total length}}$:—in *M. dispar* $\frac{1}{6—7}$ in *M. uria* $\frac{1}{5·25}$. Six oral hairs in *M. dispar*, none in *M. uria*. Short filiform caudal appendage in *M. uria*, none in *M. dispar*. Males more frequent in *M. uria*, unknown in *M. dispar*.

Cobb's Formula— ♂ $\dfrac{1{\cdot}03 - \times - 2{\cdot}32 - 2{\cdot}83 - 2{\cdot}32}{{\cdot}51 - \times - 13{\cdot}9 - 50{\cdot} - 85{\cdot}8}$

♀ $\dfrac{\times - \times - 3{\cdot}1 - 3{\cdot}8 - 2{\cdot}5}{\times - \times - 17 - 58 - 83{\cdot}}$

Leptosomatum indicum, sp nov.

(Pl. xxxi, figs. 11—14.)

Indian Museum, No. ZEV. 6142/7.

Manikpatna, outer channel of Chilka Lake, on the 16th of September 1903, from algae an an oyster shell. A single male specimen, mounted in glycerine jelly-formalin.

Head rounded. Diameter of the body increases in the first 0·34 mm. of the length to 0·0703 mm., thereafter increases very gradually to 0·088 mm. at a distance of 0·185 mm. from the tail. The tail is curved ventrally.

Lips none. Papillae none. The mouth is surrounded by a membranous ring. A cap of yellow cuticular substance lies under the cuticle of the head, the base of the cap reaching to a distance of 0·022 mm. from the anterior extremity. The cap when seen in optical section presents the appearance of distinct skeletal pieces. A circle of very scant (4) short and stout hairs surrounds the head. Lateral organs are present—spherical capsules opening by an oval pore to the exterior; breadth of the capsule 0·0074 mm. (The lateral organs are described by Bastian as the apertures of the excretory glands.) Buccal cavity not present.

No rings or markings of the cuticle. No hairs except around the mouth.

Tail rounded obtuse. Anus slightly prominent. A papilla situated in the midline 0·071 mm. before the anus. No caudal bristles. Oblique muscles in front of the anus as in *Dorylaimus* Three tubular caudal glands opening at the posterior extremity. The duct of the caudal glands, while traversing the substance of the cuticle, is dilated to form a peculiar biscuit-shaped ampulla.

Alimentary System.—The oesophagus is of uniform breadth throughout the greater portion of its length. It measures 0·022 mm. until within 0·29 mm. from the posterior extremity of the organ. At this level it commences to expand slightly and reaches a maximum of 0·033 mm.

The oesophagus is not divided into sections nor dilated to form bulbs: colour of a dull yellow; not markedly muscular. A nipple-like appendage of the oesophagus projects into the commencement of the lumen of the intestine.

Intestine of the usual form; it does not exhibit tesselation on the outer surface, which is rough and irregular in appearance. Rectum not observed.

Nervous System.—Nerve ring 0·02 mm. in breadth, distant 0·289 mm. from the head. Cellular collar commences 0·05 mm.

from the head and clothes the remainder of the oesophagus: is exceptionally developed. Ocelli two in number, diameter of the ocellus 0·009 mm; distance of ocelli from the head 0·56 mm. They lie on the outer surface of the oesophagus immediately dorsal to the lateral lines; colour, black with a tinge of red. Two lines of fine red-black granules extend backward for a short distance from the ocelli.

Lateral organs as described above.

The Excretory System.—Excretory glands not distinguishable, but may exist in the mass of collar cells. No opening of the ventral gland distinguished unless a slight mark in the ventral line opposite the nerve ring represents the pore.

Male Reproductive Organs.—The fundus of the anterior testis lies 1·7 mm. distant from the head. Testes double; remainder of tract single. Spicules two, of the form indicated in fig. 13 of Pl. xxxi, hollow. A single accessory piece.

$$\text{Cobb's Formula—} \quad ♂ \quad \frac{0—1{\cdot}32— \quad 1{\cdot}32— \quad 1{\cdot}55 \quad — \; 1{\cdot}7}{0—5{\cdot}78—15{\cdot}78—50{\cdot}0 \quad —98{\cdot}4}$$

Monhystera megalaima, sp. nov.

(Pl. xxxii, figs. 21—27.)

Indian Museum No. ZEV. 6237-7. Among filamentous algae at edge of lake, Chilka Lake, Gantasila. 19-4-14. One male, one female, mounted in glycerine-jelly-formalin.

Measurements, see Table I.

Female.—A delicate organism. Body tapering only very slightly to the head, the posterior extremity tapers gradually from a short distance in front of the vulva; tail pointed but not filiform, with a permanent ventral curvature.

Head marked off from the body by a slight annular constriction; anterior surface flatly rounded (Pl. xxxii, figs. 22, 23); a circle of stout bristles, six in number, surrounds the head; length of bristles 0·0136 mm.; internal to this ring is a second ring of very short spines. No lips or papillae. Lateral organs large, circular, 0·0088 mm. in diameter; their anterior margin 0·0187 mm. from the head, a distance approximately equal to the breadth of the head. Mouth capsule oval, transverse, walls delicate; no teeth or cuticular thickenings.

Cuticle marked with very fine transverse rings from head to tail; the rings extend throughout the thickness of the cuticle. Hairs scanty, scattered irregularly, of remarkable length (0·02 mm., i.e. more than half the breadth of the body) and tenuity, sometimes spirally curled. No papillae.

Lateral lines and muscle fields not distinguishable.

Tail, see Pl. xxxii, fig. 24; a circle of short bristles close to the tip, no bristles at the anus or vulva. No glands or papillae.

Oesophagus simple, club-shaped, no bulb or division; a transverse diaphragm in the muscular substance at a level immediately in front of the lateral organs. Intestine with brown granules and without tesselation.

Neither nerve ring nor cellular collar visible.

No ventral gland.

Fundus of ovary 0·205 mm. from head. Gonad tube single as in the genus. Uterus contains large unsegmented ova.

Male.—General outline resembles the female but the tail is more blunt. (Pl. xxxii, fig. 25).

The specimen is coiled on itself, and owing to its delicate character could not be straightened. The head is therefore seen obliquely and foreshortened. Indications of a buccal cavity are however visible, together with the cephalic ring of setae as in the female (Pl. xxxii, fig. 26). Lateral organ faintly distinguishable.

Cuticle as in the female. No bristles observed on the body.

Tail narrows abruptly near the termination. No glands, papillae, or bristles.

The testis commences immediately behind the oesophagus and lies on the left side of the intestine. Vas deferens situated ventrally to the intestine. Spicules (Pl. xxxii, fig. 27) with knob-like proximal extremities, twisted shafts, and glans-like distal extremities, hollow.

This species resembles *M. dubia*, Bütschli, and *M. agilis* de Man, in possessing a transversely striated cuticle; contrasted with the former, however, it is of more slender form, and the lateral organs are not spiral; contrasted with the latter, the vulva is situated more posteriorly, and the distance from vulva to anus is equal to, not twice as great as, the distance from anus to tail.

Cobb's Formula,— ♀ $\dfrac{\times \;-\; \times \;-\; 2{\cdot}69 \;-\; 2{\cdot}84 \;-\; 2}{0{\cdot}69 \;-\; \times \;-\; 16{\cdot}1 \;-\; 78{\cdot}1 \;-\; 88{\cdot}3}$

LIST OF SOME IMPORTANT PAPERS DEALING WITH FREE-LIVING NEMATODES.

(1) Bastian, Charlton — Monograph of the Anguillulidae.—*Trans. Linn. Soc.*, vol. 25, 1866.

(2) Bütschli, O. .. Beiträge zur kenntniss der freilebenden nematoden.—*Nov. Act. Kais. Leop. Carol. Akad.*

(3) Bütschli, O. .. Zur Kenntniss der freileb. Nemat.—*Senckenbg Natforsch. Ges. Abhand.* 1873.

(4) Daday, v. .. Freshwater nematodes of South America.—*Zoologica*, 1905, p. 51.

(5) Daday, v. .. Freshwater nematodes of German Africa.—*Zoologica*, 1910, vol. 23.

(6) Daday, v. .. Die freilebende Süsswasser-Nematoden Ungarns.—*Zoologisch. Jahrb.*, Syst., Bd. 10.

(7) Man, de .. *Nematoden der Niederländisch. Fauna*, Leiden, 1884.

(8) Man, de .. *Mém. Soc. Zool. de France*, vol. 1.
(9) Man, de .. *Mém. Soc. Zool. de France*, vol. 2.
(10) Man, de .. *Zool. Jahrb.*, Suppl. 15, vol. 1, 1912.
(11) Schneider, G. .. *Zool. Anz.* 29, p. 626.

LETTERING OF PLATES.

Reference letters—acc. p=accessory piece, *amp.*=ampulla, *an.* =anus, *b.c.*=buccal cavity, *ceph. cap*=cephalic cap, *d. ej.*= ductus ejaculatorius, *d.h.*=dorsal hair, *d. t.*=dorsal tooth, *d. tu.*= dorsal tubule, *go.*=gonads, *h.*=hair, *in.*=incisura, *int.*=intestine, *lat. h.*=lateral hair, *l. l.*=lateral line, *l. lat. lip pap.*=papilla of lateral lip, *l. m* =longitudinal muscle, *L. lat. o.*=left lateral organ, *l.o.* and *lat. o.*=lateral organ, *l. oc.*=left ocellus, *L. sp.*=left spicule, *n. r.*=nerve ring, *obl. m*=oblique muscle, *oc.*=ocellus, *oe. pig. gran.*=oesophageal pigment-granules, *oes.*=oesophagus, *oes. l.*=oesophageal lumen, *ov.*=ovary, *pap.*=papilla, Pap. R. *lat. lip.*=papilla of right lateral lip, *q.*=quill, *rect.*=rectum, *R. lat. o.*=right lateral organ, *r.s.v.p.*=right sub-ventral papilla, *R.s.v.t.*=right sub-ventral tooth, *s.d.t.*=right subdorsal tooth, *sp.*=spicule, *t. g.*=tail gland, *ut.*=uterus, *v.*=vulva, *vag.*=vagina, *v.h.*=ventral hair, *v t.*=ventral tooth, *v tu.*=ventral tubule.

Table I.	*Oncholaimus chilkensis.*			*Dorylaimus*, sp.			*Monhystera uria.*			*Monhystera macrolaima.*		*Leptosomatum indicum.*
	♀6237A	6195	♀6237B	♂ from *Suberites.*	♂6194 2	♀6194 2	♂6196 1*a*	♂6196 1*b*	♀6196 3	♀6237	♂6237	♂6142
Total length ...	2·210	1·540	2·700	2·000	1·870	1·938	.	·660	·536	1·300	·765	5·000
Maximum breadth ...	·060	·057	·074	·041	·044	·052	...	·019	·024	·044	·025	·088
Head to maximum br. ...	·022	.	...	...	...	..	...	...	...	...	...	4·815
Mx. br.	1	1	1	1		1		1	1	1	1	1
Total l.	36·8	28·7	36·	50	...	37	...	37	23	29·5	30·6	56·8
Head br.	·022	...	·026	·015	...	·012	..	...	...	·0185	...	·033
Buccal capsule l. ...	·039	·032	·037	...	...	...	...	·003	...	·009	...	...
Br. of body at end bucc. cap.	·037	·027	·037	..	...	...	...	·007	...	...	...	...
Oesophag. l.	·323	·269	·323	·377	·425	·400	...	·092	·093	·210	·0935	·799
Oesophag. l.		1		1	1	1		1	1	1	1	1
Total l.	...	5·7		5·3	5	4·4	...	7·1	5·8	6·2	8·07	6·38
Br. of body at end oes. ...	·055	·056	·070	·037	...	·040	·015	·015	·017	·035	·020	·066
Ant. end oes. to nerve ring...	...	·104	.	·200	...	·200	...	...	...	...	...	·289
Nerve ring to post. end oes.	...	·155	..	·177	...	·200	...	...	...	...	...	·510
Ant. end oes. to n. r.		1										1
N. r. to post. end oes. ...	...	1·49	...	...	...	...	...	...	..	...	...	1·7
Br. of body at n. r. ...	...	...	...	...	...	·035	...	...	...	...	...	·066
Oes. ant. mx. br. ...	·022	·017	·026	·026	...	·019	...	...	...	...	...	...
Oes. ant. min. br. ...	...	...	...	·022	...	·014	...	..	...	...	...	...
Oes. post. mx. br. ...	·033	·029	·042	·030	...	·032	...	...	...	...	...	·033
Oes. post. min br. ...	...	...	...	..	...	...	...	...	...	...	...	...
Head to vulva	1·280	...	1·240	...	...	·850	...	...	·314	1·016	...	...
Vulva to tail	1·140	...	1·450	.	...	1·090	...	...	·222	·284	...	...
Head to vulva	1		1			1			1	1		...
Vulva to tail	0·89	...	1·17	...	...	1·28	...	...	0·7	0·28	...	...

Table I.	*Oncholaimus chilkensis.*			*Dorylaimus*, sp.			*Monhystera uria.*			*Monhystera macrolaima.*		*Leptosomatum indicum.*
Br. of body at middle ...	...	...	...	...	...	...	...	...	...	·044	·025	...
Br. of body at vulva ...	·060	...	·074	·040	...	·055	...	·019	·020	·037	...	·078
Head to anus	2·060	...	2·564	1·978	...	1·920	...	...	·434	1·148	·680	4·922
Anus to tail	·150	...	·136	·022		·018	·093	·0935	·102	·152	·085	·078
Post-anal length / Total length ...	1/14·7	...	1/19·8	1/91	...	1/107·7	...	1/7·1	1/5·25	1/8·5	1/9	1/64·3
Br. of body at anus ...	·037	...	·044	·030	...	·029	...	·015	·014	·026	...	...
Caudal appendage l. ...	...	...	·075	...	...	...	·015	·202	...	...	...	·085
Caudal appendage br. ...	...	...	·007	...	...	...	·002	·002	·003	...	...	...
Spine or quill l.	...	...	...	·023	...	...	...	...	...	...	...	...
Lat. organ diameter ...	·005 × ·0085	...	·005	...	...	...	...	·004	...	...	...	·007
Lat. line mx. br. ...	...	...	...	...	...	...	...	·0017	...	...	...	·013
Head to ventral pore ...	...	...	...	...	...	...	...	...	...	...	...	...
Male spicule l.	...	...	...	·037	...	...	·027	·030	...	...	...	·088
Uterine ovum l. ...	...	...	...	...	...	...	...	...	...	...	...	...
Uterine ovum br. ...	...	...	...	...	...	...	...	...	...	...	...	...

EXPLANATION OF PLATE XXX.

FIG. 1.—*Oncholaimus chilkensis*, sp. n., immature, ×150.

,, 2.—*Oncholaimus chilkensis*, sp. n., immature, ×1000, head from right side.

,, 3.—*Oncholaimus chilkensis*, sp. n., immature, ×1000, head from ventral aspect.

,, 4.—*Oncholaimus chilkensis*, sp. n., immature, ×750, tail.

,, 5.—*Dorylaimus* sp., male, ×325, outline.

,, 6.—*Dorylaimus* sp., male, ×750, tail from the left side.

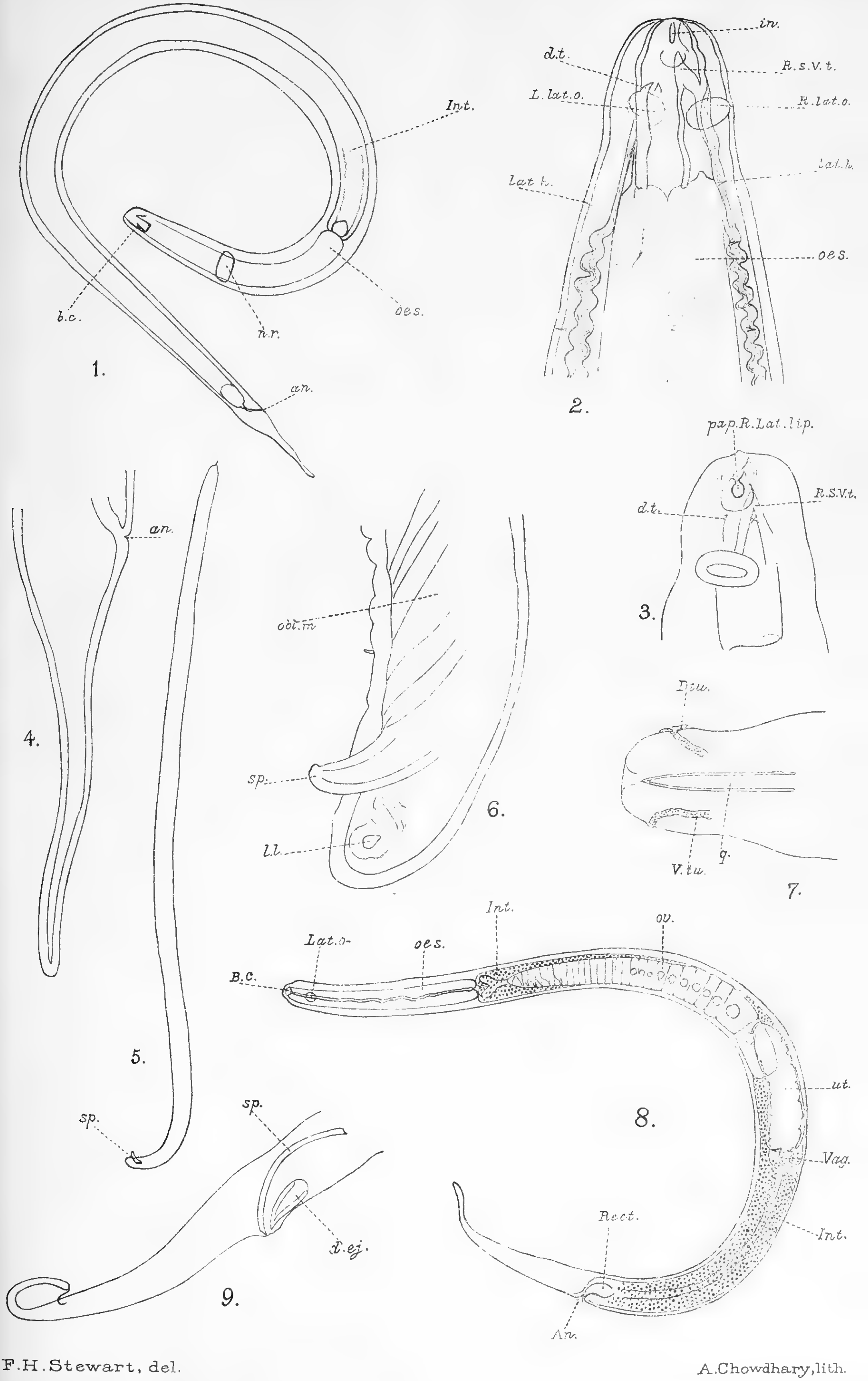
,, 7.—*Dorylaimus* sp., male, ×1000, head from left side.

,, 8.—*Monhystera uria*, sp. n., female, ×283.

,, 9.—*Monhystera uria*, sp. n., male, ×750, tail from right side.

Rec. Ind. Mus., Vol. X, 1914.

XXV.
Plate ~~XXXII~~.



F.H.Stewart, del.

A.Chowdhary, lith.

NEMATODES FROM CHILKA LAKE.

EXPLANATION OF PLATE XXXI.

FIG. 10.—*Monhystera uria*, sp. n., immature, ×650.

,, 11.—*Leptosomatum indicum*, sp. n., × 686, head from right side.

,, 12.—*Leptosomatum indicum*, sp. n., × 686, head from right side.

,, 13.—*Leptosomatum indicum*, sp. n., ×333, male, tail from right side.

,, 14.—*Leptosomatum indicum*, sp. n., male, ×30, outline.

,, 15.—*Oncholaimus chilkensis*, sp. n., female, ×1000, head from left. No. 6237a.

,, 16.—*Oncholaimus indicus*, v. Linst. Outline of head, ×433, for comparison with fig. 17.

,, 17.—*Oncholaimus chilkensis*, sp. n. Outline of head for comparison with fig. 16. × 433.

,, 18.—*Oncholaimus chilkensis*, sp. n., female, × 433, tail (No. 6237b).

,, 19.—*Oncholaimus indicus*, v. Linst. female, × 433, tail for comparison with fig. 18 (No. 5576/2).

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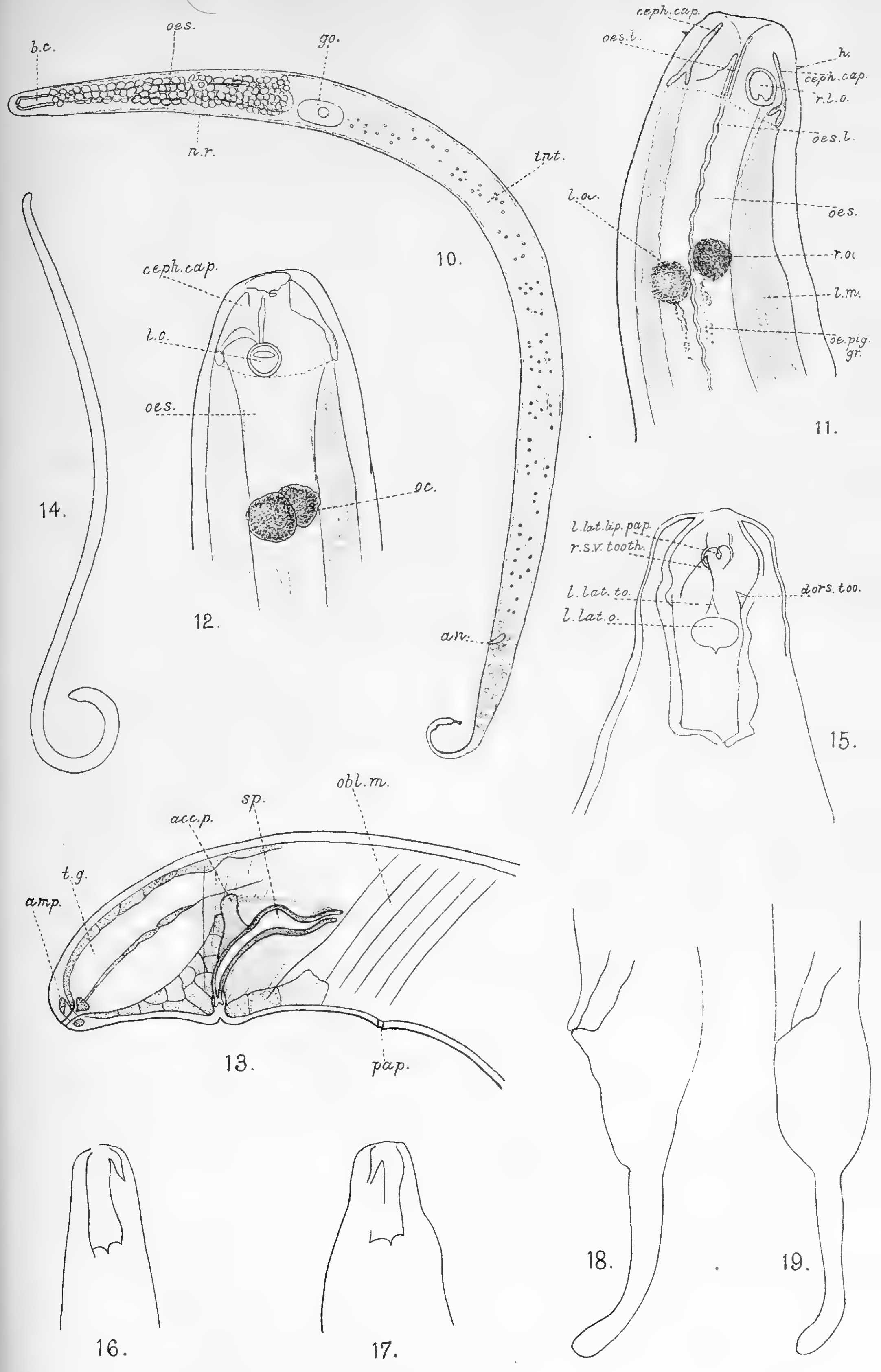


F. H. Stewart, del.

A. Chowdhary, lith.

NEMATODES FROM CHILKA LAKE.

EXPLANATION OF PLATE XXXII.

FIG. 20.—*Oncholaimus fuscus*, Bast., male, tail (copied from Bastian) for comparison with fig. 18.

,, 21.—*Monhystera megalaima*, sp. n., female, × 118.

,, 22.—*Monhystera megalaima*. sp. n., female, anterior extremity × 379

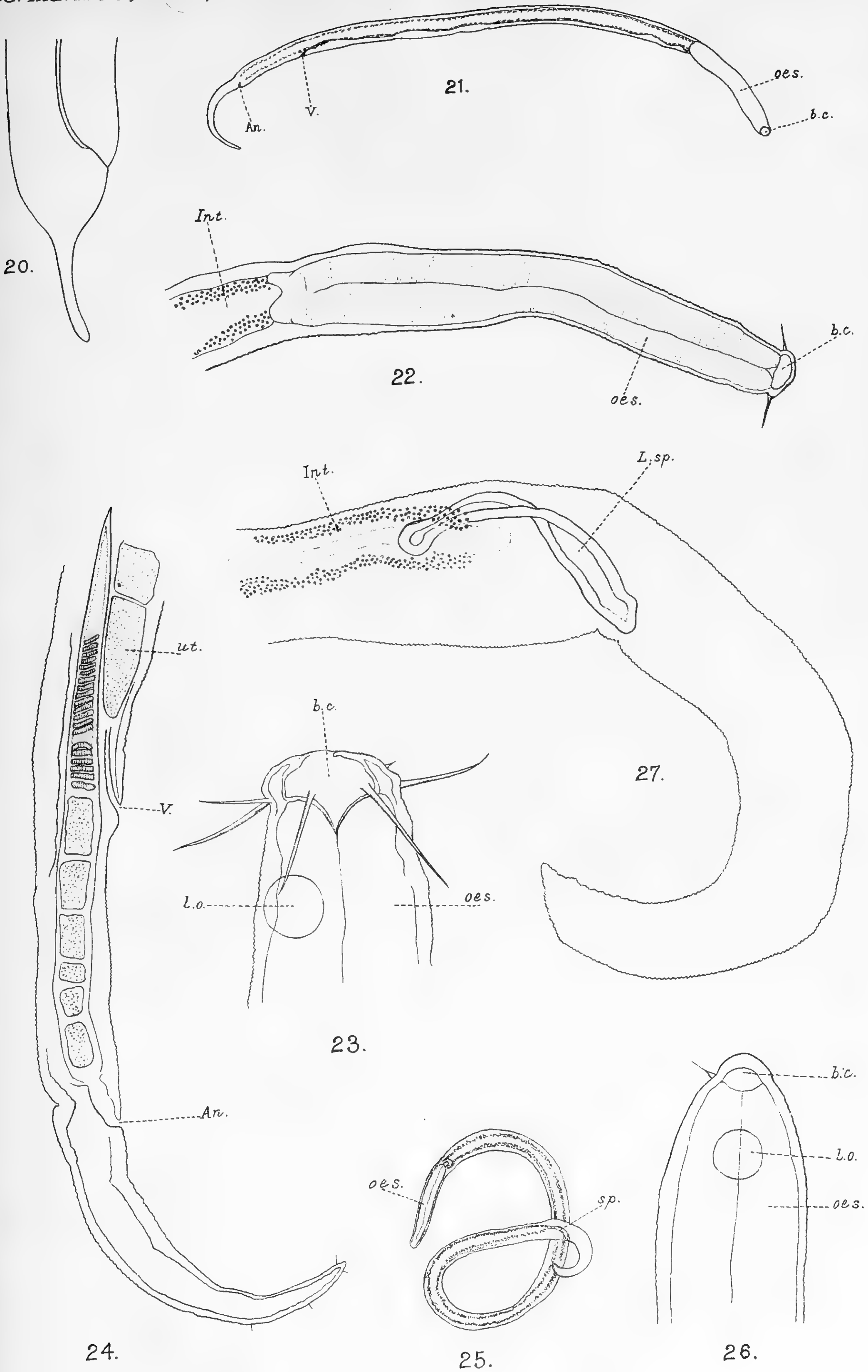
,, 23.—*Monhystera megalaima*, sp. n., female, head, × 1110.

,, 24.—*Monhystera megalaima*, sp. n., female, tail, × 382.

,, 25.—*Monhystera megalaima*, sp. n., male, × 150.

,, 26.—*Monhystera megalaima*, sp. n., male, head, × 1500.

,, 27.—*Monhystera megalaima*, sp. n., male, tail, × 1100.



F. H. Stewart, del.

A. Chowdhary, lith.

NEMATODES FROM CHILKA LAKE.

XIV. LITTORAL OLIGOCHAETA FROM THE CHILKA LAKE ON THE EAST COAST OF INDIA.

By J. STEPHENSON, *D.Sc., Major, I.M.S., Prof. of Biology, Government College, Lahore.*

On the occasion of a recent visit to Calcutta, Dr. Annandale handed over to me for examination three specimens of a worm, which had recently been taken at the Chilka Lake during a preliminary survey of that area. I subsequently received in Lahore four more captures of Oligochaete worms, taken during the more detailed investigation of the lake. Three of these were specifically identical with the specimens I had examined in Calcutta, and represent a species of *Pontodrilus* which I identify with *P. ephippiger*, Rosa. Since, however, the specimens show a considerable amount of variation among themselves, as well as some minor differences from the form with which I identify them, I give a fairly complete description below

The remaining batch of specimens, which I identify with *Criodrilus lacuum*, Hoffmstr., consisted of a very large number of individuals; but unfortunately I failed to find any which showed the least external mark of sexual maturity. However I dissected two of the best-grown specimens, and fortunately found the genital organs in an early stage of development. But as under these conditions there must be at least a slight element of doubt in the specific, if not generic, diagnosis, I have given here also a number of descriptive details, in order that the result may be amenable to criticism if necessary.

General Remarks.

The occurrence of *Criodrilus tacuum* is interesting, since the family (Glossoscolecidae) to which it belongs is represented in India, so far as hitherto known, by only two or three species. The nearest locality to India from which this species has previously been reported is, I think, the Lake of Tiberias in Palestine (Stephenson, 10 from specimens collected by Annandale); and along with this may be mentioned several places in Syria (Rosa, 8). This is of interest in view of Annandale's recent remarks (1) concerning the relationship between the faunas of India and of the Jordan Valley. *Criodrilus lacuum*, as its name implies, has a limnic habitat; I am not aware whether it has previously been recorded from any locality which could be described as 'littoral,' though the Lake of Tiberias of course contains a high percentage of salt. For the rest, it occurs principally in Central Europe.

The genus *Pontodrilus* has been recorded twice previously from the Indian region. The references are to *P. bermudensis*, Bedd., from Ceylon (cf. Michaelsen, 7), the distribution of which is circummundane in the tropics; and to Beddard's species *laccadivensis*, which occurs in both the Laccadive and Maldive Islands (3).

Criodrilus lacuum, Hoffmstr.

Shore at Satpara, Puri district, Orissa, from fisherman; 14-iii-1914. Very numerous specimens, none showing external marks of maturity.

Length average 80, maximum 100 mm.; breadth 2 mm. Colour an equable grey. Segments *ca.* 240. Prostomium zygolobous. No dorsal pores.

The body from about segment ix onwards is somewhat four-cornered; in the posterior fourth of the body, the dorsal surface is concave, thus presenting a shallow longitudinal groove. The posterior end is sharply pointed. The anus is dorsal, and forms a longitudinal slit with whitish margins, the posterior end of which does not reach the pointed posterior end of the body. The number of segments over which the anus extends is difficult to count, as they are small, and, at the end, not completely differentiated; but about 6 or 7 can be recognized and counted, as well as a small undifferentiated zone posteriorly. The segments after the first three are triannulate, soon becoming four- and five-ringed by the subdivision of one or more of the primary rings; posteriorly the segments are again three-ringed.

The setal intervals vary somewhat; the relations may roughly be expressed thus:—$aa = 2\text{–}2\frac{1}{4}ab = bc = 2\text{–}2\frac{1}{4}cd = \frac{2}{3}\text{–}\frac{3}{4}ad$. In the anterior part of the body $aa = 1\frac{2}{3}ab$. The setae are ornamented towards the tip, but much less markedly than is shown by Vejdovsky in his figure (11).

The first septum is $\frac{4}{5}$; thereafter the septa gradually increase in thickness, being moderately thick at $\frac{8}{9}$, and so continuing to $\frac{12}{13}$. Behind this the thickness rapidly decreases again, and $\frac{16}{17}$ and those behind are of the usual attenuated type.

A rudimentary gizzard was present in segments xiii–xiv in one specimen dissected; in the other it was questionable whether there was anything which could be called a gizzard.

The last heart is in segment xi. Nephridia begin in xii (xi one side of one specimen).

The testes are situated in x and xi; one funnel was seen in x. The four pairs of seminal vesicles depend, two anteriorly (i.e. forwards from the posterior wall of the segment) into ix and x, and two posteriorly into xi and xii. Ovaries and ovarian funnels were seen in xiii and small ovisacs depending backwards into xiv.

Pontodrilus ephippiger, Rosa.

In damp mud under stones at edge of Chilka Lake at Gantasila, Ganjam district; 27-xii-1913; three specimens, two being fully mature.

Chilka survey 28 Z.E.V. $\frac{6226}{7}$; a number of specimens.
,, ,, 75 Z.E.V. $\frac{6227}{7}$; two specimens.
,, ,, 82 Z.E.V. $\frac{6228}{7}$; three specimens.

Length variable in the different captures, 32–65 mm.; diameter maximum 2–$2\frac{1}{2}$ mm. Colour in general light grey throughout; the first batch of specimens however were olive-green, the anteclitellar region paler, and clitellum with a reddish tinge.

Prostomium slightly epilobous. Segments 106–108. No dorsal pores.

The lateral setae are not paired. In front of the clitellum the setal intervals may be represented by the formula $ab = \frac{3}{5}aa = \frac{3}{5}bc = \frac{3}{5}cd$, aa, bc and cd being thus equal to each other; or cd may even be slightly greater than bc. Behind the clitellum the relations are $ab = \frac{1}{2}aa$, and $aa =$ or slightly $> bc = cd$. Throughout the body $dd = 2cd$. No ornamentation can be seen on the setae even under the oil-immersion lens.

The clitellum is absent ventrally, the ventral surface in this region forming a broad groove. The clitellum extends from $\frac{1}{2}$xiii–xvii = $4\frac{1}{2}$ (once xiii–xvii = 5).

The male apertures are situated on small papillae in segment xviii in the line of setae *b*. At the margins of the ventral surface in xviii, and extending on to the adjacent parts of xvii and xix, are a pair of very prominent longitudinal ridges, white and rounded. Internal to the ridge of each side is a deep depression, also, like the ridge, narrow, longitudinal, and well-defined, i.e. an antero-posterior groove of the same length as the ridge, which latter bounds the groove on its outer side. Between the grooves of the two sides the ventral surface may be slightly hollowed. The situation of the male apertures is on the inner, rather more gently sloping, wall of the longitudinal grooves above described.

The female apertures appear as two white points anteriorly in xiv, nearer the groove $\frac{13}{14}$ than the line of the setae; they are one on each side of the nerve cord, which can be seen shining through, and internal to the line of setae *a*.

The spermathecal apertures are two pairs, on small white papillae, in furrows $\frac{7}{8}$ and $\frac{8}{9}$ in the line of setae *b*. In one specimen, while three of the four apertures were in the lines of *b*, one (left anterior) was exactly in line with the setae *a*.

The genital markings are variable. (i) Most constant is one in $\frac{19}{20}$, of an oval shape with long axis transverse; its extent varies, between setae *a* and *a*, or between *b* and *b*; the form it takes also varies:—(*a*) It may be a depression, with a well-marked lip-like margin, and thus somewhat sucker-like; (*b*) or a broad white low papilla with a flat surface; (*c*) or a whitish well-defined area, but not raised above the general surface; or (*d*) it may be very inconspicuous, though never, so far as I observed, entirely absent.

The next commonest genital mark is (ii) a similar oval area in furrow $\frac{12}{13}$, of whitish colour, stretching from between lines *a* and *b* on one side to a corresponding point on the other. This has the form of a low flat papilla; it was present, though not always equally well-marked, in about half the specimens examined. (iii) In one case there was a slight whitish ill-defined elevation in the situation of groove $\frac{13}{14}$.

Septum $\frac{5}{6}$ is thin or only slightly thickened; the septa increase in thickness from $\frac{6}{7}$ to $\frac{9}{10}$, and then continue thick to $\frac{11}{12}$; $\frac{12}{13}$ is thinner again, and thence onwards all are thin.

There is no gizzard; the intestine begins to swell out in xv. The last heart is in xiii.

The nephridia are absent from the first twelve segments; they are present in segment xv, and onwards, but (in the specimens dissected) absent in xiv, though either one or a pair were found in xiii.

Small testes were seen in segment x; they were not identified in xi, but funnels were present in both segments (x and xi). Testes and funnels were free in the body-cavity.

The vesiculae seminales are two pairs, in xi and xii, each grapelike, being cut up deeply into small lobes

The prostates are of moderate size, tubular and slightly coiled, especially at the free end, which is posterior; they run forwards and inwards, from the eighteenth to the seventeenth segment, and at their anterior end, where the duct commences, they lie alongside or under cover of the intestine (in the dissected animal). The duct runs backwards and outwards, roughly parallel to and on the inner side of the glandular portion; it is strong, stout and intensely glistening, only slightly curved, and of approximately the same diameter throughout (or perhaps slightly narrower at its outer end); it is rather shorter than the gland.

Ovaries and ovarian funnels were seen in xiii.

The spermathecae are two pairs, lying in segments viii and ix. The ampulla varies in shape from roughly spherical to elongated ovoid; the duct is of moderate or relatively considerable width, and is nearly as long as (subspherical ampulla), or more than half as long as (elongated ampulla), the ampulla itself. The diverticulum is tubular, not swollen or very slightly swollen at its internal end; its length also appears to vary,—it may either fall considerably short of or extend considerably beyond the end of the ampulla, according as this latter is or is not elongated in form. The name diverticulum is in strictness hardly applicable, as the structure to which it is applied is here implanted on the inner surface of the body-wall separately from though close to the end of the duct. No penial setae were discovered.

The present species has been described by Rosa (9) from Christmas Island; the chief differences between that author's specimens and mine are the absence of the genital papillae on $\frac{12}{13}$ and $\frac{13}{14}$, and the "deep slit-like" character of the marking on $\frac{19}{20}$

in Rosa's examples; though he and I describe the area surrounding the male pores in different ways, there appears to be an essential similarity between the two accounts.

I have also compared Beddard's account of *P. laccadivensis* (3). This latter is a larger worm, and the spermathecal apertures are situated, in some but not all individuals, near the extremities of long dumbbell-shaped cutaneous thickenings in $\frac{7}{8}$ and $\frac{8}{9}$; but the male area (illustrated not in the original paper, but in 4) resembles very much that of *P. ephippiger*. Since *P. ephippiger* is a variable species (compare the data as to size, papillae, first nephridia, characters and length of spermatheca and diverticulum given above, from a limited number of specimens), and *P. laccadivensis* is so also, at least in the matter of cutaneous thickenings or papillae, I believe that the two species should be united.

Michaelsen has recently united *P. insularis* (Rosa) with his own species *P. arenae* and Beddard's *P. bermudensis* (compare 5, and the lists of Indian species in 6 and 7). I can see no essential difference between the descriptions of *P. ephippiger* and *P. arenae*, except that the setae are ornamented in *P. arenae*, not in *P. ephippiger*; and when the revision of the genus is next undertaken it will be necessary, I believe, to consider whether this is sufficient to distinguish them; since Beddard, even when looking for it, at first failed to find the ornamentation (2). This would reduce *P. bermudensis*, *arenae*, *insularis*, *ephippiger*, and *laccadivensis* to a single species. Some consideration should also be given to *P. matsushimensis*, which possesses the same characteristic male genital area; though the absence of a distinct muscular prostatic duct is perhaps a sufficient ground for separation.

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XV. DESCRIPTION OF A NEW SPECIES OF TERRESTRIAL ISOPODA FROM BORNEO.

By WALTER E. COLLINGE, M.Sc., F.L.S., F.E.S.

(Plate xxxv, figs. 1–9.)

Amongst the collection of terrestrial Isopoda in the Indian Museum, which Dr. Annandale has kindly placed in my hands for examination and identification, is a tube containing a number of specimens of a new species of *Cubaris* collected near Sarawak, which is here described. I have much pleasure in associating with it the name of Dr. Annandale.

Cubaris annandalei, n. sp.

Body (fig. 1) oblong oval, dorsally convex with a series of ridges on the mesosomatic segments; metasome broad and partly hidden by the overlapping segments of the mesosome. Cephalon (fig. 2) small and flanked by the lateral plates of the 1st segment of the mesosome; epistome with small median triangular ridge; lateral lobes small and indefinite, median lobe absent. Eyes lateral and prominent. Antennulae small and 3-jointed. Antennae (fig. 3) slender, covered with small setae and one or two spines; last segment elongated, flagellum 2-jointed, the distal joint being the larger. Mandibles (fig. 4) short and stout with four blunt tooth-like surfaces and two tufts of setae. 1st maxillae (fig. 5): outer lobe with four large pointed spines, then five more slender ones, with their apices divided into two or more divisions, and one incurved pointed spine; inner lobe small and narrow with two setaceous spines distally (fig. 6). 2nd maxillae small and plate-like with slight indication of a division into two lobes. The segments of the mesosome are all ornamented with a series of irregular ridges; lateral plates well defined and separated from one another, the 1st and the 6th are broadest. Maxillipedes (fig 7) large, the outer lobe terminates in a curved spine divided at its point and two smaller pointed spines; the inner lobe is well-developed and provided with four small marginal spines. Thoracic appendages (fig. 8) comparatively short, covered with setae and well-developed spines on the inner borders of the three terminal segments. Uropoda (fig. 9) largely hidden by the telson and not extending beyond it; basal plate thick and somewhat triangular, exopodite small, articulating in a cavity on the inner margin and dorsal surface of the basal plate, the endopodite is considerably larger, triangular in section and fringed with numerous spines, distally it terminates in three long whip-like setae. Its point of articulation is on the ventral side of the inner proximal extremity of the basal plate. Telson (fig. 10) constricted above the middle, with the free edge almost straight. Length 8 mm. Colour (in alcohol) greenish-grey with lighter coloured ridges.

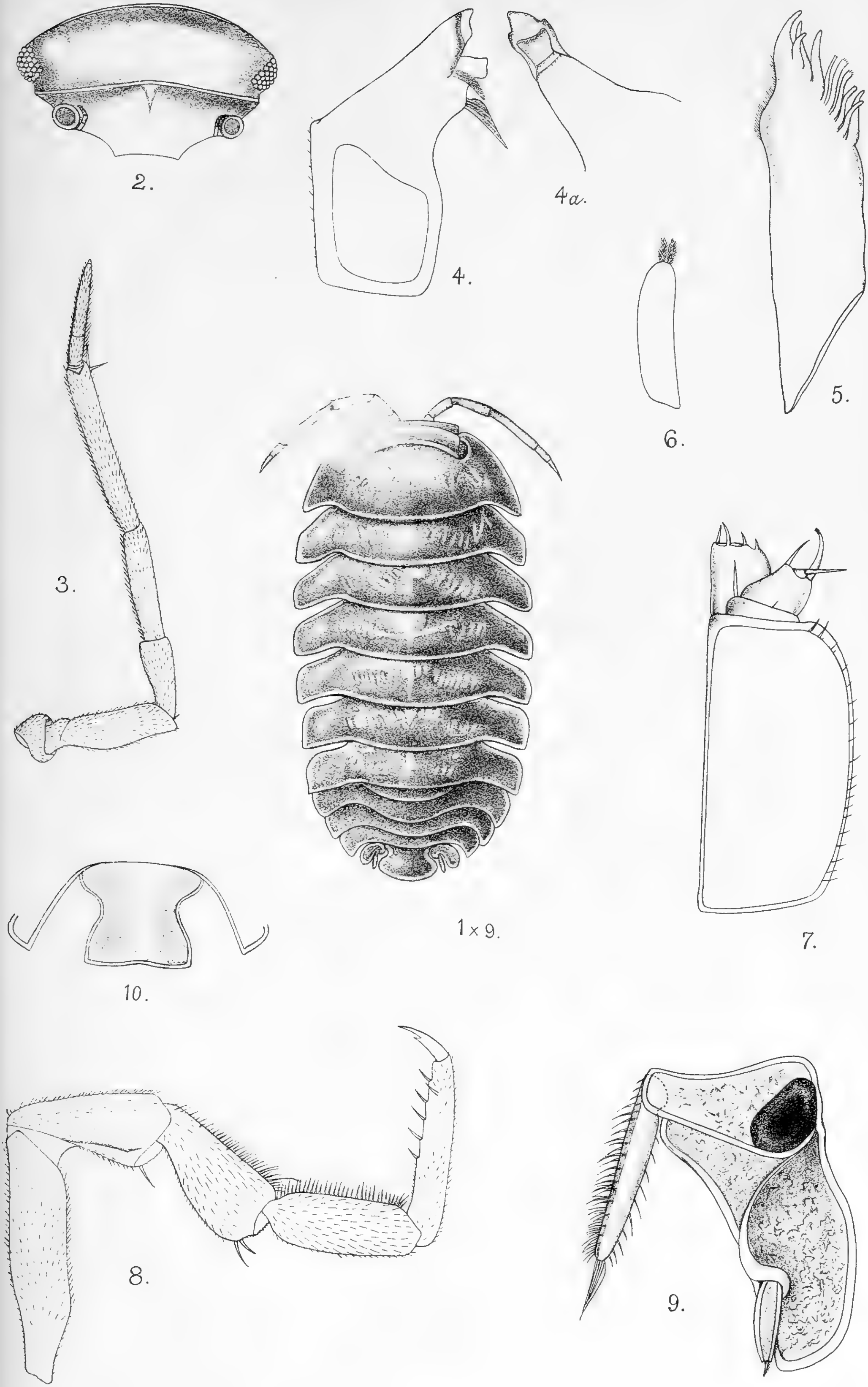
Habitat.—Ten miles south of Sarawak, Borneo, 26-vi-1910 (*C. W. Beebe*). Regd. No. 8601-10.

Type.—In the collection of the Indian Museum.

The form of the uropoda and telson at once separates this species from any hitherto described.

DESCRIPTION OF PLATE XXXV.

FIG. 1.—*Cubaris annandalei*, n. sp. Dorsal view: × 9.
,, 2.— Antero-dorsal view of head.
,, 3.— Antenna.
,, 4.— Left mandible, inner side.
,, 4a.— ,, ,, outer side.
,, 5.— 1st maxilla, inner lobe.
,, 6.— ,, ,, outer lobe.
,, 7.— Maxillipede.
,, 8.— Second thoracic appendage.
,, 9.— Uropod of right side, dorsal view.
,, 10.— Telson, dorsal view.



A. Chowdhary, lith.

CUBARIS ANNANDALEI, n. sp.

MISCELLANEA.

INSECTS.

Notes on Cicadidae.—The following notes are upon a collection of Cicadidae made in the Eastern Himalayas between April, 1912, and May, 1913, by His Excellency Lord Carmichael, to whom I am greatly indebted for his kindness in sending them to me. My thanks are also due to Dr. N. Annandale, Superintendent of the Indian Museum, Calcutta, for his courtesy in inviting me to publish this contribution in this Journal. In all the collection contained 12 species, the most striking of which are the two beautiful species of *Tosena*, and several of the series are very large. The range in altitude is from 500 feet at Sukna to 7000 feet at Darjiling. Several of the species, notably *Huechys sanguinea* and *Scieroptera splendidula*, have an immense range over India and Malaysia, while others, such as *Platylomia saturata*, *Meimuna tripurasura*, and *Haphsa nicomache*, are typically and exclusively Indian.

Sub-family *CICADINAE*.

Division Tacuaria.

Gen. *Tosena*, Am. et Serv.

1. *T. melanoptera*, White.
   Two males, taken at Singla, Darjiling District (1500 ft.), in June, 1912.
2. *T. mearesiana*, Westw.
   A series of 11, males and females, from Ghumti (4000 ft.), taken in August, 1912, and one from Sevook, 1000 ft. (May, 1913). All perfectly typical.

Division Dundubiaria.

Gen. *Platylomia*, Stål.

3. *P. saturata*, Walk.
   Six specimens from Government House grounds, Darjiling.

Gen. *Haphsa*, Dist.

4. *H. nicomache*, Walk.
   A large series, about 30, from Darjiling. In the whole series there is only one female. Taken in May, 1912.

Gen. *Meimuna*, Dist.

5. *M. tripurasura*, Dist.
A still larger series of about 60 specimens, all males. Darjiling, May, 1912, and Singla.

Gen. *Pomponia*, Stål.

6. *P. thalia*, Walk.
A single specimen, male, very much mutilated. Taken at Sevook in April, 1912.

Subfam. *GAEANINAE.*

Division CICADATRARIA.

Gen. *Terpnosia*, Dist.

7. *T. clio*, Walk.
One female from Sukna (April, 1913) and one male from Sevook (April, 1913).

Gen. *Gaeana*, Am. and Serv.

8. *G. festiva*, Walk.
One male from Singla, May, 1913. A typical specimen, resembling closely the figure in Distant's *Monograph of Oriental Cicadidae.*

Gen. *Balinta*. Dist.

9. *B. octonotata*, Westw.
A typical series from Singla, taken in May, 1912. All males.

Gen. *Mogannia*, Am. and Serv.

10. *M. conica*, Germ.
One male from Singla, April, 1913. Rather more distinctly marked than usual, the central stripe being very well defined.

Subfam. *TIBICININAE.*

Division HUECHYSARIA.

Gen. *Huechys*, Am and Serv.

11. *H. sanguinea*, de Geer.
A fairly large series from Sukna, April, 1913. Most of them are females, and curiously enough, in other series of this species I have had from Tonkin and Japan the females have largely predominated. These Sukna specimens are very typical of the species,

with beautiful deep black tegmina and very rich red front to head, mesonotum, and abdomen.

Gen. *Scieroptera*, Stål.

12. *S. splendidula*, Fabr.

Four specimens from Singla. They are of the variety named as *cuprea*, with very distinct yellow costal membranes to the tegmina.

HOWARD ASHTON.

BATRACHIA.

LARVA OF *Rana curtipes*, Boul. ("Fauna," p. 458).—According to Dr. Boulenger, *R. curtipes* is reported to occur in the West Coast of India, and all the specimens in my collection were taken in Coorg. It is not essentially aquatic, but is found concealed under stones and dry vegetation, coming out in the night for food. The species is often mistaken by natives for *Rhacophorus maculatus* (the chunam or tree frog) and, because of the superficial resemblance, is often called "kal therai." The frog enters the water during the breeding-season, which begins with the appearance of the S. W. monsoon. The males which are smaller are very lively and their call notes may be denoted by the short syllables "Thrub, Thrub," quite characteristic of the species. Last May, specimens of larvae were secured illustrating practically the different stages in the metamorphosis.

Larva.—The tadpoles are plentiful in small jungle streams and occur in April, May and June. They may be described as follows:—

Head and Body.—The body is oval; the dorsal and ventral surfaces are flat. It is much longer than broad. Snout broadly rounded. Mouth ventral. Tip of tail moderately rounded. Skin quite smooth.

Nostril and Eye.—Interorbital space slightly more than twice the distance between the eye and nostril. Eyes moderate, dorsolateral. Pupil round, becoming horizontal as the forelegs develop. Nostril dorsal, nearer the eye than to snout. (In the adult, the nostril is nearer the snout, and the interorbital space less than $1\frac{1}{4}$ times the distance between the eye and nostril).

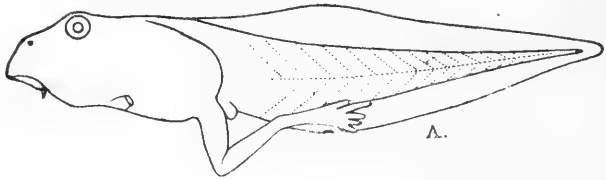
Mouth.—Ventral, fairly large, with the lower lip better developed. It is directed slightly backward. The upper margin of the upper lip devoid of papillae; but the sides of the upper lip and corners of the mouth fringed with two or three rows of big tubercles. Smaller ones fringe the lower lip. The dental formula may be expressed thus; $3:\ 3\text{—}5 + 3\text{—}5 \mid 1 + 5 : 5\text{—}7$, meaning that in the upper lip there are from three to five inner broken and three outer complete rows of short horny teeth, and in the lower lip there is one inner interrupted and from five to seven complete series. The beak consists of an upper and a lower horny provisional jaw; the latter is crescentic in form and both are finely serrated or granulate.

Glands.—No definite glands can be made out in any regular series, except a few pits on the head of some tadpoles and the parotoids, which, however, are by no means conspicuous. A row of fine white roundish glandular masses along the outer margins of the dorsal and ventral crests of the tail.

Spiracle tubular, sinistral, opening backwards and slightly upwards. Somewhat low on the side.

Anus situated in median line in front of the lower tail lobe.

Tail almost $1\frac{1}{2}$ times the length of the body. The muscular portion is stout and tapers to a fine point. Tip moderately rounded. In the middle part of the tail the upper and lower lobes nearly equal in depth. Both are strongly arched. In individuals in which the hind limbs are not fully developed, the dorsal fin begins beyond the root of the tail.



A.

B.

Dimensions of an individual (A) in which the hind limbs are just sprouting and (B) in which they are fully developed:—

	(A)	(B)
Length from snout to tip of tail ..	55 mm.	68 mm.
,, of head and body .	23 ,,	27 ,,
,, of tail	32 ,,	41 ,,
Maximum breadth of body ..	14 ,,	16 ,,
,, depth of body ..	10 ,,	12 ,,
,, ,, of tail ..	10 ,,	13 ,,

Colouration.—Dorsal part of the body uniformly dark with a few darker spots. Ventral dirty white. The muscular parts and the lobes are blotched.

Biological.—The tadpoles are active swimmers, but are easily caught. They are mainly found in shoals near the margins of the stream, browsing on weeds. They do not object to but greedily take animal food.

The tail persists in this species as a short stumpy process even when the frog has reached almost the maximum size.

CENTRAL COLLEGE,
BANGALORE.

C. R. NARAYAN RAO.

REPTILES.

NOTES ON AQUATIC CHELONIA OF THE INDUS SYSTEM.—In the volume on the Reptiles and Batrachia (1890) in the "Fauna of British India," Boulenger records six species of aquatic Chelonia (*Emyda granosa, Damonia hamiltonii, Hardella thurgii, Kachuga dhongoka, K. smithii, K. tectum*) from the Indus without comment, while he includes this river in the area of distribution of two others (*Trionyx gangeticus* and *Chitra indica*) with some doubt. *Trionyx gangeticus* has been definitely recorded from the Indus system by Dr. Siebenrock in his "Synopsis der Rezenten Schildkröten" (*Zool Jahrbucher*, Jena, 1909) and by Dr. Annandale in *Rec. Ind. Mus.*, Vol. vii (1912). I have also found it in rivers of the same system; in which I have recently taken specimens of *Chitra indica*. The following notes refer to these two species and others that I have recently obtained in the Punjab.

The following are the six Chelonia that I found in the Indus system:—

Trionychidae.	Testudinidae.
Trionyx gangeticus, Cuvier.	*Kachuga smithii* (Gray).
Chitra indica, Gray.	*Kachuga tectum* (Gray).
Emyda granosa (Schoepff).	*Damonia hamiltonii* (Gray).

I have to thank Dr. N. Annandale for the very great help he gave me in the preparation of this paper, and for the kindness, and the facilities given me while working in the Indian Museum for a few days.

Trionyx gangeticus (Cuvier).

Boulenger, *Fauna*, p. 12: Siebenrock, p. 596: Annandale, (2) p. 157.

The Indus, the Ganges and their tributaries, probably also the Brahmaputra system. The form from the Mahanaddi River has been separated as *Trionyx gangeticus mahanaddicus* by Dr. Annandale (*Rec. Ind. Mus.*, Vol. vii, Part iii, No. 25). Specimens of the typical form were obtained from the following places:—

Ferozepore (Rivers Sutlej and Beas united).
Makhu. " "
Lahore (Ravi and Chota Ravi stream).
Ludhiana (Budha stream).

Food:—On the whole it is carnivorous in habit.

A large specimen from the Chota Ravi on being dissected showed bones of some bird in its stomach, another from the

Sutlej (Ferozpore) had the complete femur of a large bird in its stomach, while yet another had the nearly complete pelvic girdle and the sacral and two other vertebrae of a frog. *T. gangeticus* is attracted by kneaded flour, which is used by the fishermen for baiting their lines; hence very often they find on examining the line a number of these creatures hanging by the hooks. The fishermen usually bring these out of the river and breaking their necks throw them out of the river, owing to the very large amount of damage that they do to the line, also because the fish avoid the place where there are tortoises. Some specimens from Ferozpore were kept living in a tub of water for about two months. It was found that they preferred old rotten flesh to everything else, though they would not desist from eating any and everything when hungry.

Remarks:—In the Punjab tortoises are not much esteemed as an article of food except by the nomad tribes. The *Sahnsies* consume them in quite large numbers. They have a peculiar way of their own for catching them. They take the rotten and foul smelling flesh of some animal and put it into the river close to the shore. The tortoises are attracted in large numbers by the smell and begin to feed on the flesh. Then a large number of these people with a peculiar sort of harpoon of their own go into the river and surround the spot on all sides; and begin making a good deal of noise, uttering shrill cries and so on. The animals becoming terrified rush away, but are harpooned in large numbers by the *Sahnsies*. The harpoon pierces the carapace and in some cases when it was wielded by some very strong man, it was seen even to pierce the plastron of quite large individuals.

The flesh is eaten, while the fat is stored and used instead of oil or for making embrocations. The *Sickligars* also eat these animals, but in much smaller numbers.

Chitra indica (Gray).

Boulenger, *Fauna*, p. 16: Siebenrock, p. 608: Annandale (2), p. 169.

The range for this animal as given in the Fauna is "Ganges and Irawaddy; Indus?": by Dr. Siebenrock "Indien; Nepal, Allahabad; Ganges, Calcutta; Irawaddy": and by Dr. Annandale "The Ganges and Irawaddi river systems as far as the base of Himalayas in the former. The species is not uncommon in the Gangetic delta and large individuals can often be bought in the Calcutta market, in which, however, they are less abundant than *T. hurum* and *T. gangeticus*." A specimen was recently obtained from Makhu (Rivers Sutlej and Beas united), along with the other forms here mentioned. It was a young female. The carapace measured 16·8 × 18·4 cm. I have since obtained a larger specimen at Ludhiana.

Dr. Annandale has called my attention to the extremely small size of the young of this species, which is certainly the largest of the Indian Trionychidae when full grown.

The measurements of some in the collection of the Indian Museum are as follows :—

1. Carapace	52·3 cm. × 59·7 cm.	Largest specimen from Calcutta.
2. ,,	5·9 cm. × 6·05 cm.	A specimen from Jalpaiguri, Northern Bengal.
3. ,,	4·8 cm. × 5·1 cm.	The smallest specimen from Jalpaiguri.
4. ,,	2·9 cm. × 3·3 cm.	A very small ♀ from Allahabad.

On comparing the young one with a young specimen of *Emyda granosa scutata* (Peters) which was taken at Moulmein just after hatching and the size of which is 4·1 cm. × 3·6 cm., it appears that the young ones of *C. indica* on hatching are actually smaller than those of *Emyda granosa scutata*, which is a much smaller form when adult.

In the young specimens of this form it appears that the upper jaw is not fully ossified as it breaks off when the skeleton is being prepared. This was the case with my specimen from Makhu and some of the skeletons in the Indian Museum.

On the inner margin of the hypoplastron there are five processes on that of the left side and four on the right side.[1]

The contents of the stomach of a specimen from Ludhiana included the bones of a fish and some small snail-shells.

Emyda granosa (Schoepff).

Boulenger, *Fauna*, p. 49 : Siebenrock, p. 59 : Annandale (2), p. 171.

Distribution :—"Valleys of the Indus and the Ganges, but it probably occurs in Assam and certainly does so on the coast of Arrakan." Specimens of the typical form were obtained at Phagwara in a small stream known as the *Baen*, in a small rivulet about four miles from Ferozpore, and also in the *Budha* stream at Ludhiana.

The colour of the plastron varied from perfect white to yellow.

The number of bony marginal plates varies from 14 to 20.

Kachuga smithii (Gray).

Boulenger, *Fauna*, p. 42 : Siebenrock, p. 453.

Distribution :—The species has been recorded from the upper Ganges and Indus with their tributaries. Dr. Annandale tells me that the young specimen he recorded (*Rec. Ind. Mus.*, vol. i, p. 171 ; 1907) from Rajshahi on the lower Ganges as *K. sylhetensis* really belongs to this species. I found it to be quite abundant at Ferozpore (Sutlej and Beas united), Lahore (Ravi), and at Kapurthala (in a small stream known as *Baen*).

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[1] Annandale in *Rec. Ind. Mus.*, VII, p. 170, says that there are three or four.

Boulenger's description in the "Fauna" quite corresponds with that of specimens from various localities, except in the appearance of the fourth vertebral shield, which varies very much in specimens from the same as well as from different localities. In some it tapers very much in front so that the suture between this shield and the third is quite narrow, while in others it is much broader.

The colour also varies somewhat, from olive brown to pale brown dorsally. In the young of this species there is an orange-coloured band on the anterior part of the dorsal keel; two orange spots are also present just behind the nape, one on each side; these disappear in adults.

The animal chiefly feeds on rotten flesh. On enquiring from fishermen at Ferozpore it was found that the animal is never attracted by the flour bait which they use in fishing, but is often caught also by the small prawns which they sometimes use as bait. Specimens kept living in large tubs were seen to like flesh much better than anything else. Large amounts of vegetable matter found in the stomach of a specimen cut up in the Museum at Calcutta show, however, that it takes vegetables also. Thus it appears that the animal is omnivorous. A young specimen of this form was found buried in mud with the head projecting, on the side of the river Ravi at Lahore. The water had retracted from this place about three months before, yet the animal was found living. It appears, therefore, that this form can hibernate like *Emyda granosa*.[1]

Kachuga tectum (Gray).

Boulenger, *Fauna*, p. 43: Siebenrock, p. 454: Annandale (3), p. 38.

The range for this animal as given in the "Fauna" is Ganges and Indus systems. Specimens were obtained at Makhu from the united water of the Sutlej and the Beas. None, however, could be got at Ferozpore and the fishermen there also stated that this form does not occur there. Specimens were also got at Ludhiana from the *Budha* stream, a tributary of the river Sutlej.

The colour of this form is variable with age. In the young the plastron is orange-coloured with very distinct black spots, while in the adult the orange is replaced by yellow and the black spots become less numerous. The carapace in the young is olive green with small black dots all over and the orange band on the first three vertebrals is very much more distinct than in the adult; moreover, the carapace in the adult becomes dark olive.

The animal is herbivorous; it desists from flesh but eats blades of grass and other vegetables very readily.

[1] Annandale in *Rec. Ind. Mus.*, VII, p. 171.

It is a very active animal, moving at a very rapid rate on land though thoroughly aquatic, and swimming very quickly in water.

Damonia hamiltonii (Gray).

Boulenger, *Fauna*, p. 84: Siebenrock, p. 476.

This form has been recorded from Bengal, Punjab, and Upper Sindh. A single specimen of this was obtained from Makhu. It is at present in the collection of the Indian Museum, Calcutta. One thing to be particularly noted about this form is the large number of round yellow spots on the cornea.

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BAINI PARSHAD, *B.Sc.*

RANGE OF *Acanthodactylus cantoris*, Günther.—The range of the genus *Acanthodactylus*, Weigmann, as given by Boulenger in the *Fauna of British India, Reptilia and Batrachia*, is as follows: "South of Spain and Portugal; Africa, north of the equator; South-Western Asia, eastwards to the Punjab;" and that of the species *Acanthodactylus cantoris* is "North-Western India from Agra to Sind, Baluchistan, South-Western Persia". Thus it appears that Boulenger specially excludes the Punjab from the area in which this species is found. But I found it in the following places in the Punjab: Lahore, Abohar, Dharamkot and Nathana in the Ferozpore district, and in Jullundher.

The colouration of the specimens obtained from various localities did not differ very much and quite corresponds to the description given by Boulenger, except that in some specimens the white and black longitudinal lines alternating with each other become rather indistinct. In one of the specimens from Lahore there were two tails one above the other, these appeared to have grown out in place of the tail which somehow had got broken. The specimen has been sent to the Indian Museum.

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XVI. NEW AND INTERESTING PEDUNCULATE CIRRIPEDES FROM INDIAN SEAS.

By N. Annandale, *D.Sc., F.A.S.B., Superintendent of the Indian Museum.*

(Plates xxxiii–xxxiv.)

For some years past the main biological work of the 'Investigator' has been carried out in comparatively shallow water, and the Surgeon-Naturalists (Capts. R. B. Seymour Sewell and T. L. Bomford) have devoted considerable attention to the littoral and sub-littoral fauna. The result has been, so far as the Cirripedia Pedunculata are concerned, to add several new and interesting species to the fauna of the Bay of Bengal. I propose here to describe or notice these, together with a species of which specimens have been obtained by Mr. J. Hornell off the coast of Baluchistan.

Family Scalpellidae.

Scalpellinae, Pilsbry, *U.S. Nat. Mus. Bull.* 60, p. 4 (1907).
Pollicipedidae Annandale, *Mem. Ind. Mus.* II, p. 63 (1909).

Of this family four species have now to be added to the Indian fauna, one belonging to the genus *Lithotrya* and three to the subgenus *Smilium* of the genus *Scalpellum*.

Genus **Scalpellum**, Leach.

Subgenus **Smilium** Gray.

Annandale, *Rec. Ind. Mus.* V, p. 145 (1910).

The species of this subgenus often inhabit shallower water than those of *Scalpellum* (*s.s*). It is, therefore, not surprising that the exploration of the coast of Burma should have resulted in the discovery of forms not hitherto known from these seas, for most of the biological work of the 'Investigator' has been carried out hitherto in much deeper water. The three species here noted have all been found already elsewhere in the Oriental Region.

Scalpellum (Smilium) kampeni, Annandale.

Rec. Ind. Mus. III, p. 267, figs. 1-4 (1909); *Vid. Med. naturhist. Foren. Köbenhavn*, 1910, p. 82.

This species was originally discovered by Dr. P. van Kampen in 13–16 fathoms off the coast of Sumatra. It has since been found off Singapore and in the Gulf of Siam (by Dr. Th. Mortensen) at depths of from 15–30 fathoms. Several specimens were obtained by Capt. Sewell off the coast of Burma in comparatively shallow water. Precise details as to their *provénance* are not at present forthcoming.

Scalpellum (Smilium) rostratum, Darwin.

Darwin, *Mon, Cirr. Lepadidae*, p. 259, pl. iv, fig. 7 (1851).
Hoek, *Siboga-Exp.*, Mon. XXXI*a*, p. 65, pl. v, fig. 13 (1907).
Sewell, *Journ. As. Soc. Bengal (n.s.)* IX, p. 329 (1913).

Originally described from the Phillipines (20 fathoms), this species was taken at several places in the Malay Archipelago by the 'Siboga' in depths of from $8\frac{1}{2}$ to $61\frac{1}{2}$ fathoms. A young specimen was obtained by Capt. Sewell off the coast of Burma in 50 fathoms ('Investigator' sta. 395: lat. 13° 29′ N., long. 97° 30′ E.).

Scalpellum (Smilium) sinense, Annandale.

(Pls. xxxiii, xxxiv, fig. 1.)

Ved. Med. naturhist. Foren. København, 1910, p. 211, pl. iii, fig. 3.

This species was first reported from the China Sea. Capt. Bomford obtained three specimens on the spines of a sea-urchin of the family Cidaridae (together with the types of *Heteralepas reticulata*, described below) in 60 fathoms in the Mergui Archipelago (sta. 534: lat. 12° 4′ N., long. 96° 44′ E.). These specimens, which were taken in April, have no males attached, although one is ovigerous.

The proportions of the valves and the shape of the terga vary somewhat, the external membrane is much denser in some individuals than in others, and the form of the mandible is extraordinarily variable. In the specimen from China first dissected there were five main teeth (including the inner angle) with a small subsidiary tooth between the first two; in one Burmese example there are six subequal teeth, but in another there are seven teeth, the fourth of which has, however, almost the nature of a subsidiary tooth. The following appear to be specific characters:—the appendage as a whole is never very strongly curved, the first main tooth is never either much larger than or widely separated from the second; all the teeth (except the small subsidiary ones) are of moderate size, subequal and about equidistant; the inner angle forms a blunt tooth not much larger than the others and clothed with short spines or hairs.

The eggs are broadly oval in outline, 0·4 mm. long by 0·29 mm. broad. They are present only in comparatively small numbers, each lamella containing about 100. That is to say, each barnacle produces about 200 eggs at a time.

Genus Lithotrya, G. B. Sowerby.

The species of this genus are usually found boring in coral-reefs, among the shells of molluscs or in soft limestone.

The Indian species are still imperfectly known, having been recorded only from outlying groups of islands such as the Maldives and the Nicobars.

Lithotrya (Conchotrya) valentiana (Gray).

Darwin, *Mon. Cirr. Lepadidae*, p. 371, pl. viii, fig. 5 (1851).
Gruvel, *Mon. Cirh.*, p. 104, fig. 113 (1905).

Mr. Hornell took two specimens of this species in cavities in limestone rocks on the shore of Churnah I. off the coast of Baluchistan and has kindly presented them to the Indian Museum. The original specimens were embedded in an oyster-shell from the Red Sea, and others have since been found in a similar position at Zanzibar.

L. valentiana is distinguished from all others of the genus by the absence of lateral valves. The rostrum is rudimentary and the scuta, terga and carina lock together in an unusually intricate manner. These characters are perhaps sufficient to justify the retention of Gray's name *Conchotrya* as that of a subgenus of which this species would be the type and, so far as is known, the sole representative. The peduncle is normal in shape. It is covered with minute chitinous tubercles and bears a transverse suboval calcareous plate on its posterior surface at or near the base.

Family LEPADIDAE.

Subfamily *Oxynaspidinae*.

Oxynaspis indica, Annandale.

Oxynaspis celata subsp. *indica*, Annandale, *Mem. Ind. Mus.* II, p. 69, pl. vii, fig. 10 (1909).

I think it best on the whole to recognize the Indian *Oxynaspis* as a distinct species, although it is closely allied to the one from the Atlantic described by Darwin as *O. celata*. It has a narrower capitulum than that form and neither the shape of the valves nor the structure of the appendages is quite the same.

I was wrong (*loc. cit.*, 1909) in differing from Darwin as to the nature of the spiny covering of the shell in this genus. In a young specimen recently examined the antipatharian has produced a flat, spiny growth over the valves, and from this growth normal branches are actually given off at the tip of each tergum of the cirripede, reaching a length of several millimetres. There can, therefore, be no doubt that the external covering of the barnacle is produced, not by the animal itself, but by the organism to which it is attached—as Darwin originally stated.

O. indica occurs on both sides of the Bay of Bengal at depths of from 15 to 20 fathoms. I have recently found two small specimens on an antipatharian from 'Investigator' station 464 (S. of Ceylon: lat. 5° 56′ N., long. 75° 45′ E.: 52–68 faths.).

Subfamily *Lepadinae.*

Genus **Alepas** (Rang), Pilsbry.

Alepas, Pilsbry, *U.S. Nat. Mus. Bull.* 60, p. 103 (1907); Annandale, *Mem. Ind. Mus.* II, p. 64 (1909).

Pelagic Lepadinae with translucent or transparent tissues, without calcareous valves or with a pair of scuta only, without a muscular lining to the capitulum, without anal appendages or with uniarticulate anal appendages, with straight or nearly straight cirri of not more than about 14 joints to each ramus, with (in one species) 5 lateral filaments on each side. The joints of the cirri bear circles of hair distally; the mandibles are well developed, with five or six teeth; the maxillae often have the cutting edge scalariform.

The synonymy of the genus thus redefined is discussed by Pilsbry in the paper cited. I have adopted his views on the subject because they seem to be consistent and to tend to simplicity in the classification of the Lepadidae, but it is of course true that the identification of the species described by Quoy and Gaimard and by Rang on the one hand and by Lesson on the other must remain in doubt.

In my own paper to which reference is made I proposed to recognize *Alepas* provisionally as the eponymous genus of a subfamily of somewhat degenerate Lepadidae characterized by their transparent tissues and simplified valves and appendages. It is clear, however, from an examination of the species described below that I was mistaken in my views as to the relationships of the genus, which must be placed near *Conchoderma*. Indeed, the characters whereon the two genera are separated (the thickness of the capitulum, the length of the cirri, the spinulation of these appendages, and apparent differences in the form of the mouth-parts, which are unknown in some species of *Alepas*) are hardly of generic importance unless considered together. Whether some of the other genera (*Chaetolepas*, *Microlepas*, etc.) placed by me in 1909 in the "Alepadinae" should be separated from the Lepadinae is doubtful, but *Anelasma* appears to be very distinct. I have not seen examples of any of these genera.

The different species of *Alepas* have in nearly all cases been found on the umbrella of pelagic medusae. The genus evidently occurs in all warm and tropical seas, but individuals appear to be extremely rare. Specimens identified by Gruvel as *A. parasita*, Sander-Rang, have been taken in the southern part of the Indian Ocean [1].

Alepas investigatoris, sp. nov.

(Pls. xxxiii, xxxiv, fig. 2.)

The whole animal is white and translucent, except that the cement-glands have a yellowish tinge, which is also present in the

[1] *Bull. Soc. zool. France*, 1907, p. 163.

ova. The scuta are white and opaque.[1] The outline of the capitulum and peduncle is graceful and as a rule markedly sinuous; the relative proportions of the two regions differs considerably in different individuals and probably the peduncle is contractile as well as capable of being twisted and curved in various directions.

The posterior outline of the capitulum is strongly arched, the anterior outline markedly sinuous, strongly convex down the edge of the orifice and almost straight and vertical below it. The apex of the capitulum as seen from the side is slightly produced but not pointed. The whole capitulum is somewhat compressed. As seen from above it is distinctly emarginate in front, a median notch separating its anterior border into two almost rectangular lobes. The sides in this view are sinuous, but roughly parallel; the posterior border broadly rounded. The margins of the orifice are retroverted and a little thickened, but not fringed. The orifice is patent.

The peduncle is slender and cylindrical, a little swollen at the base, a little longer than, as long as, or a little shorter than the capitulum.

The scutum is well calcified, **Y**-shaped but with the relative lengths of the three arms variable.

The cirri are straight and of moderate length. Those of the first pair are not widely separated from the others, which they resemble in general form though they are considerably shorter than the second pair; each ramus has 8 joints, but the anterior ramus is distinctly shorter than the posterior one. The two basal joints of each are devoid of terminal hairs, but all the other joints bear a complete circle thereof, and also a fringe descending from it for some little distance down the posterior face. The second cirrus has 9 joints in each ramus, a complete circle of hairs at the tip of each joint and an incomplete (distal) marginal fringe in front. The rami of the remaining cirri have from 11 to 14 joints, some of those at the base being sometimes imperfectly differentiated. The terminal circles of hairs are sometimes interrupted on the posterior cirri, but the incomplete marginal fringe is always present at any rate on the last 8 to 10 joints. The sixth cirrus is slightly the longest. In all the cirri the rami are much longer than the undivided basal part of the appendage.

There are no anal appendages, but the position of each is indicated by an indistinct papilla.

There are 5 lateral filaments on each side, situated as follows:—two at the base of the first, one at the base of the third, one at the base of the fourth and one at the base of the fifth cirrus. Each filament is a delicate tapering flattened structure, quite transparent and easily overlooked though of considerable relative size; the first pair are larger than the others, which diminish in size from before backwards.

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[1] In some specimens preserved in formalin the calcareous matter has apparently been dissolved out.

The mouth-parts are prominent, but the labrum is not markedly bullate. It is quite smooth. The mandibles have six sharply pointed teeth; the outermost is separated by a considerable gap from the second, towards which it does not converge; the two inner teeth are close together. The inner edge of the first four teeth is pectinate. The whole appendage is minutely pubescent and there is a short fringe of minute hairs on the inner margin within the innermost tooth. The maxilla bears a single stout yellow spine at the outer extremity of its cutting edge but, almost concealed by it, there are two smaller spines on each side; the edge is strongly sinuous with four distinct depressions; it is clothed with soft flattened hairs of various lengths. The inner maxilla is broad and stout, clothed with short soft hairs.

The penis is moderately long and stout, smooth and tapering. It is clothed with fine hairs.

The eggs are remarkably small and numerous. They are invisible individually to the naked eye but form a fairly stout yellowish lamella that appears smooth and homogeneous until examined with a strong lens. They are broadly oval in outline.

Dimensions of largest specimen.

Length of capitulum	..	30 mm.
Breadth of capitulum	..	30 ,,
Length of peduncle	..	38 ,,
Breadth of peduncle	..	10 ,,

Habitat.—Morrison Bay, Mergui Archipelago; on Rhizostomous medusa.

Type.—No. 8711/10, *Crust., Ind. Mus.*

A. investigatoris is closely related to *A. pellucida* (Aurivillius) and *A. pacifica*, Pilsbry, but is apparently distinguished from both by the emargination of the capitulum above, by having five lateral filaments on each side and by its longer cirri, as well as by other characters more likely to be variable.

Two specimens, one large and one small, were found together on the edge of the umbrella of a medusa by Capt. Sewell, while another medusa of about a foot in diameter was surrounded in the same region by a number of individuals of different sizes. None were found on other specimens of the coelenterate examined at the time.

Genus **Heteralepas**, Pilsbry.

Heteralepas (Paralepas) reticulata, sp. nov.

(Pls. xxxiii, xxxiv, fig. 3.)

The capitulum and peduncle are (in spirit) of an opaque slightly yellowish tint, due to the muscular layer, which is covered externally by a thick transparent, tough, quasi-cartilaginous integument. The whole animal is very small.

The capitulum is almost globular; there is no carinal crest, but the posterior part and the sides are covered with a reticulation of deep grooves and in the centre of each mesh there is a projecting tubercle; below the aperture the surface is smooth or marked with irregular (mostly transverse) grooves. No scuta can be distinguished but the outline of a pair of irregular areas is sometimes indicated on the smooth anterior part of the capitulum, in the position they would occupy. The aperture is less than a third as long as the capitulum and can be almost completely closed so as to appear merely as a narrow vertical slit with horizontal grooves extending outwards from it; when open it is subtriangular and surrounded by a distinct fringe: it can evidently also be protruded so as to be almost tubular.

The peduncle is cylindrical. It is rather shorter than the capitulum, but at the base is often produced in front in the form of a tapering flattened process that lies in one of the grooves on the sea-urchin's spine and sometimes is as long or nearly as long as the peduncle.

The cirri are short and feebly curved, but the rami are relatively long as compared with the undivided basal portion. The first cirrus is widely separated from the second and differs considerably in outline from all the others. Its anterior ramus is much the shorter and more slender of the two (although each has 8 joints) and is nearly cylindrical in form. The posterior ramus tapers to a point, and is considerably swollen at the base. In both rami the apical part of each joint bears a more or less incomplete circle of very stout bristles; on the basal joint of the posterior ramus the circle is widely interrupted posteriorly. On the anterior ramus the circle is so deep that it occupies a half or even two-thirds of some of the joints. The other cirri are similarly armed, but the circles of bristles, which are complete on the anterior cirri and laterally interrupted on the posterior ones, are not so deep.

The anal appendages are long and slender, having 7 or 8 joints, the tip of each of which is surrounded by a sparse circle of long but very fine hairs. The distal part of the appendages is much attenuated.

The penis is slender and smooth, much contorted in the preserved specimen and clothed with fine hairs.

The mouth-parts are very prominent. The labrum is not bullate; it bears a semicircle of minute, blunt chitinous teeth. The mandible has four teeth, of which the outermost is the largest. It is rather widely separated from the second tooth, towards which it is slightly curved. The remaining three teeth are straight, subequal and equidistant; the second and third are sharply pointed; their inner margin bears several short stout spines that give it a pectinate appearance. The innermost tooth is minutely bifid or trifid and bears on its inner edge several irregular projections and a fringe of fine hairs similar to those that cover the greater part of the body of the appendage. The cutting edge of the maxilla is definitely scalariform, with four distinct steps; it bears numerous stout bristles. The second maxilla is slender; it is armed with hairs of varying size, some of them moderately stout and long.

Dimensions of a large specimen.

Length of capitulum	..	5 mm.
Breadth of capitulum	..	3·5 ,,
Length of peduncle	..	3 ,,
Thickness of peduncle	..	2 ,,

Habitat.—Mergui Archipelago: 60 fathoms ('Investigator' sta. 534): on spines of Cidarid sea-urchin, with *Scalpellum sinense.*

Types.—No. 8713/10 *Crust., Ind. Mus.*

The external appearance of this species is very characteristic and will at once distinguish it from any other of the genus.

EXPLANATION OF PLATE XXXIII.

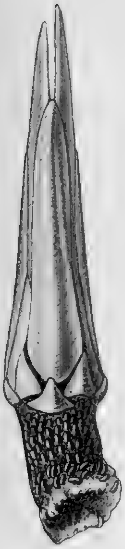
FIGS. 1, 1*a*, 1*b*.—Shell and peduncle of *Scalpellum* (*Smilium*) *sinense*, Annand. from Burma (× 5).

The tip of the left tergum was broken in the specimen figured.

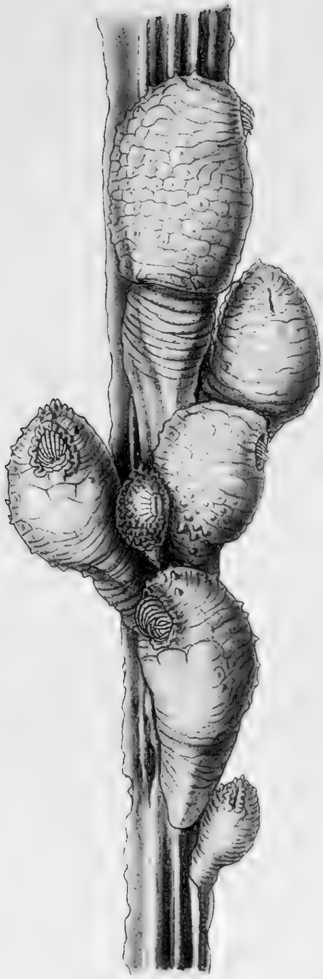
,, 2.—*Alepas investigatoris*, sp. nov., from Burma (nat. size).

,, 3.—*Heteralepas* (*Paralepas*) *reticulata*, sp. nov., on spine of Cidarid sea-urchin from Burma (× 5).

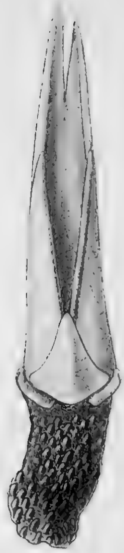
,, 3*a*.—The orifice of one of the same specimens further enlarged (× 16).



1b.

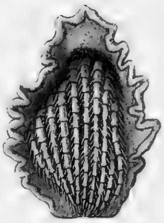


3.

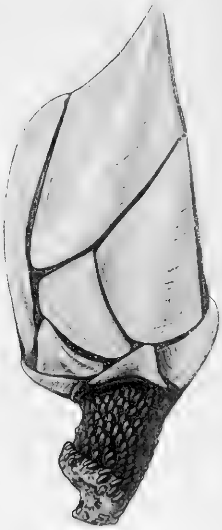


1a.

2.



3a.



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S. C. Mondul del.

Bemrose, Collo., Derby.

Fig. 1. Scalpellum sinense. Fig. 2. Alepas investigatoris.
Fig. 3. Heteralepas reticulata.

EXPLANATION OF PLATE XXXIV.

FIG. 1.—First cirrus of *Scalpellum* (*Smilium*) *sinense*, Annand. (× *ca.* 13).

,, 1*a*.—Maxilla of same species (× *ca.* 27½).

,, 1*b*.—Mandible of same species (× *ca.* 27½).

,, 2.—Animal of *Alepas investigatoris*, sp. nov. (× 1⅓).

The hairs and bristles on the appendages, etc., are not shown.

,, 2*a*.—Mandible of same species (× *ca.* 6).

,, 2*b*.—Maxilla of same species (× *ca.* 6).

,, 3.—First cirrus of *Heteralepas* (*Paralepas*) *reticulata*, sp. nov. (× *ca.* 32).

,, 3*a*.—Mandible of same species (× *ca.* 44).

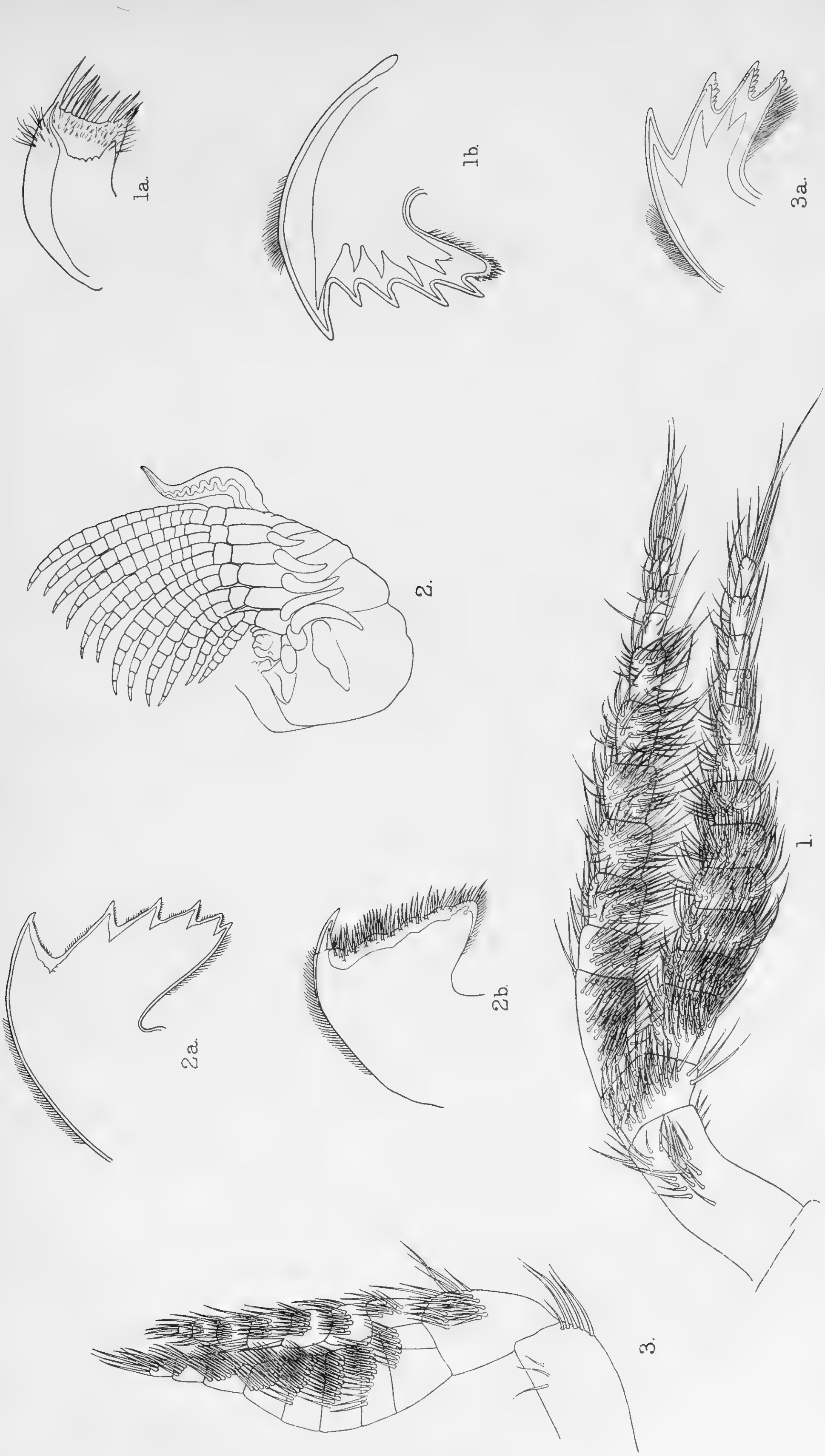


Fig. 1. Scalpellum sinense. Fig. 2. Alepas investigatoris. Fig. 3. Heteralepas reticulata.

S. C. Mondul del.

Bemrose, Collo, Derby

XVII. MORE NOTES ON INDIAN DERMAPTERA.

By MALCOLM BURR, *D.Sc., F.E.S., etc.*

Since the publication of my half volume on the Dermaptera in the Fauna of British India Series, material has accumulated with considerable rapidity. This has led to the following papers on Indian Dermaptera :—

BORELLI, A. (1911[1]). Diagnosi preventive di Dermatteri nuovi della regione indiana. (Boll. Mus. Torino. No. 640, vol. xxvi, pp. 1-4, 1912).

,, (1912[3]). Dermapteres nouveaux ou peu connus du Museum de Paris. (Bull. Mus. Hist. Nat. Paris, vol. xviii, pp. 221-240, 1912).

BURR, M. (1911[15]). Contribution to our knowledge of Indian Earwigs (J. Asiat. Soc., Bengal, vol. vii, No. 11, pp. 771-800, December 1911).

,, (1913[4]). Zoological Results of the Abor Expedition, 1911-12. X. Dermaptera. Rec. Ind. Mus., viii, pp. 135-147).

,, (1913[5]). Indian Dermaptera collected by Dr. A. D. Imms. (J. Proc. Asiat. Soc, Bengal (N.S.), ix, No. 5, pp. 183-187, 1913).

Since the appearance of the above papers, I have received still further material, a list of which is incorporated in the following pages. For these I am indebted as follows:—

(i) to Father Astruc, S.J., for material collected at Shembaganur, and the Pulney Hills in the Madura District, Madras.

(ii) A small collection from Southern India kindly sent me by my old friend Mr. T. B. Fletcher, F.E.S., now Imperial Entomologist at Pusa.

(iii) A small collection made at Jaunsar and in the Central Provinces, by Dr. A. D. Imms, late Forest Etomologist to the Government of India.

(iv) Various material in the Indian Museum, submitted to me by my old friend Dr. N. Annandale.

(v) The private collection of His Excellency Lord Carmichael, Governor of Bengal, also sent me by the Indian Museum. This collection will ultimately be distributed to different museums in India, Great Britain and Australia.

The material referred to is to be assumed to be in the Indian Musuem, unless stated otherwise; specimens from Dr. Imms and

Mr. Fletcher are indicated by the respective initials (A. D. I., and T. B. F.). Dr. Imms's specimens have been returned to Dehra Dun, and Mr. Fletcher's are incorporated in my own collection, thanks to his generosity.

The numbers refer to the official numbering of the Indian Museum.

PROTODERMAPTERA.

Family PYGIDICRANIDAE.

Subfamily *DIPLATYINAE.*

Genus **Diplatys**, Serv.

1. **Diplatys gladiator**, Burr.

Chota Nagpur, Purulia, Manbhum District, 10-ii-12, No. 9529/19 ♀ : pass between Chaibassa and Chakardharpur (nymph). 2-4-iii-13, No. 9539/19.

Bengal, Calcutta, June 11, ♂, No. 9511/19: Calcutta in house, Jan. 12, ♀, No. 9506/19, Calcutta, 1 ♀, 20-ii, No. 498/20.

S. India, Coimbatore, on wet rock, ix-12 (P.S. coll.).

Hitherto only recorded from neighbourhood of Calcutta.

2. **Diplatys falcatus**, Burr.

W. Himalayas, Almora, Kumaon, 6500 ft., vii-11, (♂ ♂ ♂ ♂) Nos. 9555/19, 9556/19 (a fragment), 9557/19, 9558/19, 9577/19, (♀), 9580/19, larva, 9574/19 : Mussoorie, 7000 ft. 20-iv-05. ♂ ♂, (♀) No. 518/20. (Brunetti). No. 519/20 has the forceps long, straight, contiguous, and not dilated.

Also two fragments (Nos. 9565/19 and 9566/19) from same locality, probably referable here.

3. **Diplatys lefroyi**, Burr.

S. India, Coimbatore, 2-xii-12. ♂ (T. B. F.).

4. **Diplatys rufescens**, Kirby.

W. Himalayas, Almora, Kumaon, 6500 ft., 18-vii-11, ♂ ♂, 9554/19, 9562/19, 9570/19, 9576/19, 9579/19.

S. India, Coimbatore, ♂ (K. S. P.).

5. **Diplatys annandalei**, Burr. ?

Chota Nagpur, pass between Chaibassa and Chakardharpur, 2-4-iii-13. No. 9591/19.

I think this specimen must be referred to this species. Hitherto only known from Siam.

6. **Diplatys liberatus**, Burr.

S. India, Puthir, S. Canara, 29-i-13 (Y. R.), ♂.

7. **Diplatys bormansi**, Burr. ?

Bombay, Satara District, Bamnoli to Akalpa, Ratnagiri District. 27-x-12. 2 ♀. No. S.P.A./341–342, Medha, Yenna Valley, 2300 ft., 23-iv-12. S.P.A./172, a fragment, same locality, S.P.A./175. Helvak, Koyna Valley, 2000 ft., iv-12. S.P.A./198, a fragment.

It is possible that where sufficient material has been examined, and especially, the genital armature observed, that several species of this difficult genus will require to be fused. To dissect out the genitalia, and the ninth sternite of the male, which offers such valuable specific characters in this genus, but is often difficult to observe, specimens in alcohol are necessary. I am inclined to think that there are dimorphic forms of the males in several instances.

Subfamily *PYGIDICRANINAE.*

Genus **Kalocrania**, Zacher.

1. **Kalocrania eximia**, Dohrn.

Assam, Sonapur, ♂, No. 9586/19 (L. W. Middelton).

E. Bengal, ♀, No. 9540/19 (H. Stapleton).

Upper Burma: Northern Shan Hills, ♂ (J. C. Brown). A defective small specimen, with the tips of the forceps broken off, No. 535/20.

2. **Kalocrania picta**, Guer.

Bengal, Calcutta, rains, 2 ♂, No. 9587/19 (Gravely).

3. **Kalocrania valida**, Dohrn.

S. India, Ootacamund, 20-31-xii-12 and 27-x-12, at 7500 ft. (T. B. F.), 2 ♀. The elytra is unusually short.

Genus **Dicrana**, Burr.

1. **Dicrana kallipyga**, Dohrn.

S. India, Ootacamund, 12-14-i-13 (T. B. F.), 4 ♂, 3 ♀, 31.
id., 7500 ft. 27-x-12. ♂ (T. B. F.). Shevaroys, Hopeville Estate, 4000 ft., 16-x-12, (T. B. F.), larva. Mysore, Bababudin Hills, xi-12, 4000–5000 ft. (T. B. F.), Maddur, 3000 ft., 23-vii-12, ♀ (T. B. F.).

Bombay, Satara District, Taloshi, Koyna Valley, 2000 ft., ♀, S.P.A./180, Helvak, Koyna Valley, 2000 ft., iv-12, S.P.A./197.

2. **Dicrana dravidia**, sp. n.

Fusco-nigra, fulvo-variegata: forcipis bracchia ♂ basi ipso contigua, tum fortiter arcuata, apice bimucronata, attingentia.

		♂
Long. corporis	..	19 mm.
,, forcipis	..	3·5

Small: greyish black, varied with tawny: antennae greyish: head smooth, black, marbled with tawny: pronotum as broad as the head, longer than broad, parallel-sided, posterior border straight, all angles rounded, black, with a median tawny band and narrow tawny edging: scutellum tawny: elytra black, with a broad, oblique broad pale tawny band: legs tawny, marbled with black: abdomen greyish and black, densely clothed with a golden pubescence: last tergite ample, smooth: ninth sternite broadly rounded, entire; forceps stout and depressed, trigonal, stout and broad at the base and subcontiguous at the base itself, arcuate to enclose a lozenge-shaped area, the points meeting and bimucronate: inner margin crenulate near the base.

S. India: Madura District: Shembaganur, 1 ♂ (Father Astruc, *c.m.*).

The forceps readily distinguish them from other Oriental species: in appearance it recalls the African *D. frontalis* and *D. separata*.

Family LABIDURIDAE.

Subfamily *ALLOSTETHINAE*.

Genus **Gonolabidura**, Zacher.

1. **Gonolabidura minor**, sp. n.

Statura minore: *G. piligeri* vicina: differt statura multo minore, sculptura abdominis crebriori, segmento ultimo dorsali lateribus carinatis.

		♂
Long. corporis	..	11 mm.
,, forcipis	..	1·5

Small: colour red-brown: antennae greyish, basal 2 segments yellow and apical ones whitish; about 15 segments; 3rd. clyindrical, about twice as long as broad; 2nd. much shorter, obconical, the rest gradually lengthening, form pear-shaped to long ovate. Head smooth, shining, sutures faint: pronotum transverse, rectangular: meso- and metanota larvae: sternum typical: legs yellow: abdomen chocolate brown, hairy, densely but very finely punctulate: sides of 7–9th segments convex and finely rugulose: last dorsal segment ample, smooth, with a keel along each side corresponding to the lateral ridge of the forceps: penultimate ventral segment rounded: metaparameres lanceolate, acuminate: forceps with branches subremote, trigonal, tapering, unarmed, gently arcuate.

S. India: Anamalai Hills, 4000 ft., 23-i-12. ♂, nymph, (T. B. Fletcher, *c.m.*).

This is a diminutive relation of *G. piligera*: it differs in its much smaller size, more densely, but equally finely, punctulate abdomen, and laterally keeled last dorsal segment. I took it at first for a larva of that species, but the apical segments of the parameres are protruding: these are typically narrow and pointed. I hesitated to extract them, prefering to wait for more material, as there is no doubt as to the position of the species, and I did not wish to damage the only adult male available, which is dry.

Subfamily *PSALINAE.*

Genus **Homoeolabis**, Borelli.

1. **Homoeolabis maindroni**, Bor.

S. India: Coimbatore, 21-vi-12. Under a log, ♀ (Y. R.). Coorg, on coffee estate, 3400 ft., 4-iv-12, Bangalore.

Genus **Euborellia**, Burr.

1. **Euborellia stali**, Dohrn.

S. India, Bangalore, under flower pots, 3300 ft., 28-i-12, many specimens; Coimbatore, many specimens: *id.*, at light. 30-ix-12 (T. B. F.): *id.*, 22-v-12 (Y. R), ♂.

Bombay (town), Elphinstone College Compound, 4-viii-11, under stone, No. 1545/19.

2. **Euborellia penicillata**, Bor.

S. India, Ootacamund, 12-14-i-13: many specimens. (T. B. F.).
id., 27-x-12. 2500 ft. ♂. (T. B. F.).

3. **Euborellia moesta**, Gene, vel species **vicina**.

Bombay, Satara District, Mahableshwar; 4200 ft., 13-16-iv 12. S.P.A./161, 167, 168. ♂ ♂: S.P.A./166, 169 larvae.

4. **Euborellia**, sp.

E. Himalayas, La-ai River, Kalem Valley, Mishmi Country. 31-x-12. ♀. No. 7701/19.

5. **Euborellia greeni**, Burr.

Mysore: Bababudin Hills, 4500-5000 ft.

Madras: Shevaroy Hills, Hopeville Estate, 4000 ft., 16-x-12. 2 ♂: Vallakadai Peak, 4500 ft., 18-x-12. Kadiar Rocks, 4000 ft., 15-x-12. Yercaud, 4500 ft., 20-x-12.

All the above specimens were taken by Mr. T. Bainbrigge Fletcher in October, at an elevation between 4000 and 5000 ft., under logs and in dead leaves.

It somewhat resembles *E. penicillata*, but it is a little bigger, more clumsily built, and lacks the tuft of hairs in the ninth sternite of the male: the colour is much less rich, and the sculpture of the head much more marked.

These South Indian specimens differ from the original Singalese examples, taken by Mr. Green, in more dull-coloured legs, which do not contrast so strikingly with the black body.

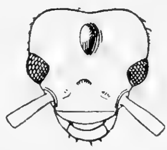
The species is already known from Southern India, as there is one from the Nilgiris in the British Museum.

Travancore :—Top Station, 6000 ft. (Andrews).

This is a very small pair, the male being only 10 mm. long: the forceps are decidedly arcuate apicad, but it agrees in other respects with the specimens from the Shevaroys.

6. **Euborellia sisera**, sp. n.

Caput rufum, occiput profunde excavernato: pronotum rufum, subquadratum: elytra ad suturam attingentia, scutello



brevi et lato: pedes fulvi: abdomen ♂ segmentis lateribus 6–9 carinulatis, acuminatis ac rugulosis: segmentum penultimum ventrale ♂ rotundatum: forcipis bracchia ♂ subremota, triquetre, irregularita arcuata et asymmetrica.

		♂
Long. corporis	..	18·20 mm.
,, forcipis	..	3

Antennae red-brown with 18 segments, the 3 basal segments yellow and some paler before the apex, 3rd, cylindrical and elongate; 4th, half; the 5th, nearly as long as 3rd; all subcylindrical. Head deep red or reddish black, smooth and tumid, the suture faint: the middle of the occipital region occupied, from the base of the head to the transverse suture, by a deep, regular, longitudinal cavity. Pronotum subrectangular, slightly concealed by the rudimentary elytra, which meet for the greater part of the sutural length, exposing only a very short scutellum, which is almost as broad as the mesonotum. Metanotum larval. Prosternum elongate and parallel-sided constricted before the base: mesonotum rounded and metanotum truncate posteriorly: all sternum yellow. Legs orange yellow; tarsi long, the first and third segments about equal, the second minute. Abdomen black, very finely punctulate: sides of 6–9th segments in the ♂ acuminate, finely keeled and rugulose. Last dorsal segment ♂ ample, smooth, transverse, with a median sulculus, truncate posteriorly, with a rugulose keel down each side: penultimate ventral segment ♂ rounded. Forceps with the branches ♂ not contiguous, trigonal and tapering, rather elongate and irregularly arcuate, asymmetrical.

S. India, Anamalai Hills, 4000–4200 ft., 22-23-i-12, under dead logs., 2 ♂ (T. B. Fletcher: type in *c.m.*).

I am indebted to Mr. T. Bainbrigge Fletcher for this peculiar species: it is chiefly remarkable for the curious cavity in the top of the head: at first I took this to be a pathological feature, but it is identical in both the male specimens available: under the lens it has every appearance of being structural. It would be most interesting to investigate its functions: possibly it is a scent-gland.

In all other respects it appears to be a typical *Euborellia*: the structure of the elytra is as in *E. greeni*, but the forceps are quite distinctive. It most nearly approaches the large black variety of *E. greeni* recorded by me from Ceylon, which is very probably a good species.

Genus **Anisolabis**, Fieber.

1. **Anisolabis annulipes**, Luc.

Simla Hills, Dharampur, 5100 ft., 15-v-13, ♂ (Phaku Ram).

Darjiling District, Singla, 1500 ft.: No. C.C./373 (Lord Carmichael's collection).

Satara District, Medha, Yenna Valley, 2300 ft., 24-x-12: ♀ with young. S.P.A./174 and 384.

Coimbatore, ♀ on a mass of eggs under a stone in house. 23-vi-12 (Y. R.).

Possibly some of these are anelytrate varieties of *E. ståli*.

2. **Anisolabis maritima**, Bon. ?

Nilgiris, Coonoor, xi-12; ♀ No. 9592/19.

3. **Anisolabis** ? sp. n.

Satara District, Mahableshwar, 4200 ft., 13-16-iv-12 (♂, ♀ and nymph). S.P.A./162–4.

Genus **Psalis**, Serv.

1. **Psalis dohrni**, Kirby.

Elphinstone College Compound, Bombay, 4-viii-11. Under stones. No. 1545/19 ♂ ♀. Vela, Koyna Valley, 2100 ft. (♂). S.P.A./181.

2. **Psalis lefroyi**, Burr. ?

Bangalore, 17-vii-12. ♀ (T. B. F.).

3. **Psalis femoralis**, Dohrn.

Upper Burma, Northern Shan Hills, ♂: No. 534/20.

Subfamily *LABIDURINAE*.

Genus **Nala**, Zacher.

1. **Nala lividipes**, Duf.

Purulia, Manbhum District, Chota Nagpur, 10-ii-12; 2 ♀. Nos. 9527-8/19, ♂ 9530/19, ♀ 9538/19, ♂ 9537/19, ♀ 9536/19.

Collectorganj, Cawnpore District, U.P. (♂ ♂, ♀) 9541-3/19.

Anwarganj, Cawnpore District, U.P.; ♂ 9544/19; between Amausi and Harauni, near Lucknow, U.P., ♀ ♀ ♂ 9549-51/19.

Hamirpur Road, U.P. 16-17-x-11. ♀. 9553/19.

Satara District, Moleshwar, 3200 ft., iv-12. ♀. S.P.A./202.

Calcutta, rains. 7787/20. ♂ (Gravely).

Calcutta, in Museum cabinets. ♂. No. 497/20.

Kurseong, 13-16-vii-07. ♀. No. 507/20.

Darjiling District, Singla, 1500 ft.; C.C./373 (Lord Carmichael's coll.).

Coimbatore, at light, many specimens: (Y. R. and T. B. F.).

Mysore, at light. 14-xi-12. (T. B. F.).

Bellary at Yemmganur. 20-24-xii-12: ♂ (Y. R.).

2. **Nala nepalensis**, Burr.

Darjiling District, Singla; 3 ♂, 3 ♀, 3 larvae. C.C./372. (Lord Carmichael's collection).

Dharampur, 5100 ft., 15-v-13 (♂) No. 528/20 (Phaku Ram).

Genus **Labidura**, Leach.

1. **Labidura riparia**, Pallas.

Simla Hills, Matiana, 8000 ft., larva; 532/20.

Satara District, Kudali Valley, Kudal, 2300 ft., iv-13; S.P.A. 392-4.

Balighai near Puri, Orissa, 16-20-viii-11 (♂) 9588/19.

Japog Reservoir, 6-i-08, Jodhpur, Rajputana; 9595/19, larva.

Bellary at Yemmganur, 18-24-xii-12; ♂ ♀ (Y. R.).

Between Amausi and Harauni, near Lucknow, U.P. (♂ ♂) and ♀; 9546-8/19.

Kanauj, U P. 18-xii, larva, 9552/19.

The following specimens of a small, dark red form:—Limbadia to Sason, Kathiawar, 5-xi-12 (♀) S.P.A./324: Sasan, Kathiawar (♂ ♀) S.P.A./325-6; also ♀ ♀ and 1, S.P.A./333-5.

Labidura riparia Pallas var. **inermis**, Br.

Sasan, Kathiawar, ♀ S.P.A./336.
Beyt, Dwarka, Kathiawar, 15-x-12. ♂. S.P.A./337.
Medha, Satara District, 25-x-12. ♀. S.P.A./338.
Khed, Ratnagiri District, 31-xi-12 (larvae). S.P.A./339-40.
Purulia, Manbhum District, Chota Nagpur, 10-ii-12. Nos. 9513-9517/19, 9519-9524/19, 9531-2/19.
Calcutta, ♀, ♂. Nos. 495-6/20.

2. **Labidura bengalensis**, Dohrn.

Purulia, Manbhum District, Chota Nagpur, 10-ii-12 (♂, 3 ♀) 9515-6/19, 9518/19, 9525/19.

Genus **Forcipula**, Bol.

1. **Forcipula trispinosa**, Dohrn.

Purulia, Manbhum District, Chota Nagpur, 10-ii-12 (♀) 9514/19.
Sasan, Kathiawar, 5-xii-12 (♀) S.P.A./328.
id., ♂, of race *minor*, S.P.A /329.
Simla Hills, Dharampur, 6-8-v-07 (♂) (N. A.) 520-1/20, 522-4/20.
id., 5100 ft., 1-v-13 (♂, ♀) (Phaku Ram) 525-7/20.
Satara District, Kudali Valley, Kudal, 2300 ft., iv-13. ♀. S.P.A./395-6.
Darjiling District. 1-3000 ft., vi-12 (♂ ♀) C.C. 376 7.
Calcutta, Museum Compound, 25-ii-13. 9593/19.
Kotwan, Mirzapore District, U.P, 29-xii-12, "below rocks in bed of stream." 2 ♀. No. 9594/19.
Base of hills, Chakardharpur, Singbhoom District, Chota Nagpur, 1-4-iii-13 (race *minor* ♂) 9590/19.

2. **Forcipula pugnax**, Kirby.

Darjiling District, 1-3000 ft. v-vi-12. 3 ♂, 9 ♀. C.C./371.
Sasan, Kathiawar, 5-xii-12. S P.A./327.
Darjiling District, Singla, 1500 ft. C.C./372 (two brachypterous ♀ ♀, probably referable here).

3. **Forcipula quadrispinosa**, Dohrn.

Medha, Yenna Valley, Satara District. 2300 ft., 13-iv-12 (♂) S.P.A./170.
Kumbarli, Vashishti Valley, Ratnagiri District. 300 ft. ♀. S.P.A./203.
Sasan, Kathiawar. 5-xii-12. ♂, ♀ ♀. S.P.A./330-2.
I consider that the number of abdominal spines, armature and curvature of the forceps are untrustworthy as specific characters,

and if we rely entirely upon one, say the spines, we shall find various types of forceps, and *vice versa*. Probably the three species should be fused into one.

Subfamily *PARISOLABINAE*.

Genus **Pseudisolabis**, Burr.

1. **Pseudisolabis burri**, Bor.

Simla Hills, Matiana, 8000 ft. (♀) 531/20.
Hitherto only recorded from Kashmir.

Family APACHYIDAE.

Genus **Apachyus**, Serv.

1. **Apachyus feae**, Borm.

E. Himalayas, La-ai River, Kalem Valley, Mishmi Country, 31-x-12. No. 7700/19. Larva.

EUDERMAPTERA.

Family LABIIDAE.

Subfamily *SPONGIPHORINAE*.

Genus **Irdex**, Burr.

1. **Irdex nitidipennis**, Borm.

Anamalais, 5500 ft., 21-i-12. (T. B. F.).
Mysore, Bababudin, xi-12. 4500–5000 ft. (T. B. F.).

Genus **Spongovostox**, Burr.

1. **Spongovostox semiflavus**, Borm.

Nilgiri Hills, Karkur Gât, 1500 ft. v-11 (Andrews), ♂. 9582/19.

Subfamily *LABIINAE*.

Genus **Labia**, Leach.

1. **Labia curvicauda**, Motsch.

Tamarasseri, Travancore, 19-i-13. On a coconut palm (Y. R. *coll.*).

2. **Labia pilicornis**, Motsch.

Calcutta, ♀, 499/20 (or *minor*, L. ?).

Genus **Prolabia**, Burr.

1. **Prolabia arachidis**, Yers.

Trivandrum, "in bed mats, associated with *Cimex*". 9596/19.
Bombay, Girgaon, "in bamboo basket". 1542/19.

This species seems to have a preference for artificial conditions, whence the facility with which it has become cosmopolitan.

Genus Chaetospania, Karsch.

1. **Chaetospania thoracica**, Dohrn.

Tamarasseri, Travancore, 19-i-13. On a coconut palm. (Y. R.). ♂.

Family CHELISOCHIDAE.

Genus **Chelisoches**, Scudd.

1. **Chelisoches morio**, Fabr.

Tamarasseri, Malabar, 19-ii-13. "On a coconut palm." (Y. R.)
Puthir, "in toddy", 25-i-13. ♀. (Y. R.).

Genus **Proreus**, Burr.

1. **Proreus simulans**, Stål.

Balighai, near Puri, Orissa. 16-20-viii-11 (♀) 7788/20.
Calcutta, Eden Gardens, at light. 17-x-11. 3 ♂, 5 ♀. Nos. 9501-5/19, 9507/19, 9509-10/19.

2. **Proreus melanocephalus**, Dohrn.

Calcutta, Eden Gardens, at light, 31-x-12 (♂) 9508/19.
Calcutta, in house. 9-vi-12 (♂) 9512/19.

3. **Proreus cunctator**, Burr.

Darjiling District, Singla, 1500 ft. (♂) C.C./373.
Recorded from the Assam-Bhutan frontier.

Genus **Lamprophorus**, Burr.

1. **Lamprophorus kervillei**, Burr.

Darjiling District, Singla, 1500 ft. C.C./373. ♀.
Hitherto recorded only from Java and North-East Assam.

Family FORFICULIDAE.

Subfamily *ANECHURINAE*.

Genus **Anechura**, Scudd.

1. **Anechura zubovskii**, Sem.

Simla Hills, Theog, 800 ft., 27-iv-07 (♀) 533/20.

Genus **Allodahlia,** Verh.

1. **Allodahlia scabriuscula,** Serv.

Pussumbing, Darjiling, 4700 ft., xii-06: Dr. H. H. Mann (♀ ♀) 504 5/20.

2. **Allodahlia ahrimanes,** Burr.

Pussumbing, Darjiling, 4700 ft., xii-06: Dr. H. H. Mann (♂) 506/20.

Subfamily *FORFICULINAE.*

Genus **Hypurgus,** Burr.

1. **Hypurgus fulvus,** Burr.

Upper Burma, Northern Shan Hills (♂) 536/20.

Genus **Elaunon,** Burr.

1. **Elaunon bipartitus,** Kirby.

Coimbatore, 30-ix-12, at light: macrolabious ♂. (T. B. F.).
Shevaroys, Kadiar Rocks, 4600 ft., 15-x 12 (T. B. F.).
Bangalore, 3000 ft. 1-xii-12. Macrolabious ♂. (Anstead).
Kumaon, Almora, 6500 ft. 18-vii-11. Macrolabious ♂ ♂, 9560–1/19, 9568/19, 9571–2/19.
id., ♀ ♀ ♀. 9563-4/19, 9567/19, and 9569/19.
id., cyclolabious ♂. 9573/19.

Genus **Forficula,** L.

1. **Forficula beelzebub,** Burr.

Darjiling, 7000 ft., 17-ix-05 (♂) 508/20: Brunetti.

W. Himalayas, Mussoorie. 7000 ft. 20-vi-05 (♂ ♂, ♀) 515-6-7/20 (Brunetti).

Darjiling District, Senchal, 8000 ft., v-03 (♂, ♀ ♀) C.C./375. Lord Carmichael's coll.

Darjiling District, 1–3000 ft., vi-12 (♂) C.C./378.

2. **Forficula ornata,** Borm.

Chutri Gouri, Nepal Terai, 27-iv-07 (♂) 509/20.

3. **Forficula greeni,** Burr.

Calcutta, at light, 9-x-12 (♀) 9535/19

4. **Forficula** ? sp.

N. Bengal, Siliguri, 18-20-vii-08—♀ only. 500/20, 502/20, 503/20.

Body except abdomen absolutely smooth, with a rich, glistening green metallic oily lustre: general colour black: abdomen deep chestnut to black, and finely punctulate: last tergite weakly crested at the exterior angles: branches of forceps depressed, straight, stout, and tapering.

The rich, smooth, brilliant, lustre of the head, pronotum, elytra and wings render this a very distinctive species, but I refrain from naming it, as without the male it is impossible definitely to decide its exact generic position.

5. **Forficula** ? sp.

Nymph only. Lucknow. 510–513/20.
do. Bijnor District, Rampore Chaka, U.P., 514/20.

6. **Forficula** ? sp.

Darjiling District, Senchal. 8000 ft. v-13. ♀ only. (Lord Carmichael's collection). C.C./375.

7. **Forficula gravelyi,** sp. n.

Fusco-castanea: pronotum pentagonale: forcipis bracchia ♂ per duas partes diplanata ac dilatata, hac parte rectangulo terminata.

			♂
Long.	corporis	..	10·5 mm.
,,	forcipis	..	6

Build moderately strong: general colour deep chestnut, abdomen black: antennae rather thick, black: fourth segment nearly as long as the third: head rather depressed, smooth, sutures faint: pronotum smooth, pentagonal, convex posteriorly: elytra deep brown, smooth, broad, not very long, truncate: wings protruding slightly, dark brown. Legs brown: abdomen jet black, pliciform tubercles very distinct, dorsal surface finely and densely punctulate: last tergite rectangular, transverse, punctate, not crested: pygidium minute, obtuse. Forceps with the branches robust, strongly depressed and dilated through two-thirds their length, this part ending with a right angle, but no tooth: tip gently arcuate.

Poona: Khed District, among rubbish in house: No. 1544/19.

This species very closely resembles the African *F. rodziankoi*, Sem., differing from the dark macropterous forms of that variable species almost solely in the shape of the pronotum, which is almost pentagonal, being obtusely rounded posteriorly with straight and parallel sides.

Subfamily *OPISTHOCOSMIINAE*.

Genus **Eparchus**, Burr.

1. **Eparchus insignis**, Haan.

Mysore, Bababudin Hills, 4500-5000 ft., xi-12 (T. B. F.).

Yercaud. "Under log; when exposed, ♀ moved eggs in mouth." ♂, ♀ : 20-x-12, 4500 ft., and in dead leaves.

Fairlands Estate, 3500 ft. Sidapur, Coorg. "Under log: ♀ with eggs." 17-xi-12. (T. B. F.).

Shevaroys, Hopeville Estate, 4000 ft., 16-x-12 (♂, ♀) (T. B. F.).

Darjiling District, Singla, 1500 ft. C.C./374. ♀ and larva.

Genus **Timomenus**, Burr.

1. **Timomenus lugens**, Borm.

Darjiling District, Singla, 1500 ft. ♂. C.C./373.

XVIII. DESCRIPTION OF A NEW SPECIES OF *HIPPOCAMPUS*.

By GEORG DUNCKER (*Hamburg*).

Hippocampus brachyrhynchus, n sp.

Ann. 11+(33-37), Ann. subd. 2(-3)+1, D. 17-19, A. 4, P. 13-15, B. i. 6-8.

Annuli with blunt spines, nearly uniform, except on ann. vii t. and ann. iv, vii, xi and xiv c., where they are dorsally a little enlarged. Crista abdom. prominent, in males with a black cutaneous fringe (dewlap). No cutaneous appendages, except simple papillae on the breeding-pouch, more closely arranged in its posterior half. Coronet scarcely developed. Rostrum very short, $\frac{1}{2}$-$\frac{3}{4}$ in postorbital length of head, up to $1\frac{1}{2}$ times in orbital diameter. Total length up to 70 mm.

Uniformly dark coloured; light radiating stripes from the eye.

Ind. Mus. No. 8508, 5 ♂, 4 ♀. Chilka Lake, Rambha Bay, Ganjam distr., Madras (*Chilka Survey*).

Ind. Mus. No. 14299, 1 ♂. Mekran Coast, Baluchistan (*F. W. Townsend*).

Types in the Indian Museum, Calcutta.

XIX. MOLLUSCA FROM THE CHILKA LAKE ON THE EAST COAST OF INDIA.

By H. B. PRESTON, *F.Z.S.*

[The shells here described were collected, unless it is otherwise stated, by Mr. Kemp and myself in 1913. The types of the new species (except that of *Nassa denegabilis*) are in the collection of the Indian Museum.—*N. A.*]

Class GASTROPODA.

Order *PROSOBRANCHIA*.

Family TEREBRIDAE.

Terebra rambhaënsis, sp. n.

(Figs. 5, 5*a*, p. 298).

Shell small, subulate, shining, pale reddish brown ornamented with a whitish spiral band; remaining whorls 7, flat, regularly increasing, sculptured with coarse, rounded, rather closely-set, very slightly oblique costulae which bulge considerably in their subsutural and lower parts; suture impressed; base of shell without plication and smooth but for growth striae; columella margin obliquely descending, callously thickened and inwardly bulging above; labrum simple; aperture broadly inversely auriform.

Alt. 4, diam. maj. 1·25 mm.

Hab.—Rambha Bay, south end of Lake Chilka, Ganjam District, Madras.

Family NASSIDAE.

Nassa sistroidea, G. and H. Nevill.

J. Asi. Soc. Bengal, vol. xliii, pt. 2, pl. i, fig. 6.
Channel between Satpara and Manikpatna.

Nassa labecula, A. Ads.

Proc. Zool. Soc., London, 1851, p. 98.
Channel between Satpara and Manikpatna.

Nassa denegabilis, sp. n.

(Fig 9, p. 301).

Shell fusiform, pale greenish yellow painted with a subsutural and broad basal band of pinkish red; whorls 7, regularly increasing, sculptured with coarse, transverse, rounded costae which become obsolete on the base of the shell, which is also sculptured with fine, wavy, revolving lirae; suture impressed, broadly, margined below; columella margin whitish, tinged with flesh colour, excavated, porcellanous, diffused above into a well-defined, restricted parietal callus, which is thickened into a tubercle near its junction with the upper margin of the labrum above; labrum

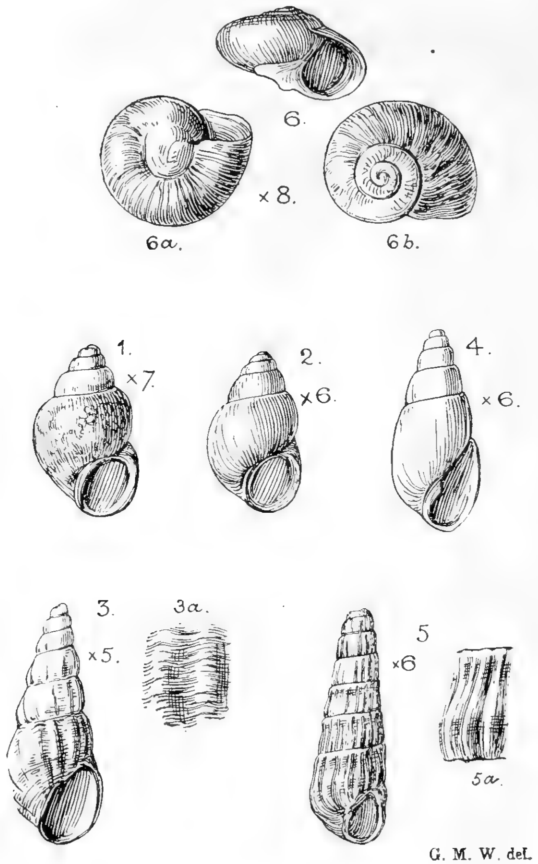


FIG. 1. *Stenothyra chilkaënsis.*
,, 2. ,, *orissaënsis.*
,, 3. *Litiopa (Alaba) kempi.*
FIG. 4. *Odostomia chilkaënsis.*
,, 5. *Terebra rambhaënsis.*
,, 6. *Tinostoma variegata.*

coarsely varicosely thickened behind, acute, very slightly outwardly reflexed, having five denticles within; aperture obliquely ovate; canal short, broad, a little recurved; interior of shell pure white.

Alt. 11, diam. maj. 5, diam. mim. 4 mm.

Aperture: alt. 4, diam. 1·5 mm.

Hab.—Lake Chilka, "along marine side of Lake Estuary." (G. Nevill).

The type specimen is in the British Museum.

Specimens were also taken by Dr. Annandale at the following localities:—Manikpatna in 4 feet of water; channel between Satpara and Manikpatna; Breakfast Isd., Ganjam District (young and adult); Satpara, close in shore; between Barnakuda and Nalbano Isd., in 10 feet; Barkul, among weeds at the edge of the lake.

Nassa orissaënsis, sp. n.

(Figs. 10, 10*a*, p. 301).

Shell fusiform, rather thin, pale brown, painted on the last whorl with a rather broad, subperipheral chestnut band; whorls 5, shouldered above, the first very small, the second proportionately large, the remainder regularly increasing, sculptured with coarse, transverse costulae crossed by fine, spiral lirae, thus presenting a somewhat cancellate appearance; suture impressed; columella margin vertically descending, angled above and oblique at the base, spreading above into a well defined, whitish, parietal callus which reaches to the upper margin of the labrum; labrum erect, varicosely thickened behind, crenellated, especially above, by the terminations of the spiral lirae; aperture oval; canal very broad, short.

Alt. 6·25, diam. maj. 3·25, diam. min. 3 mm.

Aperture: alt. 2·75, diam. 1 mm.

Hab.—Lake Chilka, Orissa, on a muddy bottom at a depth of from 6 to 8 feet, about three miles off Balugaon (Type); about two miles off Balugaon, on a muddy bottom at between 6 to 8 feet; Manikpatna, in 4 feet; Rambha Bay, south end of Lake Chilka, in the Ganjam District; Satpara, close in shore; between Barnakuda and Nalbano Isd., in 10 feet; off east end of Nalbano Isd., in from 4 to 6 feet.

Family MURICIDAE.

Thais carinifera, Lam.

Lamarck, Animaux sans Vertèbres, vol. vii, 1822, p. 241.

Breakfast Isd., "inhabited by a hermit crab (*Clibanarius padavensis*, de Man.); off Samal Isd., Ganjam District, Madras.

Family CERITHIIDAE.

Potamides (Tympanotonos) fluviatilis, Pot. and Mich.

Cat. Moll. de Douai, p. 363, pl. xxxi, figs. 19–20.

Off eastern end of Nalbano Isd., Orissa, in 4–6 feet; Manikpatna, in 4 feet; channel between Satpara and Manikpatna; off Satpara.

Family LITIOPIIDAE.

Litiopa (Alaba) kempi, sp. n.

(Figs. 3, 3*a*, p. 298).

Shell fusiform, imperforate, in dead condition white, but bearing traces of having been covered with a reddish brown periostracum; remaining whorls 6, sculptured with coarse, transverse costulae and, on the lower half, with indistinct spiral lirae while, in addition, microscopic, confluent striae are also visible; suture impressed; base of shell finely spirally lirate; columella margin obliquely descending; labrum acute; aperture ovate.

Alt. 5·25, diam. maj. 2·25 mm.

Aperture: alt. 1·5, diam. ·75 mm.

Hab.—Rambha Bay, south end of Lake Chilka, Ganjam District, Madras.

Family VIVIPARIDAE.

Vivipara bengalensis, Lk.

Anim. s. Vert. (ed. Desh.), vol. viii, p. 513, 1838: Reeve, Con. Icon. *Paludina*, pl. II, fig. 5, vol. xiv, 1864.

About half a mile east of Nalbano Isd., Orissa, in from 10 to 12 feet of water, a single young specimen (an empty shell).

Family HYDROBIIDAE.

Stenothyra minima, Sow.

Ann. Mag. Bot. Hist. (Charlesworth's series), vol. i, London (1837), p. 217, fig. 22*b* (as *Nematura*).

On a muddy bottom in from 6 to 8 feet of water, about two miles off Balugaon, Orissa.

Stenothyra, chilkaënsis, sp n.

(Fig. 1, p. 298).

Shell minutely rimate, ovate, yellowish brown; whorls 5, the first very small, the second large in proportion, the last also large, convex, without sculpture; suture well impressed; perforation reduced to a very narrow chink; labrum continuous; aperture oblique, ovate.

Alt. 2·75, diam. maj. 2 (nearly), diam. min. 1·5 mm.

Hab.—Barkul, Lake Chilka, Orissa, among weeds at the edge of the lake.

Stenothyra orissaënsis, sp. n.

(Fig. 2, p. 298).

Shell small, narrowly perforate, ovately turbinate, pale greenish yellow; whorls 5, regularly increasing, smooth, but for growth markings, the last convex and rapidly descending in front; labrum continuous, slightly erect; aperture strangulate, oblique, oval.

Alt. 2·25, diam. maj., 1·5 mm.

Hab.—Off Satpara, Lake Chilka, Orissa, at a depth of from 4 to 6 feet, close in shore (Type); dead specimens were also taken at Manikpatna at a depth of 4 feet.

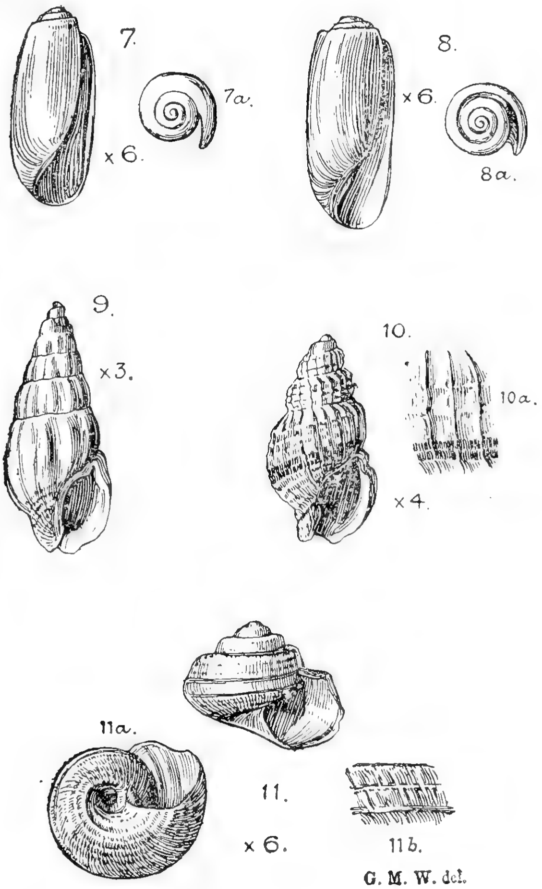


FIG. 7. *Tornatina estriata.* FIG. 9. *Nassa denegabilis.*
,, 8. ,, *soror.* ,, 10. *Nassa orissaënsis.*
FIG. 11. *Solariella satparaënsis.*

Family PYRAMIDELLIDAE.

Odostomia chilkaënsis, sp. n.

(Fig. 4, p. 298).

Shell elongately ovate, opaque, in somewhat eroded condition white, without trace of sculpture; whorls 6, shouldered above, the first three small, regularly increasing, the last three proportionately very long; suture well impressed; columella margin thickened into a very oblique plait which enters the shell above; labrum simple; aperture obliquely, slightly curvedly and elongately subtriangular.

Alt. 3, diam. maj. 1·5 mm.

Aperture: alt. 1, diam. ·25 mm.

Hab.—Manikpatna, Lake Chilka, Orissa, at a depth of 4 feet.

Family CYCLOSTREMATIDAE.

Tinostoma variegata, sp. n.

(Figs. 6, 6*a*, 6*b*, p. 298).

Shell depressedly turbinate, polished, shining, pale greyish white shading to pale yellowish brown and painted with irregular, zigzag, radiate, transverse bands of dark ashen-grey which are more pronounced in the subsutural region; whorls 4, the first three regularly increasing, the last large, the earlier whorls smooth, the last two bearing radiate growth plications; suture impressed, narrowly margined below with white; base of shell very moderately convex, conspicuously painted with rather closely-set, radiate, whitish bands and presenting a slightly microscopic, granular appearance; umbilical region overlaid by a coarse, convex, greyish callus which becomes again overlaid and thickened by a broadly outwardly extending, nacreous callus round the base of the columella; columella margin callously thickened, vertically descending then angled and very obliquely descending below, spreading above into an interiorly situate, thick, nacreous, parietal callus; labrum simple; aperture roundly subovate.

Alt. ·75, diam. maj. 2, diam. min. 1-5 mm.

Hab.—Manikpatna, Lake Chilka, Orissa, at a depth of 4 feet.

Family TROCHIDAE.

Solariella satparaënsis, sp. n.

(Figs. 11, 11*a*, 11*b*, p. 301).

Shell small, turbinate, polished, shining, whitish ornamented with blackish brown blotches and spiral rows of the same colour; whorls 5, regularly and rather rapidly increasing, narrowly planulate above, sloping below, spirally lirate, the uppermost and, on the last whorl, the peripheral lirations being considerably coarser than the remainder, the interstices finely, closely, transversely striate; suture impressed, very narrowly submargined below; base of shell moderately convex, also sculptured with revolving lirae, but without trace of transverse striation except in the actual umbilical cavity; umbilicus shouldered and wide at the margin, rapidly narrowing, funnel shaped, deep, also spirally lirate and very noticeably, closely, transversely striate; columella margin curvedly excavated above, obliquely descending below; labrum acute, waved and angled above by the terminations of the spiral lirae; aperture subquadrate.

Alt. 2, diam. maj. 3, diam. min. 2·5 mm.

Aperture: alt. 1 diam. 1 mm.

Hab.—Satpara, Lake Chilka, Orissa, at a depth of from 4 to 6 feet, close in shore.

Class OPISTHOBRANCHIA.

Family BULLIDAE.

Bulla (Haminea) crocata, Pease.

Proc. Zool. Soc., London, 1860, p. 19.
Satpara, Orissa, found dead on shore.

Family TORNATINIDAE.

Tornatina estriata, sp. n.

(Figs. 7, 7*a*, p. 301).

Shell ovately cylindrical with moderately exserted spire, white, semitransparent; whorls 4, smooth polished, without sculpture, showing only indistinct growth markings; suture narrowly channelled, the channel overhung by the upper portion of the whorl below; columella margin descending obliquely, scarcely curved, somewhat twisted above where it enters the shell; labrum acute, very slightly constricted and bent inwards over the aperture in the median part, a little dilated below, obtusely angled above, aperture straight and somewhat narrow above, commencing to widen in the median region and considerably open below.

Alt. 3·75, diam. maj. 1·5 mm.

Hab.—Lake Chilka, Orissa, on muddy bottom at a depth of from 6 to 8 feet, about two miles off Balugaon (Type); Manikpatna, Orissa in 4 feet.

Tornatina soror, sp. n.

(Figs. 8, 8*a*, p. 301).

Shell differing from *T. estriata*, Preston, in its larger size and less ovately cylindrical form which, in the present species, is more shouldered above and slightly tapering towards the base; the columella margin does not descend as obliquely as in that species, but bulges somewhat inwardly above, is excavated and curved in the median region and descends slightly obliquely below in the opposite direction to that in *T. estriata*.

Alt. 4·75, diam. maj. 2 mm.

Hab.—Manikpatna, Lake Chilka, Orissa, at a depth of 4 feet.

Class **LAMELLIBRANCHIA.**

Sub-Order *MYTILACEA.*

Family MYTILIDAE.

Modiola undulata (Dkr.).

Proc. Zool. Soc., London, 1856, p. 363.
Between Barnakuda and Nalbano Isd., in 10 feet.

var. **crassicostata,** var. n.

(Fig. 15, p. 305).

Shell differing from the typical form in being anteriorly and posteriorly coarsely costate.

Long. 5·75, lat. 12·5 mm.

Hab.—Off Samal Island, Lake Chilka Ganjam District, Madras (Type); Breakfast Isd., Ganjam District, on rocks.

Modiola emarginata, Bens.

Reeve, Con. Icon. *Modiola* sp. 60, pl. x, fig. 73, vol. x, 1858.
Lake Chilka (*ex. coll.* W. T. Blanford).

Sub-Order *ARCACEA.*

Family ARCIDAE.

Arca granosa, Lin.

Linnæus, Syst. Nat., p. 1142.

On shore near Rambha, Ganjam District, Madras; off Samal Isd., in from 8 to 15 feet (a single valve).

Sub-Order *CONCHACEA.*

Family VENERIDAE.

Meroë chilkaënsis, sp. n.

(Figs. 13, 13*a*, p. 305).

Shell ovate, concentrically striate and transversely, finely costulate; umbone small; dorsal margin anteriorly gently arched, posteriorly sloping; ventral margin rounded; anterior side steeply sloping above, acuminately rounded below; posterior side angled above, roundly sloping below; right valve bearing three cardinal teeth of which the anterior is nearly vertical and moderately fine, the median oblique and coarse and the posterior very oblique, fine and elongate, and a fine anterior oblique lateral tooth.

Long. 16·5, lat. 25·25 mm.

Hab.—On shore at Satpara, Lake Chilka. Probably in a sub-fossil state.

Four valves (all right) only, were collected.

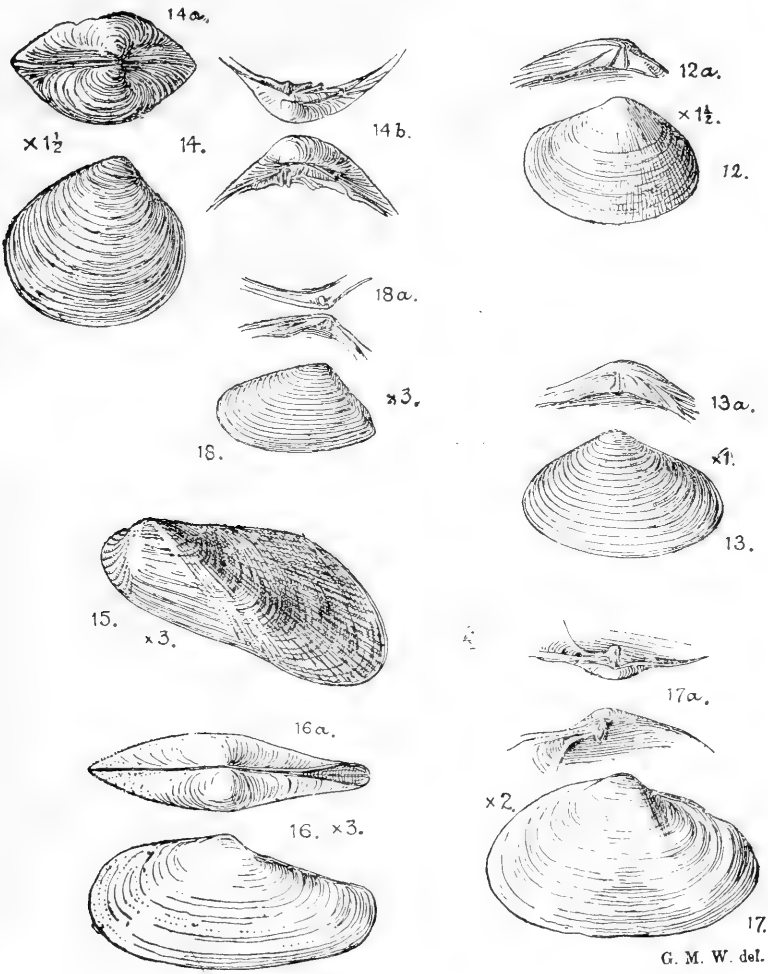


FIG. 12. *Meroë satparaënsis.*
FIG. 13. ,, *chilkaënsis.*
,, 14. *Clementia annandalei.*
FIG. 15. *Modiola undulata* var. *crassicostata.*
,, 16. *Lyonsia samalinsulae.*
,, 17. *Anatina granulosa.*
FIG. 18. *Tellina confusa.*

Meroë satparaënsis, sp. n.

(Figs. 12, 12*a*, p. 305).

Shell ovately cuneiform, regularly and closely concentrically grooved and sculptured with closely-set, fine, wavy, transverse striae; umbone moderately large, hardly prominent, showing traces of purplish colouring; dorsal margin anteriorly, steeply sloping, posteriorly gently so; ventral margin gently rounded; anterior side abruptly sloping above, sharply rounded below; posterior side produced, rounded; left valve bearing two, scarcely divergent, almost vertical, cardinal teeth, a very oblique and a little projecting, posterior, cardinal tooth, and a broad, oblique, grooved, anterior lateral; inner margin of shell crenulate.

Long. 16·5, lat. 22·25 mm.

Hab.—On shore at Satpara, Lake Chilka, Orissa. Probably in a subfossil state.

The author has only been able to examine a single valve (the left) of this interesting species.

Clementia annandalei, sp. n.

(Figs. 14, 14*a-b*, p. 305).

Shell slightly inequilateral, convex, roundly ovate, thin, white, marked with rather fine, concentric striae and coarse, flattened ridges; umbones small, not prominent, curved in an anterior direction; dorsal margin arched; ventral margin rounded; anterior side rounded; posterior side a very little produced, obtusely rounded; right valve bearing three cardinal teeth of which, the anterior is small and very slightly curved, the median short thick and cuneiform and the posterior about double the length of the median tooth, very oblique and also thickened; the left valve also bearing three cardinals of which, the anterior is short and somewhat erect, the median very oblique and running at an acute angle to the anterior, while the posterior is fine and also very oblique running again at an acute angle to the median.

Long. 16·5, lat. 17·5 mm.

Hab.—Lake Chilka, Orissa, about three miles off Balugaon, from muddy bottom at a depth of from 6 to 8 feet (Type); smaller examples were also taken on the same bottom and at the same depth at about two miles from the same locality; between Barnakuda and Nalbano Isd., in 10 feet; off Samal Isd., Ganjam District, Madras; about half a mile east of Nalbano Isd., Orissa, in from 10 to 12 feet. Port Canning, Gangetic delta (*Coll. Ind. Mus.*).

Family CYRENIDAE.

Corbicula (Velorita) satparaënsis, sp. n.

(Figs. 22, 22*a*, p. 308).

Shell moderately large, very solid, cardiiform, both valves bearing traces of radiate transverse costulae; umbones large, prominent; dorsal margin strongly arched; ventral margin gently rounded; anterior side sloping above, rounded below; posterior side somewhat abruptly descending, a little produced below; hinge plates massive; right valve bearing an obsolete anterior, an almost vertical median and a very oblique, posterior, cardinal tooth and an oblique, slightly curved, finely striated lateral; left valve bearing a rather large and nodule-like anterior, a coarse, erect, triangular, almost vertical median and an oblique, posterior tooth which is also erect and coarse and a broad, striate lateral.

Long. 46·5, lat. 48·5 mm.

Hab.—On shore at Satpara, Orissa, probably in a subfossil state (Type); on shore near Rambha, Ganjam District, Madras.

Family UNGULINIDAE.

Diplodonta (Felania) annandalei, sp. n.

(Figs. 20, 20*a-b*, p. 308).

Shell somewhat squarely ovate, not very convex, covered with a thin, very pale straw-coloured periostracum, finely concentrically striate; umbones small, but rather prominent; dorsal margin both anteriorly and posteriorly sloping; ventral margin gently rounded; anterior side sharply rounded above; posterior side little produced, the margin rather abruptly descending in a gentle curve; right valve bearing a rather oblique, broad, short, anterior cardinal and an oblique, slightly curved, narrowly and deeply bifid posterior, cardinal tooth; left valve bearing a slightly curved, broadly bifid anterior and a very oblique, elongated, posterior, cardinal tooth; palleal line simple.

Long. 6, lat. 7 mm.

Hab.—Between Barnakuda and Nalbano Isd., Lake Chilka, at a depth of 10 feet.

Diplodonta (Felania) chilkaënsis, sp. n.

(Figs. 21, 21*a-b*, p. 308).

Shell orbicular, covered with a yellowish brown periostracum, both valves closely, concentrically striate; umbones not prominent; dorsal margin a little excavated anteriorly, gently sloping posteriorly; ventral margin rounded; anterior side rather abruptly descending; posterior side rounded; both valves bearing two cardinal teeth of which the posterior is massive and bifid in the right valve, while the anterior has the same characters in the left; interior of shell pinkish.

Long. 12, lat. 12·5 mm.

Hab.—Lake Chilka (Type) (*ex coll.* Raban); Manikpatna, in 4 feet.

Diplodonta (Felania) ovalis, sp. n.

(Figs. 19, 19*a-b*, p. 308).

Shell small, ovate, very inequilateral, both valves irregularly, concentrically striate; umbones small, a little prominent; dorsal

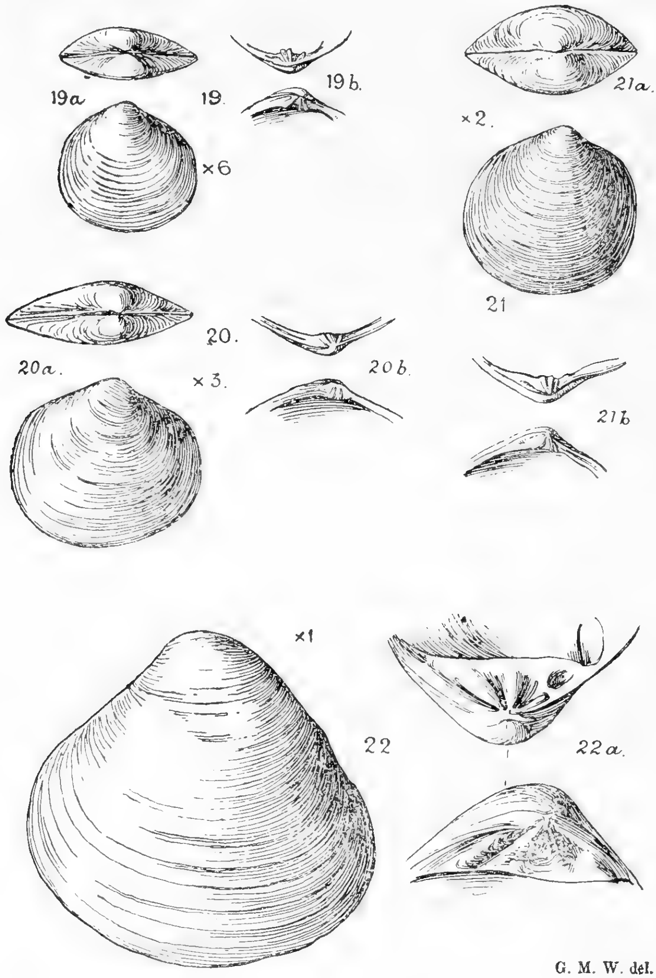


FIG. 19. *Diplodonta (Felania) ovalis.*
,, 20. ,, ,, *annandalei.*
,, 21. ,, ,, *chilkaënsis.*
,, 22. *Corbicula (Velorita) satparaënsis.*

margin anteriorly rounded, posteriorly sloping and very slightly arched; ventral margin rounded; anterior side abruptly descending, almost straight in the median part; posterior side produced, rounded; cardinal teeth in right valve consisting of a bifid, narrow, V-shaped *posterior* and a very oblique, somewhat club-shaped, *anterior* tooth in front of which is also situate a marginal projection which is almost contracted into two unequal, inwardly projecting portions; cardinal teeth in left valve consisting of a narrow, V-shaped, bifid *anterior* and a very oblique, but *straight posterior* tooth, while the marginal projection is quite lacking; palleal line simple; interior of shell suffused with pinkish red.

Long. 3, lat. 3·5 (nearly) mm.

Hab.—Manikpatna, Orissa, at a depth of 4 feet.

Family SOLENIDAE.

Solen truncatus, Wood.

Sowerby, Genera of Shells; Reeve, Con. Icon., *Solen*, pl. i, fig. 1, vol. xix, 1874.

From muddy bottom in 6 to 8 feet, about two miles off Balugaon, Orissa; Rambha Bay, south end of Lake Chilka, Ganjam District; between Barnakuda and Nalbano Isd., in 10 feet; off Samal Island, Ganjam District, in from 8 to 15 feet, all very young, but in various stages of growth.

Sub-Order *ADESMACEA.*

Family PHOLADIDAE.

Martesia striata, Lin., var.

Linnaeus, Syst. Nat.; Reeve, Con. Icon., *Pholas*, pl. viii, figs. 32*a*, *b*, *c*, vol. xviii, 1873.

Lake Chilka (*ex coll.* Raban).

Sub-Order *TELLINACEA.*

Family TELLINIDAE.

Tellina confusa, sp. n.

(Figs. 18, 18*a*, p. 305).

Shell small, cuneiform, whitish, polished, shining, both valves sculptured with fine, regular, concentric striae; umbones small, posteriorly situate; dorsal margin anteriorly sloping, posteriorly very oblique; ventral margin scarcely rounded; anterior side produced, obtusely rounded; posterior side truncately rostrate.

Long. 4·25, lat. 6·75 mm.

Hab.—Lake Chilka (*Coll. Ind. Mus.*).

The species has been confounded in the Indian Museum with *T. aequistriata*, Sow.[1] of which the original locality is unknown; as, however, the figures of that species are clearly of a much broader and more ovate form, the author considers himself fully justified in describing the present shell as new.

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[1] Reeve, Con. Icon. *Tellina*, pl. xlv, figs. 265*a*, *b*, vol. xvii, 1870.

Family SCROBICULARIIDAE.

Theora opalina, Hinds.

Proc. Zool. Soc., London, 1843, p. 78, as *Neoera.*

About two miles off Balugaon, Orissa, on muddy bottom in from 6 to 8 feet; off Satpara, Orissa, in from 4 to 6 feet; off Samal Isd., Ganjam District, Madras, in from 8 to 10 feet; between Barnakuda and Nalbano Isd., Lake Chilka, in 10 feet (Dr. N. Annandale). Port Canning, Gangetic Delta (W. T. Blanford).

Sub-Order *ANATINACEA.*

Family LYONSIIDAE.

Lyonsia samalinsulae, sp. n.

(Figs. 16, 16*a*, p. 305).

Shell small, thin, elongately ovate, posteriorly gaping, whitish tinged, especially anteriorly, with reddish orange; umbones of moderate size, not prominent, obliquely angled in a transverse direction; both valves of a somewhat coarsely granular texture and marked with coarse, concentric plications especially on the left valve; dorsal margin very slightly sloping anteriorly, more rapidly sloping and membranaceous posteriorly; ventral margin very gently curved; anterior side abruptly rounded; posterior side produced, roundedly acuminate, with membranaceous margin.

Long. 6·25, lat. 12·75 mm.

Hab.—Off Samal Isd., Ganjam District, Madras, in from 8 to 15 feet (Type); between Barnakuda and Nalbano Isd., in 10 feet; Manikpatna, Orissa, in 4 feet, young specimens only taken at this locality.

Family ANATINIDAE.

Anatina granulosa, sp. n.

(Figs. 17, 17*a*, p. 305).

Shell rather small, a little gaping posteriorly, thin, whitish, with the exception of the umbonal region where considerable erosion has taken place and the extreme posterior side, granular in texture and marked with fine radiate striae, posterior portion coarsely, concentrically laminiferous; umbones rather small, flattened; dorsal margin sloping posteriorly; ventral margin very gently rounded; anterior side sloping above, rounded below; posterior side very bluntly rostrate; projecting hinge plate in valve bearing two small, fine teeth; palleal sinus very broad.

Long. 11, lat. 18·75 mm.

Hab.—Lake Chilka (*Coll. Ind. Mus.*).

XX. DESCRIPTION D'UN NOUVEAU DRYINIDE DES INDES.

Par J. J. KIEFFER (*Bitsch*).

Mesodryinus indicus, n. sp.

♀. Entièrement jaune rougeâtre et brillant. Tête un peu transversale, presque lisse, à peine découpée en arc au bord postérieur. Vertex faiblement convexe. Yeux glabres, distants du bord occipital du tiers de leur longueur. Palpes maxillaires longs, atteignant le bord postérieur de la tête, offrant quatre articles après la flexion ; palpes labiaux courts, avec deux articles après la flexion. Antennes grêles, à peine grossies distalement, atteignant l'extrémité du thorax, c'est-à-dire, la moitié du corps, 2^e article un peu plus court que le 1^{er}, 3^e deux fois aussi long que les deux premiers réunis ou que le 4^e, le 9^e encore deux fois aussi long que gros. Pronotum faiblement convexe, allongé, plus mince que le mesonotum, celui-ci transversale, plus court que le pronotum, avec deux sillons parapsidaux faiblement marqués, ce qui distingue cette espèce de tous ses congénères. Les côtés du pronotum n'atteignent pas les écaillettes. Metanotum un peu plus court que le scutellum. Segment médian allongé, graduellement déclive en arrière, faiblement réticulé ; le reste du thorax est finement chagriné. Ailes hyalines et sans tache, stigma pâle, étroit et très long, partie proximale du radius égale au tiers de la partie distale, basale un peu oblique, peu distante du stigma. Aux pattes antérieures, la hanche est grossie et longue, le trochanter pétiolé, en massue, de moitié aussi long que le fémur, tarse et pince comme d'ordinaire dans ce genre, branche externe de la pince avec 7 spinules alignées et espacées, et une dent avant l'extrémité ; branche interne atteignant la base du 3^e article, arqué au bout, ayant une rangée de lamelles obtuses, alternant avec des soies, cette rangée est interrompue à l'endroit de la courbure. Abdomen lisse. L. 5 mm.

Obtenu par M. T. Bainbrigge Fletcher, Imperial Entomologist, à Pusa, de nymphes de *Phromnia marginella*, de la famille des Fulgorides ; 5 exemplaires.

Loc. :—Pusa, Bihar.

XXI. QUELQUES NOUVEAUX CHIRONOMIDES DES INDES.

Par J. J. Kieffer (*Bitsch*).

Dibezzia spinigera, n. sp.

♀. D'un roux marron; balanciers, hanches et pattes d'un roux clair, extrémité antérieure de l'abdomen et tout le dessous de l'abdomen roux sombre. Face proéminente en bosse. Bouche pointue, aussi longue que la tête. Yeux séparés au vertex par une ligne. Palpes de 4 articles grêles, dont le 2e est cylindrique, non grossi. Antennes de 14 articles, dont le 2e est plus long que le 3e, 3–9 subcylindriques, à peine plus gros au milieu, ayant dans leur moitié basale des soies non en verticilles et 4 fois aussi longues que l'article, et vers l'extrémité une soie plus courte, 10e article conformé comme la 9e, mais 2 fois aussi long, 10–12 graduellement allongés, 13e et 14e un peu plus courts que le 12e, leurs soies un peu plus courtes que celles des articles 2–9. Ailes finement ponctuées, hyalines, avec 3 bandes transversales sombres, dont la proximale est d'un brun noir, située à égale distance de la base alaire et de la nervure transversale, la 2e est d'un brun clair et s'étend de la transversale jusqu'à l'extrémité du radius, 3e non percurrente comme les 2 autres, d'un brun clair, occupant le quart distal du cubitus et s'arrêtant à la discoïdale; l'unique cellule radiale est peu distinctement rétrécie au $\frac{1}{5}$ proximal, son extrémité aussi éloignée de la pointe alaire que le rameau inférieur de la discoïdale, la discoïdale se bifurque peu avant la transversale, cubitus 5 fois aussi long que la radius. Thorax glabre, lisse, brillant, ayant au milieu de son bord antérieur une pétite spinule trés distincte et horizontale. Fémurs et tibias antérieurs raccourcis mais non grossis, le fémur pas plus long que la hauteur de la téte, à 3 spinules dans sa moitié distale, tarse un peu plus long que le tibia, métatarse égalant les 3 articles suivants réunis, 4e article pas plus long que gros, le 5e égalant le 3e et le 4e réunis, crochets inégaux, le grand aussi long que l'article, plus de 2 fois aussi long que le petit; aux 4 tarses antérieurs le 4e article est semblable, muni de chaque côté de son extrémité, d'un appendice assombri, bilobé et densément poilu, le lobe inférieur est armé d'une grosse soie brune, les 3 articles précédents ont à l'extrémité, sur le dessous, 2 grosses soies brunes ou spinules, métatarse de toutes les pattes avec 2 rangées de soies bulbeuses. Pattes intermédiaires conformées comme les antérieures, sauf que les fémurs et les tibias sont allongés, le tarse aussi long que le tibia, celui-ci sans peigne. Pattes postérieures encore plus longues que les intermédiaires, leur fémur grossi subitement mais faiblement dans un peu moins de leur moitié distale, inerme comme les intermédiaires, aussi long que le tibia, celui-ci à peigne double, tarse 2 fois aussi long que le tibia, métatarse d'un tiers plus, long que le 2e article, celui-ci double du 3e qui est un peu plus long que le 4e , égal au 5e , crochets inégaux et simples, le grand très long, 4-5 fois aussi long que le petit, dépassant un peu l'article tarsal, qui est 12-15 fois aussi long que gros. Abdomen à peine incurvé, sans longs poils, à peine pubescent ; pétiole cylindrique, 3 fois aussi long que gros, égalant la tête et le thorax réunis, son second article plus long que le 1er, les 5 tergites suivants plus de 2 fois aussi larges que le pétiole, transversaux, à peine convexes dorsalement, fortement convexes ventralement.—L. 5 mm.

Bihar : Purneah, 5-viii-1907.

Chironomus perileucus, n. sp.

♂ ♀. D'un roux ferrugineux ou roux jaune ; mesonotum, scutellum et balanciers verts ou jaunes, 3 bandes du mesonotum ferrugineuses, mattes et raccourcies ; antennes du ♂ brunâtres sauf le scape, dernier article antennaire de la ♀ brun noir ; abdomen d'un vert clair, avec le bord postérieur des segments d'un blanc pruineux, 2 derniers segments et pince d'un roux brunâtre, parfois l'abdomen ets jaune (♂) ou rouge (♀) ; fémurs et tibias verts ou jaunes, tarses blancs, extrémité des 3 premiers articles noire, 4e et 5e articles d'un brun noir. Lobes frontaux distincts. Antennes du ♂ de 12 articles, panache gris, articles 3–11 très transversaux, to 12e $2\frac{1}{2}$ fois aussi long que 2–11 réunis. Antennes de la ♀ de 6 articles, dont le 2e est subcylindrique, avec 2 verticilles de poils et 2 appendices sensoriels, 3-5 ellipsoïdaux, à col un peu plus court que le noeud et à 2 appendices sensoriels inégaux, 6e de moitié plus long que le 5e , *hérissé de soies 3–4 fois aussi longues que sa grosseur.* Ailes d'un blanc de lait, nervures antérieures jaunes, les autres pâles, base du cubitus et transversale noires et ceintes de noir, auxiliaire dépassant à peine la transversale, qui est oblique, radius dépassant le milieu du cubitus, qui est arqué et plus éloigné de la pointe alaire que la discoïdale, bifurcation de la posticale distale de la transversale. Pattes antérieures pubescentes, métatarse chez la ♀ 2 fois aussi long que le tibia, 2e article égal au tibia, à peine plus long que le 3e, 4e de moitié plus long que le 3e (♂ ♀), plus de 2 fois aussi long que le 5e, celui-ci 10 fois aussi long que gros, pulvilles larges. Articles terminaux de la pince convexes, longuement poilus dorsalement, moitié distale subitement amincie en lame de couteau, glabre, avec 5 ou 6 soies rigides et alignées au tiers distal du côté médian ; grands appendices larges et atteignant le milieu des articles terminaux. L. 4·5 5 mm.

Calcutta, obtenu d'éclosion à l'Indian Museum, 10–16 juillet.

Chironomus lamprothorax var. **conjungens**, n. var.

♂ ♀. Le ♂ est d'un roux ferrugineux, mesonotum plus clair, à bandes ferrugineuses, brillantes et raccourcies, metanotum d'un brun noir, flagellum brun, palpes brun-noir, pattes d'un blanc jaunâtre, aux antérieures l'extrémité du fémur, le tibia sauf un large anneau avant l'extrémite et le tarse sont d'un brun noir, comme les 2 ou 3 derniers articles des 4 tarses postérieurs, balanciers jaunâtres, abdomen vert ou jaune, moitié postérieure et pince d'un jaune brunâtre. La ♀ est d'un jaune roussâtre, 6e article antennaire ou les 5 derniers d'un brun sombre, les 3 bandes du mesonotum et le metanotum d'un noir brillant, abdomen entièrement d'un roux carné sombre, balanciers jaunâtres, pattes colorées comme chez le ♂. Antennes du ♂ de 12 articles, panache gris, articles 3–11 très transversaux, 12e $2\frac{1}{2}$ fois aussi long que les 10 précédents réunis. Antennes de la ♀ comme chez le type, sauf qui le dernier article est au moins 2 fois aussi long que l'avant dernier. Radius dépassant le milieu du cubitus, celui-ci faiblement arqué, aussi distant de la pointe alaire que la discoïdale, bifurcation de la posticale très distale de la transversale. Comme chez le type, les pattes antérieures sont pubescentes; leur métatarse de moitié plus long que le tibia, le 4e article d'un tiers plus long que le 3e, pulvilles larges, dépassant le milieu des crochets. Appendices terminaux de la pince obtus et d'égale largeur, sans longs poils, un peu plus longs que les basaux; appendice supérieur petit, n'atteignant pas l'extrémité de l'article basal, glabre, filiforme dans sa moitié basale, un peu arqué et renflé en ellipse dans la moitié, sauf le bout distal qui est rétréci, la partie ellipsoïdale porte, au côté médian, 7 ou 8 longues soies alignées et très rapprochées; appendice inférieur très large, plus large que l'article terminal, dont il atteint le tiers distal, un peu moins large dans sa moitié basale.—L. ♂ 4 mm., ♀ 2, 6 mm.

Calcutta, obtenu d'éclosion à l'Indian Museum, 25-viii-1910.

MISCELLANEA.

FISHES.

NOTE ON *Trygon kuhlii.*—A large gravid female measuring 34·5 cm.[1] across the disk was captured off the Madras coast on the 15th of January, 1914. It lived in the Marine Aquarium, Madras, till the 13th of March.

In the aquarium it was habitually sluggish, lying buried in sand with only the eyes, the spiracles and a portion of the tail visible above the surface. The large spiracle, which except when fully opened is a narrow slit, extends from near the anterior level of the eye to a point about one-third of its own length behind that organ. The upper margin of the spiracle, *i.e.* the one nearest the eye, forms behind that organ a projecting fold. Both the eye and this fold are employed in closing the spiracular aperture when sand and other foreign bodies drop from above or when the water is agitated. This curious arrangement serves both for the protection of the eye and for the exclusion of foreign objects from the spiracle. Normally the spiracles are kept wide open for purposes of respiration, causing a prominent erection of the eyes considerably above the surface of the head. This gives the ray a most grotesque appearance.

The colour of the dorsal surface of the disk is chocolate brown during life with a few scattered blue ocelli, but changes after death, becoming slate-coloured[2] in preserved specimens.

Like other species of *Trygon*, *T. kuhlii* is viviparous. On the 12th of March the above specimen gave birth to two young, both of which were males. Immediately after birth the young died and the mother died on the following day.

Description of the Young.

The young differ in size as will be seen from measurements given below :—

		Specimen A ♂.	Specimen B ♂.
Maximum length	..	133 mm.	115 mm.
Maximum width of disk	..	60 mm.	47 mm.
Length of pectoral fin	..	$22\frac{1}{2}$ mm.	18 mm.
Length of ventral fin	..	8 mm.	6 mm.
Length of tail ..	..	83 mm.	72 mm.
Umbilical chord	..	10 mm.	..

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[1] The measurement was taken from "point to point"; if measured with a tape across the back it is 35·5 cm. The usual size appears to be about 32 cm. See *Mem. Ind. Mus.*, Vol. II, No. 1, page 34.

[2] *Op. cit.*, vol. II, part 1, page 35.

The last leaves the body in the mid-ventral line immediately posterior to the gills.

Colour.—In spirit the dorsal surface is brown and the under surface whitish. The edge of the disk all round is darker than the back. The blue ocelli are absent. The ocular portion of the disk is dark brown crossed by two light bands connecting the anterior and posterior edges of the orbit respectively.

NOTE ON THE BREEDING OF *Chiloscyllium griseum*, Müll. and Henle.—*Chiloscyllium griseum*, Müll. and Henle. (= *C. indicum* (Gmel.) of the "Fauna") is one of the commonest dog-fishes on the Madras coast. In January, 1913, one of the tanks in the Marine Aquarium at Madras contained eight adult specimens captured at different times. As the period of "gestation" is

Egg-capsule of *Chiloscyllium griseum*, × $\frac{1}{2}$.

probably very long in dog-fish, there is little doubt that the fish in question must have been impregnated before entering the aquarium. Every night from January 27th to 30th a pair of egg-capsules were laid, and a single one on the night of February 1st. It could not be ascertained whether all the eggs were laid by a single individual or not

Description of egg.—The horny capsule is of the usual quadrangular shape. The shorter or terminal sides of the quadrangle are contracted and irregularly folded so as to bring the angles towards the middle line. The contraction is greater at one end than at the other, consequently the angles actually meet in the former case, while they do not do so in the latter. The four angles are not prolonged into the usual filaments for attachment, their function being relegated to extremely numerous and slender silky threads which fringe the edges of the capsule. In one of the lateral margins the threads are particularly numerous and extend to a great length, in some cases to about 180 mm., notwithstanding the fact that they are closely matted and twisted together.

Of the 9 eggs the measurements of the largest and of the smallest egg-capsule are as follows :—

		Largest egg-capsule.	Smallest egg-capsule.
Maximum length	..	78 mm.	70 mm.
Maximum breadth	..	36 mm.	32 mm.
Maximum thickness	..	21 mm.	18 mm.
Length of matted threads	..	180 mm.	..

B. SUNDARA RAJ,
Govt. Mus., Madras.

REPTILES.

THREE RARE HIMALAYAN LIZARDS.—Thanks to the generosity of Col. Tytler, R.E., and Major F. Wall, I.M.S., the Indian Museum has recently received specimens of three rare lizards from the Western Himalayas. They are *Alsophylax himalayensis*, Annandale, *Gymnodactylus lawderanus*, Stoliczka and *Acanthosaura major* (Jerdon).

Alsophylax himalayensis.

Annandale, *Rec. Ind. Mus.* IX, p. 305, pl. xv, fig. 1, (1913).

This lizard was recently described by myself from a single female specimen taken in the Simla Hills at an altitude of about 5000 ft. Major Wall has still more recently sent us a male from Almorah, taken at about the same altitude. It is rather darker and greyer than the female and has the markings on the dorsal surface denser. The tail is more distinctly swollen and there is a prominent tubercle on its ventral surface at each side a little behind the vent. There is, however, no trace of praeanal pores—a feature that seems to differentiate the lizard from the male of any other species in the genus, from the general facies of which *A. himalayensis* is, indeed, somewhat divergent.

Gymnodactylus lawderanus.

Col. Tytler has just sent us a specimen of this rare gecko which he took in July at Konsanie in Kumaon at an altitude of 6000 ft. So far as published records go, this is only the second specimen known, but Major Wall informs me that he has recently presented one or more to the British Museum. Col. Tytler's specimen is unfortunately mutilated, but it retains the basal part of the tail, which was deformed in the type. In his key to the Indian species of the genus in the "Fauna" (p. 60) Dr. Boulenger, relying on the original description and figures, includes *G. lawderanus* among those species which do not possess a lateral fold, and states that the tail is without tubercles. The type, which is in the Indian Museum, though generally in good condition so far as the body is concerned, is somewhat shrivelled and it is difficult to see whether the fold is altogether absent. In the fresh specimen it is clearly present. The tail, moreover, is partly surrounded by rings of small nail-like tubercles interrupted on the dorsal and ventral surfaces. Otherwise this specimen agrees with the type. The species is not related in any close degree to any other, but, despite its cylindrical tail, evidently comes nearest to *G. stoliczkai*, with which it was placed provisionally in my recent revision of the Indian representatives of the genus (*Rec. Ind. Mus.* IX, p. 316). The flattened tail of *G. stoliczkai* must, therefore, be regarded as no more than a specific character.

Acanthosaura major.

Boulenger, *Cat. Liz. Brit. Mus.*, I, p. 306, pl. xxiii, fig. 3 (1885).

The typical form of this species, which Dr. Boulenger has figured from the type, is a very different-looking lizard from the one I described some years ago (*Rec. Ind. Mus.*, I, p. 152 ; 1907) under the name *Acanthosaura kumaonensis*, but the difference lies solely in the smaller size, slighter build and rather longer tail of the latter. With both a male and a female of *A. major* before me—the female obtained at Tolpani in Garhwal by Col. Tytler (9000 ft.), the male by myself outside the town of Simla (*ca.* 8000 ft.)—I can find no structural difference between the two forms, except that the crest is higher in the typical male. This form reaches a length of nearly 25 cm., whereas adult males of the race or subspecies *kumaonensis*, as it may be called, are not longer than 18 cm., the females being rather shorter. The typical form is found in the Simla Hill States and Garhwal, probably at altitudes above 6000 ft., whereas the race *kumaonensis* occurs a little to the eastwards in Kumaon and in Garhwal at slightly lower altitudes. Probably the two races merge gradually the one into the other. The difference between them is similar in many respects to that between the Peninsular race (subsp. *gigas*, Blyth) [1] and the typical northern and eastern race of *Calotes versicolor*.

N. ANNANDALE.

[1] Recent investigations show that this larger race, in which the secondary sexual characters of the male are very strongly developed, occupies the whole of Peninsular India south of the Indo-Gangetic plain and also Ceylon. To the north-west its range extends far beyond the Peninsular Area into Baluchistan. The typical form of the species occupies the foot-hills of the Himalayas, the Gangetic plain, Assam, Burma, Siam, the northern part of the Malay Peninsula, etc. Only adults of the two races can be distinguished satisfactorily.

XXII. ON A COLLECTION OF OLIGOCHAETA MAINLY FROM NORTHERN INDIA.

By J. STEPHENSON, *M.B., D.Sc., Lond., Professor of Zoology, Government College, Lahore.*

Plate xxxvi.)

The present paper contains an account of a number of Oligochaeta, collected mainly from localities in Northern India. Only the smallest part of the actual labour of collecting has been done by myself; and I have to thank the many helpers whose names are given in connection with the various species for the trouble they have taken in supplying me with the material on which the present paper is based; I must especially mention L. Bishambar Das, M.Sc., Assistant Professor of Biology in this college; my pupil Baini Parshad, B.Sc., at present Alfred-Patiala Student in Zoology in the Punjab University; and my laboratory assistant Md. Ibrahim.

It will perhaps be convenient to mention first the more interesting results of a general nature.

Having regard to the general facts of distribution of the Naididae, it is neither surprising to find two new species of well-known genera (*Nais raviensis, Naidium minutum*), nor to meet with forms which are specifically identical with those of Europe (*Dero limosa, Aulophorus furcatus*). The two Enchytraeidae also belong one to an already known and one to a new species; the records are interesting, because the list of Indian Enchytraeidae grows very slowly; indeed with the exception of a form described by Beddard, of which the genus is doubtful, only one species (*Enchytraeus indicus*, 12) of this family has so far been found. *Enchytraeus harurami*, of which an account is given below, is noteworthy as being one of the few Enchytraeids in which sperm-sacs have so far been described. In the genus *Mesenchytraeus* they are present, as is well known, and have the same relations as in the Naididae; Eisen apparently records them (in a paper which I am unfortunately unable to consult) in some species of the genus *Enchytraeus*, though they are certainly not present in all (*cf.* Welch, 17). In the present species the sacs are of the nature of the testis-sacs seen, for example, in *Ocnerodrilus* (*O.*) *occidentalis* (to mention only another worm in the present collection), not of the seminal vesicles of the Naididae; each consists of a peritoneal membrane in the form of a bag, which surrounds the testis (but not, as for example in *Eutyphoeus*, the funnel also), and within which the sexual cells, ripening and freeing themselves from their attachment, undergo the change into sperm-morulae. Exactly how the sexual cells escape, and as ripe spermatozoa find their way to the mouth of the funnels, is not evident in the preparations of the present form.

Perhaps the most curious, though not the most important, fact recorded is the occurrence of the genus *Microscolex* in a remote spot in the extreme north of India, 700 miles in a direct line from the sea. The species (*M. phosphoreus*) is widespread; its original home is probably (Michaelsen, 7) in the temperate zone of South America, whence, with other representatives of the genus, it has been carried by the drift due to the prevalent westerly winds across the South Atlantic and Indian Oceans, and so has become widely dispersed in the Southern Hemisphere. Direct importation by the agency of man is apparently, however, the only means by which it could have reached Northern India; its isolated occurrence at Peshawar is certainly strange. This is the only record of a member of the acanthodriline group in India.

Of the same nature is the occurrence of *Ocnerodrilus* (*Ocnerodilus*) *occidentalis*, curiously enough also not far from Peshawar (Mardan in Peshawar District), as well as at Rawal Pindi, 120 miles east of Peshawar. The species has been recorded by Michaelsen (6) from Ceylon and Travancore.

Of the two species of *Lampito*, *L. mauritii* is a well-known wanderer; *L. barodensis*, however, would seem to represent an extension northwards of the proper range of the genus.

The three species of *Pheretima* are of course also well-known peregrine forms. But it is curious to note that while *Pheretima* is the commonest genus in the Punjab, as it is certainly one of the commonest in Bengal (i.e. "the lower provinces," used as including Bihar), it is nevertheless almost absent from the intervening territory. Though the United Provinces (the upper Gangetic plain) is one of the best investigated regions in India in the matter of terrestrial Oligochaeta, *Pheretima posthuma* has hitherto been found nowhere within its limits; though it is on the one hand the commonest worm of the Punjab, and on the other has been recorded by Michaelsen (4) from no fewer than ten places in Bengal. A few species of *Pheretima*, including those found in the Punjab, have indeed been recorded from one or two places in the Himalayas bounding the United Provinces on the North; but never, I think, from the upper Gangetic plain.

Before the publication of Michaelsen's paper of 1907 (4) on the Oligochaete fauna of India, the genus *Eutyphoeus* comprised about half a dozen species, and it could scarcely have been suspected that it was one of the large and dominant genera of the country. Michaelsen added fourteen species (though he subsequently slightly reduced the number); I found four more in the material gathered during the Abor expedition (15), and several new species appear also in the present paper. The United Provinces and Bengal (including Assam) are the head-quarters of the genus, outside which territories it has hitherto scarcely been found at all. The present records extend the range of the archaic species *E. incommodus* into the Punjab (as far as Hoshiarpur District at the foot of the Himalayas), and that of the widespread and variable *E. waltoni* to Baroda on the West Coast on the one hand and to Hoshiarpur district (the same place as for *E. incommodus*) on the other. The South-East Punjab is also, owing to the discovery of a new species (*E. ibrahimi*) at Kapurthala near Jullundur (Jalandhar), to be included in the endemic area of the genus.

Similarly the range of the genus *Octochaetus* is considerably extended by the record of *O. fermori* and also of a new species (*O. bishambari*) from Saharanpur (extreme north-west of the United Provinces, on the border of the Punjab); while another new species (*O. dasi*) makes its appearance at Baroda on the West Coast.

The Lumbricidae are all peregrine forms.

As regards the Punjab and North-West Frontier Province, the curious fact emerges that, so far as is known at present, this region can scarcely be said to have a proper earthworm fauna of its own. The territory of the genus *Eutyphoeus* must be extended to include a part of the South-East Punjab; but for the rest, the terrestrial Oligochaeta have come from outside. There are earthworms in Lahore, for example, in any abundance; but they are species of *Pheretima* from the South-East, or of *Helodrilus* from the North-West.

It may be added that, except from the Simla hills, the only previous records of earthworms from the Punjab and North-West Frontier Province are those of *Pheretima hawayana* and *Lampito mauritii*, both from Lahore; examples of which were some years ago transmitted from me by the Indian Museum to Dr. Michaelsen.

Fam. NAIDIDAE.

Nais raviensis, sp. nov.

Specimens of this worm were found in material taken from the river Ravi near Lahore in February 1914.

The worms are minute in size, and are only to be discovered by a systematic search with a dissecting binocular microscope. The length of a chain of two is only 3 mm.; in breadth they are about ·12 mm.; their colour is whitish.

The prostomium is blunt and short, shorter in length than the breadth of its base. There are no eyes. The number of segments in a double animal is about 26, that is about 13 in each half.

The *setae* are arranged in the manner usual in the genus. The first four pairs of ventral setal bundles are used actively, apparently as claws by which the animal pulls itself along; the bundles are first thrust forwards, the setae being together and parallel to the long axis of the body; then, as they are drawn backwards, they are spread out fan-wise, and lastly come together again parallel to each other. When in action, the points of the setae are directed backwards, like claws, the convexity of the curve of the distal (free) portions of the setae facing forwards.

The *dorsal setae* begin in segment vi, each bundle consisting as a rule of one hair-seta and one needle-seta; occasionally two needles are met with. The hair is short and fine, in length 83μ or less. The needle (text-fig. 1*c*) is of the double-pronged type; the shaft is almost straight for the most part, slightly curved distally; the two teeth of the forked end are short, stoutish at their base, separated by a considerable angle, and of equal length; the nodulus is about $\frac{2}{7}$ of the length of the shaft from its distal end; in length these setae are 40μ.

The *ventral setae* are usually four, sometimes three, per bundle; they may be divided into two groups, an anterior comprising those belonging to segments ii-v, and a posterior comprising the remainder; those of the anterior group are longer and thinner, with proximal nodulus, those of the posterior have the opposite characters.

More particularly, the anterior setae (fig. 1*a*) may reach a maximum length of 90μ; their breadth is approximately 2·2μ. The distal prong of the free forked end is considerably longer than the proximal, and the two prongs are of equal thickness at their base; the angle between the prongs is narrow. The shaft is comparatively straight; the nodulus is very markedly proximal to the middle of the length of the shaft, the proportions of the sections of the shaft proximal and distal to the nodulus respectively being 1 : 2 or 3 : 5.

The posterior ventral setae (text-fig. 1*b*) reach a length of 48μ, and are in breadth about 2·5μ. The proximal prong of the forked end is slightly longer, and is twice as thick at the base as the distal; the angle between the prongs is moderately wide. The

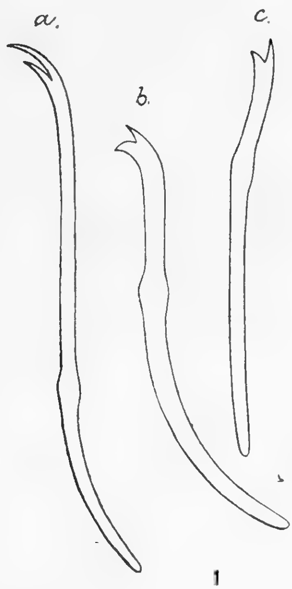


FIG. 1.—*Nais raviensis*; setae; *a*, anterior ventral, *b*, posterior ventral; *c*, dorsal needle. *a* × 830, *b* × 1150, *c* × 1350.

curves of the shaft are more marked than in the anterior setae: and the nodulus is distal, the ratio being:—proximal to nodulus; distal to nodulus : : 5 : 3.

No *coelomic corpuscles* were seen.

On the dorsal side of the *pharynx*, and back as far as segment v, are a number of large, oval or pyriform, perhaps glandular cells, with well-marked nucleus, not very unlike the cells of the septal glands in the genus *Pristina*. *Chloragogen cells* begin in segment vi. No *stomach* was noted in the living animal; the oesophagus was narrow as far as segment viii, where it widened to form the *intestine*; in a stained specimen, however, there appears to be a stomachal dilatation in viii, followed by a narrower portion for a short distance, but this part of the tube quickly dilates again to become the intestine before it has quitted segment ix. The *anus* is dorsal.

A lateral *commissural vessel* was seen in segment vi; no others were noted, but it would perhaps be rash to say they do not exist. The blood is yellow.

The first *nephridium* is in segment vii; thenceforward they occur regularly. Each nephridial tube dilates to form a small chamber in the parietes just before it opens externally in front of the ventral setal bundle.

The *cerebral ganglion* is large, extending forwards nearly to the tip of the prostomium and back to the level of the first bundle of ventral setae. It is bifid posteriorly (text-fig. 2).

Reproductive organs were not present in any of the specimens examined. Asexual division, however, was taking place; $n=13$ in the specimens examined. The first five segments and prostomium of the hinder animal are formed in the budding zone.

This species differs from most of those of the genus in having no eyes. It resembles in some respects two specimens insufficiently described by Walton (16) under the name of *N. tenuidentis*.

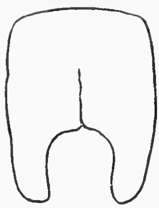

2.

FIG. 2.—*Nais raviensis*; cerebral ganglion.

It is useless, as Walton does, to describe the "ventral setae"; in at least most species of the genus *Nais* and also of some allied genera these differ widely in the anterior and in the succeeding parts of the body. The points of difference usually extend to the length, thickness, curve of shaft, position of nodulus, and relative and absolute proportions of the teeth; and no description can fit both sets. In the present state of our knowledge, and with the multiplication of species differing from each other in comparatively minute points, the setae furnish the chief characters for their discrimination; and it is unfortunately impossible to make use of a description which does not specify whether the anterior or posterior group of ventral setae is meant, or whether, as may perhaps happen, these are similar in character throughout. The two groups are not distinguished by Walton in any of the four species which he describes; yet it is in the highest degree improbable that in all four cases both anterior and posterior setae should be capable of description in the same terms.[1]

[1] The figure of the ventral setae given by Walton is stated to be of those of segment ii; the position of the nodulus, however, resembles what is usually found in more posterior segments.

In the present case the teeth of *N. tenuidentis*, as described by Walton, have a considerable resemblance to those of the anterior, though widely different from those of the posterior, setae of the present form.[1]

The value of *n*, however, which is much smaller in the present species, should serve easily to distinguish it. The smaller size of the present form may also be mentioned, though of subsidiary importance.

Naidium minutum, sp. nov.

Specimens of this worm were found in material taken from the river Ravi near Lahore in February 1914. The animal is too small to be seen except by hunting through the material with a dissecting binocular over a black background; with the exception, perhaps, of *Chaetogaster punjabensis*, it is the smallest Oligochaete known to me.

The length of a chain of two animals, moderately extended, is 2 mm.; its breadth in the extended condition 0·1 mm. Each animal is a small whitish thread, often marked, when seen by reflected light against a black background, by spots or transverse bands of a brilliant opaque white; these represent masses of coelomic corpuscles. When the worm retracts the anterior part of the body, the snout, from the level of the first ventral setae forwards, is somewhat kinked upwards.

The prostomium, with rounded end, is longer than it is broad at its base; it is not elongated to form a proboscis. There are no eyes. The number of complete segments in a double animal is 17 or 19, excluding new segments just forming in the budding zone between the two; $n = 12$, —constantly, so far as observed. The segments in the hinder part of the body, behind the stomach, are much longer than those in front; the first six segments are all quite short.

3

FIG. 3.—*Naidium minutum*; dorsal needle-seta, × 1,600.

The *dorsal setae* begin in segment ii, each bundle consisting of one needle-seta and one hair-seta; the hair-seta is tapering, and very slender, in length 80–90μ (thus less than the diameter of the body), and in thickness about 1μ. The needle-seta (text-fig. 3) is 35μ in length, and in thickness rather stouter than the hair, something over 1μ; its shaft has a slight double curve, and its distal end is forked, the prongs being almost equal in length,

[1] The longer of the two prongs in Walton's specimens measured as much as 20μ in length; here the longer prong of the anterior setae is only 7—8μ, but the animal itself is only about half the size of Walton's form.

and separated by a fairly wide angle; there is a slight nodulus one-third of the length of the shaft from its distal end.

The *ventral setae* are usually 3, occasionally 4, and rarely 5 per bundle; there is no sharp division into an anterior and a posterior group. They are 30–40μ long, approximately 1·25μ thick, of the usual double-curved and double-pronged type, the nodulus generally distal.

Differences between different segments may be illustrated by a few further details. In segment iv, as an example from the anterior region, the length was 35μ, the nodulus was distal in the ratio:—distal portion of shaft: proximal portion : : 2 : 3; the distal prong of the fork was slightly longer. In segment x the prongs were equal in length, but the proximal prong was the thicker at its base; the nodulus here also was distal.

In segments ii and iii the setae were shorter, 30μ; and the nodulus at the middle of the shaft, or slightly or obviously proximal. In vi and viii setae were met with in which the nodulus was at the middle or only slightly distal.

Coelomic corpuscles are numerous. They appear black, i.e. are opaque, under the low power; by reflected light they cause the white spots and bands previously mentioned. With the high power they are seen to consist of aggregations of minute oil-like refractile globules, the proper colour of which is apparently yellowish. In shape they are circular or occasionally oval, and in size from 6 to 15μ in diameter; a fairly large one would be 10μ; in stained specimens they are seen to be nucleated. The corpuscles can move forwards as far as the tip of the prostomium; in the first few segments they travel about with no apparent hindrance.

A second type of corpuscle was seen in fresh specimens, but in smaller numbers; these were of about the same size, but hyaline; no nucleus was observed in the living condition.

The *pharynx* is bulky, and occupies segments ii and iii. The *oesophagus* begins in segment iv. The *septal glands* are rather variable; they are apparently always present in segments iv and v, with the addition usually of a smaller pair in segment iii, or in segment vi, or (in one specimen) in both iii and vi. The *stomach* is in viii, of a pyriform shape with the broad end directed forwards; it has a somewhat streaked appearance, due apparently to the chloragogen granules being arranged more or less in rows. The alimentary tube is still narrow for some distance behind the stomach, and in contracted specimens forms here a small loop directed backwards; this is not quite straightened out even when the animal extends itself. The *intestine* begins in segment ix.

I failed to discern any transverse *vascular commissures*.

The first *nephridium* is in segment ix; the next is in xi, and there are no more in the anterior animal of a chain of two; in the posterior animal a nephridium occurs opposite the second pair of setal bundles, i e. as will appear immediately, in what will be the ninth segment of this individual after separation.

The *cerebral ganglion* (text-fig. 4) is slightly bifid posteriorly, and has a concave anterior border.

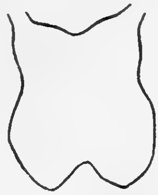


FIG. 4.—*Naidium minutum*; cerebral ganglion.

Sexual organs were not present in any of the specimens. *Asexual reproduction* was going on, and chains of two were usually observed; a chain of three, with two budding zones, was also seen. The budding zone establishes itself behind the twelfth segment ($n = 12$); and of the new segments formed in the zone, the hinder seven, with a prostomium, are apportioned to the posterior animal (text-fig. 5); in other words, in an animal which is about to

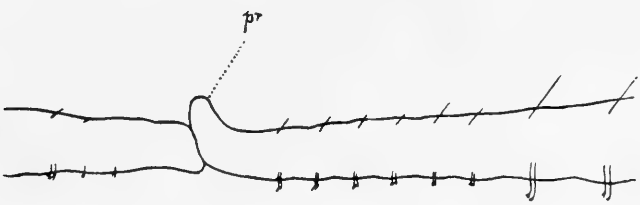


FIG. 5.—*Naidium minutum*; zone of budding.
pr., prostomium.

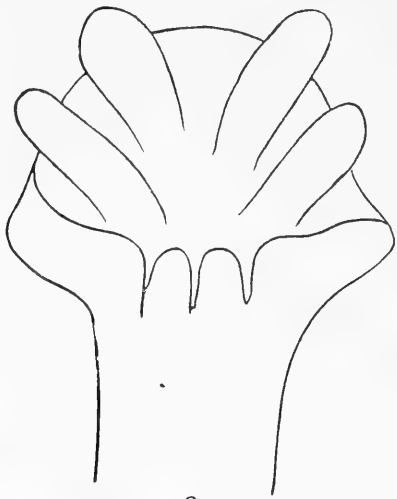
separate, the rudiments of six pairs of setal bundles are seen forming in its anterior part. In such a specimen the prostomium of the hinder individual may be seen projecting dorsalwards just behind the line of approaching division (*cf.* text-fig.); although after separation it is a small structure and not at all proboscis-like.

Michaelsen (5) has recently united the genera *Naidium* and *Pristina* under the latter name; though Piguet (9) still more recently prefers to retain them as separate. Without claiming to decide the point, and reserving judgment till the genital organs of *Naidium* have been described, it may be noted that an indication of the close relationship between the two is furnished by the facts of asexual reproduction. In *Pristina*, as I have previously stated (12), the number of segments at the anterior end which have been produced in the budding zone is seven,—i.e. six seta-bearing segments, a first segment without setae, and a prostomium. This is exceptional in the Naididae; the number of such segments is in the majority of cases five, or two less than in *Pristina*; and it is interesting now to find that in a species of *Naidium* (on which there were no previous observations on the budding zone) the number turns out to be the same as in *Pristina*. The genital organs of *Naidium* have not so far been described; but since in *Pristina* their exceptional position in segments vii–viii (two segments further back than usual) is correlated with the presence of the two additional segments produced in the budding zone, it seems not improbable that the same will hereafter be found to be the case in *Naidium* also.

Dero limosa, Leidy.

This species was found at Lahore by my pupil Mohammed Afzal Husain, who kindly gave me a number of living specimens, in October, 1912.

The worms are about 6 mm. long, filiform, and pale grey in colour. When disturbed, they often execute wriggling movements



6.

FIG. 6.—Posterior end of *Dero limosa*.

like those of insect larvae; in trying to escape from under a cover-glass they may progress with the posterior end in advance. Of the specimens submitted to examination, none were undergoing asexual division.

The *prostomium* is bluntly conical. The number of *segments* is 47, 48 or 49, plus an undifferentiated region posteriorly in which setae are not yet developed. A feature of the Lahore specimens of this species is the occurrence of a number of segmentally arranged bright *orange-coloured spots*, due to a granular pigment in the surface epithelium and superficial to the muscular layer of the body-wall. They are situated on each side slightly ventral to, and approximately in the same vertical plane as, the insertion of the dorsal setal bundles. Their distribution is rather variable; they are perhaps usually best marked in the anterior segments, but are sometimes present in the posterior portion of the body also.

Two pairs of *gills* (text-fig. 6) stumpy and cylindrical, arise within the margin of the anal funnel; a third pair is formed anteriorly to these by a projection of the funnel margin; and there is a similar small fourth, most anterior or dorsal pair, which might be considered as a portion of the third pair separated off by a cleft in the margin of the funnel. The appearance is sketched in text-fig. 6, and resembles that figured by Bousfield (2), except that the interval in the middle line between the fourth gills of each side is much less in my specimens. It is usual (Michaelsen, 3; Bousfield, 2) to describe only one pair of secondary branchiae, or projections of the funnel margin, in *D. limosa*; but, as Bousfield's figures (drawn probably in a more completely expanded condition of the funnel than mine) very plainly show, there are really two such pairs. All four pairs of gills are vascular and all four show in their interior a regular series of star-shaped or spindle-shaped cells, stretching by means of their processes across the cavity of the gill-process.

The *dorsal setae* begin in the sixth segment, and each bundle consists as a rule of one capillary and one needle seta. The capillary setae are on an average 190μ long. The needles are 66μ long, are bifid at the end, with the prongs small, equal or subequal; the nodulus is about 19μ from the distal end, and the shaft has a slight sickle-shaped curve between the nodulus and the free extremity.

The *ventral setae*, beginning in segment ii, are either three or four per bundle. There is a marked difference between those of segments ii—v and of the rest of the body.

In the anterior segments (ii—v) the curves of the shaft are slight; the total length is about 127μ, and the breadth 2·5μ. The prongs of the fork are separated by a very narrow angle, and both prongs are comparatively long; the distal is the longer,—one and a half times as long as the proximal, and equal to it in thickness. The nodulus is proximal to the middle of the shaft, thus:—

proximal to nodulus : distal to nodulus :: 50μ : 78μ.
or again ,, ,, ,, : ,, ,, :: 51μ : 75μ.

In the remaining segments (vi to posterior end) the setae are much shorter, and the curves of the shaft more pronounced. The prongs are comparatively short, and the angle between them is moderately wide. The distal prong of the fork is very slightly longer than, and is only half as thick at the base as, the proximal prong. The average length is 70μ, and thickness 3μ. The nodulus is distal to the middle of the shaft; but its position varies, as will be explained immediately.

Where these setae are four per bundle, they can be distinguished as two couples, an inner and an outer (or a more ventrally and a more laterally situated); the outer couple is the shorter, and is especially short from nodulus to tip; thus,—outer couple length 66μ, nodulus 20μ from end; inner couple 75μ long, nodulus 31μ and 33μ from end.

In a bundle of three, the outer (most laterally situated) seta is the shortest, and is especially short from nodulus to tip; the innermost seta has the opposite characters, and the intermediate seta is intermediate also in measurements; thus:—

outer,	length 64μ,	nodulus to tip	21μ.
middle,	,, 71μ,	,,	26μ.
inner,	,, 75μ,	,,	34μ.

In the outer setae of the bundles the nodulus is therefore relatively nearer the distal end.

Of the remaining anatomical characters it may be noted that there are no coelomic corpuscles; that chloragogen cells begin in segment vi, and that there is a fairly well-marked stomachal dilatation in x, or ix and x; that the first nephridium is in x; and that there are four vascular loops, in segments vii—x (Michaelsen gives the loops as 5-6; Bousfield as 5, and notes that the last is much the smallest).

Aulophorus furcatus (Oken).

The material on which the following account is based was brought from a ditch on the borders of Lahore City by L. Shiv Ram Kashyap, Professor of Botany in Government College, who handed it over to L. Karam Narain, Demonstrator in Biology. From him I received thousands of specimens matted together with a filamentous alga.

From the masses of this matted material the posterior ends of the worms projected, the expanded funnels with the gills looking like miniature flowers. These retract immediately if the mass is touched, but not if the table is jarred. From a few small masses, consisting mainly of the tangled bodies of the worms, the anterior end of the animals were projecting; these stretched themselves out and attached themselves to the floor of the glass dish, apparently trying to pull themselves along, the attachment being by means of the mouth, and the pharynx probably acting as the plug of a sucker (compare the action of the pharynx in *A. tonkinensis*, Annandale *ap.* Michaelsen, 4; and Stephenson, 11). In specimens examined on the slide the pharynx was seen to be continually advanced as far as the mouth aperture and then retracted, but it was not actually protruded from the mouth.

The length of the worms is 6—16 mm.; the longer are chains of two individuals. The breadth is about ·2 mm. The number of segments, in a double animal, is 46—48, plus an undifferentiated zone posteriorly; but there may be more than 40 in a single animal, without any sign of fission. N=18, 22, 23, 24, or 25, and is thus not constant.

Four new seta-bearing segments, *i.e.*, five in all, are intercalated at the zone of fission to form the head of the posterior animal. Thus, since the dorsal setae in this species begin on segment v, the last of these newly formed segments must develop a dorsal bundle as well as a ventral; in one case this was distinctly seen to have occurred. In general in the Naididae the cephalized segments (those distinguished by the absence of dorsal setae) are those which are produced in the budding zone (12); here the budding zone produces one of the body segments also.

The prostomium is blunt and rounded.

The anal funnel at the posterior end of the body can be widely opened, and its margin everted to a much greater degree than is shown in Bousfield's figure (2, fig. 18). There is a pair of palps, and three pairs of gills. The posterior and middle pairs of gills constitute finger-like projections arising from within the funnel; the anterior gill on each side is the folded and projecting margin of the funnel, and disappears, or rather appears merely as a fold in the margin, when the funnel is fully everted. The posterior and middle pairs are about ·36 mm. in length, or twice the diameter of the body at its hinder end; and the palps are of about equal length or in some cases rather shorter. All the gills are vascular, and show a number of bipolar or stellate cells, arranged at intervals, crossing the cavity of the gill-process (*cf. Dero limosa*, *sup.*).

The *dorsal setae* begin in segment v; each bundle consists of one capillary and one needle seta. The hair-setae are on an average 200μ in length, and are quite smooth. The needles are 60–62μ long; the nodulus is situated rather more than one-third of the length of the shaft from the distal end; the free extremity is bifid, and the shaft has a slight sickle-shaped curve in its distal portion.

The *ventral setae* are usually four per bundle, rarely five; posteriorly the number diminishes to three, and in a number of the terminal segments to two only. The setae of the anterior bundles (segments ii-iv) differ from those in the rest of the body.

In the first few segments (ii-iv) their length is about 75μ, and breadth 2·5μ. The distal prong of the fork is $1\frac{1}{4}$ times as long and $\frac{2}{3}$ as thick at the base as the proximal prong. The nodulus is, in the innermost seta of a bundle, proximal to the middle of the shaft, thus:—distal to nodulus: proximal to nodulus : : 7 : 5. In the middle setae of a bundle, the nodulus is at the middle of the length of the shaft; and in the outermost it is also at the middle, or very slightly distal.

In the remaining segments (v onwards) the length is 62-66μ, and the thickness 3μ. The prongs of the fork are equal in length, but the proximal is twice, or even two and a half times, as thick at its base as the distal. The nodulus is usually distal to the middle of the length of the shaft, but its position varies in the same way as in other species of *Dero* and *Aulophorus* (10, and *cf. Dero limosa*, *ant.*); that is to say, it is more distally situated in the outer setae of a bundle than in the inner.

Thus in the innermost seta of a bundle the nodulus was found to be very slightly proximal to the middle of the shaft; in the next it was distal, the proximal and distal sections of the shaft being respectively 37μ and 33μ; in the next, these proportions were 38μ and 26μ; and in the outermost seta of the bundle they were 41μ and 26μ: i.e., the nodulus is, relatively to the length of the seta, progressively more distally situated in the more laterally placed setae of the bundle. So again:—in the innermost seta of a bundle the nodulus was slightly proximal to the middle; in the next, proximal section: distal : : 37μ : 31μ, and in the outermost, proximal : distal : : 38μ : 28μ.

The innermost seta of each bundle is also a trifle slenderer than the others, and there is a gradual thickening from inner to outer, the outermost being the thickest.

There are no *coelomic corpuscles.*

The retractor muscles of the pharynx are a number of strands, inserted into the pharyngeal wall as far forwards as the anterior boundary of the third segment, and passing back obliquely to the parietes, some being attached as far back as dissepiment $\frac{5}{6}$. Surrounding this part of the alimentary tube, in segments iii-vi, and especially on its dorsal side, is a mass of tightly packed fairly large spherical or ovoid cells, apparently glandular. Chloragogen cells begin in segment vi. There is no stomach.

The dorsal vessel is situated dorsally on the intestine, not ventrally or laterally as in a number of related forms. There are four vascular loops, in segments vi-ix; Michaelsen (3) and Bousfield (2) give five as the number in this species.

The first nephridium is in segment vii.

Fam. ENCHYTRAEIDAE.

Fridericia bulbosa (Rosa).

Found at Wagah, a few miles outside Lahore, by Mohammed Afzal Husain, in January, 1912.

Length about 8 mm. *Segments* 30–37. *Prostomium* short, rounded. *Clitellum* including segments xii--xiii.

The *setae* are curved at their inner ends, straight for the rest of their extent, bluntly pointed; their length is about 28μ, and breadth nearly 3μ. In front of the clitellum the ventral setae are usually 4 per bundle, in which case the arrangement is that characteristic of the genus,—the two middle setae of the bundle are shorter and thinner than those on each side of them. In segment ii there may be only one seta on each side; in other segments in front of the clitellum there may be three setae per bundle. Behind the clitellum the ventral setae are usually two per bundle; in one specimen all ventral bundles throughout the body comprised two setae only. The lateral setae are usually two per bundle; in front of the clitellum there may be three. Segment xii is entirely without setae.

Dorsal pores are present from segment vii onwards.

The *pharynx* is in iii; its roof is composed of much elongated columnar epithelial cells, which form a sucker-like plug. *Septal* *glands* are present in connection with septa $\frac{4}{5}$, $\frac{5}{6}$, $\frac{6}{7}$, projecting forwards into the anterior of the two segments with which the septum is in relation; except that the most anterior gland appears in sections to project backwards into v with its ventral portion, instead of forwards into iv. The *stomach* is a marked dilatation of the alimentary tube in segments x and xi; its epithelial lining consists of large cells arranged in definite longitudinal rows, each cell with a cavity in its interior. Oesophagus and stomach are markedly ciliated; the oesophagus widens in xiv to become the intestine. The *salivary glands* begin behind in segment vi, and run forwards ventral to the oesophagus through v; in iv they are much coiled, and finally enter the pharynx.

The *lymph corpuscles* are numerous circular or oval bodies, granular and, except for the very distinct nucleus, hardly staining. The largest are 22-27μ in length.

The *dorsal vessel* begins apparently behind the clitellum, about the level of septum $\frac{13}{14}$.

The *nephridia* are of the compact type, small in size, the anteseptal portion nearly as large as the postseptal; there is a marked constriction at the septum; the duct is short, about equal to the postseptal portion in length, and is directed downwards and backwards. The first nephridium is in vii.

The *cerebral ganglion* is in segment ii; it is somewhat oval in shape, and not indented posteriorly. There are no "copulatory glands" in connection with the ventral nerve cord.

The *genital organs* have the usual situation. There are large numbers of developing spermatozoa in segment xi. The male funnel is short and stumpy, not more than twice as long as broad, without everted margin. The vas deferens is very slender and much coiled, and enters the penial bulb on the dorsal side of the latter; the bulb is approximately spherical.

Segment xii contains ova, septum $\frac{12}{13}$ being bulged backwards as far as the posterior boundary of segment xiii; the condition might be described as the commencement of the formation of an ovisac.

The spermathecae are situated in segment v, in front of the septal gland; the ampulla is small, somewhat irregularly ovoid, elongated transversely, and with thin walls: it probably opens into the oesophagus, though I did not see the actual aperture. The spermathecal duct is long, narrow, coiled, in the main transversely placed behind the septum; there are no gland cells round the duct or round the external aperture.

Enchytraeus harurami, sp. nov.

Specimens were obtained by myself and my pupil, L. Haru Ram, B.Sc., on 24th March, 1914, from the duckpond in the Zoological Gardens, Lahore; they are thoroughly aquatic, living under the same conditions as, and in company with, numerous Naididae.

The worms are 4 mm. in length, and of an opaque white colour; the anterior end is narrower than the posterior, and gently tapering. The prostomium is rounded; segments 35; no head-pore or dorsal pores. The worms are of a sluggish habit.

The *setae* are two per bundle regularly throughout the body in both dorsal and ventral bundles. All are of the same type; the shaft is straight, tapering and bluntly or even moderately sharply pointed distally, with a hook at the proximal end which is curved in an arc of about 90°; the setae are frequently broadest about the middle of their length. In the posterior half of the body they are about 53μ long, and 3·5—4μ broad; anteriorly they are rather smaller, 40-46μ long.

Coelomic corpuscles are very numerous, and float freely in the body-cavity, in greater numbers towards the anterior end. They are small flat discs, oval or pear-shaped, or not infrequently spindle-shaped. In diameter the more nearly circular ones measure 10μ, while the length of the spindle-shaped corpuscles may be 15μ. They show nuclei in stained preparations; and after Heidenhain's iron-haematoxylin, a number of black granules of relatively large size. In fresh specimens the corpuscles appear to originate from occasional strands passing between alimentary tube and body-wall, and from the septa in the anterior part of the body; this is confirmed in stained and sectioned preparations, in which a number of cells with the characters of the corpuscles are seen massed together on the anterior septa.

The *buccal cavity* is tubular and extends through segments i and ii. The *pharynx*, in segment iii, is distinguished by the thickening of its dorsal wall; this is composed of a high epithelium very definitely limited in extent both anteriorly and posteriorly, with the nuclei of the cells situated near their bases. The ventral wall of the pharynx is not thickened, its epithelium being almost cubical. A lining of cuticle extends throughout the buccal cavity and over the ventral wall of the pharynx; but on the dorsal wall it stops at the high pharyngeal epithelium, which is ciliated.

The *septal glands*, as seen in the living animal, appear to be in three pairs, in segments iv, v and vi, on the anterior faces of septa $\frac{4}{5}$, $\frac{5}{6}$ and $\frac{6}{7}$, causing the septa to bulge backwards. The examination of longitudinal sections shows that between these masses are others arranged in series with them; so that the glands on each side form a connected mass of five or six lobes arranged longitudinally. The glands of opposite sides are also continuous in each segment dorsally to the alimentary tube.

Salivary glands ("peptonephridia") are present, as coiled tubes, one on each side, opening into the oesophagus close behind the pharynx and extending backwards through segments iv and v. They are quite conspicuous structures, and though their lumen is intracellular they have a maximum diameter of as much as 18μ. The *oesophagus* continues narrow to segment xii, and the tube widens slightly in xiii to form the *intestine*.

The *dorsal vessel* originates in segment xii as a much dilated "heart," which takes up the whole of the length of the segment. The *ventral vessel* is as usual separate from the alimentary tube throughout the body.

The *nephridia* begin in segment vii, and are continued backwards regularly to segment x, after which there is an interval of three segments (xi-xiii); the regular series commences again in xiv. The anteseptal portion is very short, one quarter the length of the post-septal, and consists of an obliquely facing funnel; there is a marked constriction at the septum, and the post-septal portion is continued backwards and slightly downwards to open on the exterior in front of the ventral setal bundle. The narrower terminal portion or duct is a third to a quarter as long as the mass of the post-septal. In longitudinal sections the post-septal portion is sometimes thin and narrow, sometimes relatively broad; which indicates that this part has a flattened shape, and may be cut vertical to, or parallel with, the plane of flattening.

The *cerebral ganglion* (text-fig. 7) is large, of an elongated oval shape in a lateral view of the living animal, and extending

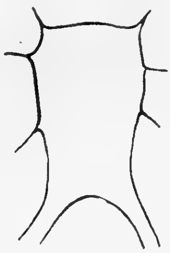


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FIG. 7.—*Enchytraeus harurami*; cerebral ganglion.

from the front of the mouth to the level of the anterior border of the pharynx; it is slightly indented behind. The nerve cells along the course of the *ventral nerve cord* form a continuous layer on its lower surface, there being no, or only the very slightest, special aggregations (ganglia) in each segment.

The *clitellum* is not conspicuous; it extends over segments xii-xiii.

The *testes* are in segment xi, attached to the posterior face of septum $\frac{10}{11}$; this septum has a large vacuity in its middle portion, and the testis may be turned forwards through this opening and thus come to lie largely in segment x (*cf.* fig. 1). A pair of *sperm-sacs* are present, but these differ from the structures which are called by this name in the majority of the Limicolae. Here the testis is continuous with a mass of sperm-morulae; the whole, testis and sperm-morulae, are surrounded by a sac of peritoneum, which is attached to septum $\frac{10}{11}$ at the origin of the testis. The sperm-sacs may therefore lie in the anterior part of segment xi, or in segment x, according as the testis happens to be turned forwards through the vacuity in septum $\frac{10}{11}$ or not (fig. 1). The sacs therefore differ from those of the Naididae and Tubificidae, which are constituted by a pocket-like backward bulging of the septum limiting the testis-segment posteriorly; and correspond rather to the testis-sacs of some of the terrestrial Oligochaeta.

A number of ripe spermatozoa are found in segment ix, round the mouths of the *funnels*. These structures are relatively small, with a well-marked rim succeeded by a globular body, the whole exactly resembling the top of a "thistle-funnel" used in chemical laboratories (fig. 1). The diameter of the funnel is 50μ; the actual lumen of the funnel is narrowly tubular, the cells of the spherical bulb-like portion being elongated, with peripherally situated nuclei and clear slightly-staining central portion.

The male duct pierces septum $\frac{11}{12}$ immediately beyond the funnel, continuing as the *vas deferens* almost straight backwards through the anterior two-thirds of segment xii, bending slightly dorsalwards to enter the atrium on its dorsal, or dorsal and anterior, aspect. The vas is a narrow tube, $6\text{-}9\mu$ in diameter.

The *atrium* (penial body) is a small spherical mass, sessile on the ventral body-wall, 55μ in diameter. Its lumen is small, nearer one side, and in horizontal section shaped rather like the figure 3. The body thus consists for the most part of a tightly packed mass of cells, with distinct nuclei, and an investment of muscular fibres. There are no accessory gland-cells The male pore appears on the surface as a slight papilla.

The *ovaries* are in segment xii, and the ova after being detached are confined to this segment. There are small *ovarian funnels* on the anterior face of septum $\frac{12}{13}$ near the ventral surface. The *oviduct* was seen in one instance as a minute tube passing backwards from the funnel to open on the ventral surface of the anterior part of segment xiii; in other cases it was indistinct.

The *spermathecae* occupy their usual position, opening on the ventral surface just behind septum $\frac{4}{5}$. The ampulla is spherical, of small size, 35μ in diameter, and distinctly marked off from the cylindrical duct. It has no opening into the alimentary canal; in one of my sections a strand, consisting apparently of a single muscular fibre, connected on the one hand with the muscular layer of the oesophagus and on the other with the muscular investment of the spermatheca, can be seen to pass between the two; but otherwise they are quite separate. The duct is about $18\ \mu$ in diameter, and twice as long as the ampulla; a diverticulum is absent.

Fam. MEGASCOLECIDAE.

Sub-fam. *ACANTHODRILINAE*.

Microscolex phosphoreus (Dug.)

Peshawar, Shahi Gardens; 29-xii-1913; Baini Parshad. A single specimen, in a poor state of preservation.

Length 50 mm.; breadth $1\frac{1}{2}$ mm.; colour mottled grey, the clitellum being whiter than the rest. Segments 81.

Prostomium epilobous $\frac{1}{2}$.

The setae are widely paired: $ab = \frac{2}{3}aa = \frac{1}{2}bc = \frac{3}{4}cd$.

Clitellum $\frac{1}{3}$xiii—$\frac{1}{2}$xvii$=4\frac{1}{6}$ (according to sections the clitellum includes the whole of xiii$=4\frac{1}{2}$).

Nephridial apertures easily visible, especially conspicuous on the clitellum; in the lateral line of the body, just below the level of setae *c*, intersegmental.

No genital apertures visible.

The internal anatomy was investigated by sections in a frontal plane. Though the state of preservation was apparently, as noted above, poor, the sections leave nothing to be desired from the point of view of the general anatomy of the specimen.

The first septum is $\frac{4}{5}$; it and $\frac{5}{6}$ are thin, while $\frac{6}{7}$—$\frac{12}{13}$ are all moderately thickened.

The gizzard is rudimentary, and is represented only by a thickening of the circular muscular coat of the oesophagus in segment v; though this thickening may be called considerable, it does not cause any swelling of the tube as a whole.

Septal glands are present in segments v-viii; in these segments they are paired structures, those in viii being smaller than the rest. In front of septum $\frac{4}{5}$ the series of glands of each side unites dorsally over the pharynx with that of the other side.

Throughout segments ix-xiii the oesophagus is fairly broad, and though not segmentally constricted seems here to have a structure which represents the calcareous glands of other forms. In the ventral portion of the tube the lumen is narrow, and the walls consist of a scaffolding or framework of a spongy appearance, carrying very numerous and large blood vessels; dorsally the lumen is wide, though the epithelium is thrown into conspicuous folds. Had the animal been large enough for dissection, the condition would probably have been capable of description in the same way as for *Eutyphoeus bishambari* and *E. waltoni* (v. post).

Hearts are present in segments x, xi and xii; in front of this the commissural vessels are quite small.

The excretory system is meganephric; each nephridium has a large end-sac.

Testes and funnels are free, in segments x and xi. The vesiculae seminales are paired, small, and situated in xi and xii. The prostates are a single pair, of small size, extending over no more than a segment, and opening behind on segment xvii at the posterior border of the clitellum, close to seta *b* and on its outer side. The vasa deferentia of each side run backwards close together, and curve round the outer side of the prostatic duct, becoming first posterior and then internal to the latter; the two ducts of the same side unite in the substance of the body-wall, and finally, reaching the surface, open at the same level as the prostatic ducts, but on the inner side of seta *b*. Owing to the sections being in the frontal plane, the setae of segment xvii are cut transversely, and hence it is impossible to discover whether they are modified in any way; the mode of sectioning, however, has the advantage that it allows a very pretty demonstration of the exact relations of ducts and setae.

The ovaries and their funnels are in segment xiii. The spermathecae are in ix, the apertures being in $\frac{8}{9}$, in line with setae *a*; the ampulla is pearshaped; two short diverticula are given off from the duct. On one side the two diverticula arise separately from the duct, on the other by a common stalk.

Michaelsen (8) has recently subsumed under the one head of *M. phosphoreus* no fewer than six forms previously accounted distinct. The diagnoses of these six forms (*cf.* Michaelsen, 3) differed in such details as the relations of the male pores and spermathecal pores to the lines of the setae, the presence of one or of two diverticula of the spermathecae, and the degree of development of the gizzard. So far as these different diagnoses have any value, the present form seems to approach most closely to the description of *M. hempeli* F. Smith, and differs from that of *M. phosphoreus* in having two spermathecal diverticula instead of a single one.

Sub-fam. *MEGASCOLECINAE.*

Lampito mauritii, Kinb.

Lahore, New Shalimar; 30-x-1911; Ibrahim.
Kapurthala (Punjab); July 1913; Ibrahim.

The only feature worthy of note is the considerable break in the setal chain ventrally ($aa = 2\frac{1}{2}-3ab$); *ab* was as usual the widest setal interval, but no regular decrease in the intervals could be substantiated on travelling outwards towards the lateral margins.

This species was represented in a small collection which I sent from Lahore to Dr. Michaelsen in 1907 or 1908 (4, p. 179); but it must be very rare near Lahore, since the capture of a single specimen in 1911 constitutes the only occasion on which it has since been met with.

Lampito trilobata, sp. nov.

Baroda; 2-viii-1912; Bishambar Das.

Length 86 mm.; breadth maximum 4 mm. Colour light brown dorsally, with, behind the clitellum, a mid-dorsal purplish streak; pale laterally and ventrally. Ventral surface flattened. Segments 160; only segment xiii is triannular.

Prostomium prolobous, i.e. separated by a transverse groove from segment i; but there is also a pair of longitudinal grooves on the dorsal surface of the first segment, which, extending backwards for half the length of the segment, are not connected with each other behind.

The first dorsal pore is in $\frac{11}{12}$.

The clitellum extends from $\frac{1}{3}$xiv to xvii$=3\frac{2}{3}$. The separate segments can still be distinguished, and setae and dorsal pores are present.

The setae form a ring, which is almost closed dorsally ($zz=1\frac{1}{2}\,yz$ approximately), but the interval is irregular. Ventrally the interval is much larger,—$aa=2\frac{1}{2}$–$3ab$, or in front of the clitellum may be as much as $4ab$. Of the intersetal intervals ab is the largest; but there is no regular decrease on passing outwards. The largest setae in each ring are aa; the dorsal setae are often difficult to make out, partly because they are smaller, and partly because of the pigmentation. The following numbers were counted :—v/28, ix/40, xii/44, xix/34, and more posteriorly 32-34.

The male apertures (fig. 2) are on segment xviii, between the lines of setae b and c, with projecting penial setae. Each pore is situated within, and nearer the outer border of, a slightly raised flat glandular area, which takes up the whole of the length of the segment, and may both encroach on segment xix and cause a forward bending of furrow $\frac{17}{18}$. The inner border of each of these areas is semicircular, the outer is indented so as to form three lobes, giving a constant and characteristic appearance (fig. 2). The apertures themselves are nearly a fourth of the circumference apart.

The female pore is perhaps indicated by a minute depression in the mid-ventral line on the anterior part of segment xiv, just in front of the annulation which marks the anterior extent of the clitellum.

The spermathecal apertures are small, in furrows $\frac{6}{7}$, $\frac{7}{8}$, and $\frac{8}{9}$, in about the lateral line of the body. There are no other genital markings.

The first septum is $\frac{5}{6}$, which is not, or only slightly, thickened ; $\frac{6}{7}$, $\frac{7}{8}$ and $\frac{8}{9}$ are considerably, $\frac{9}{10}$, $\frac{10}{11}$ and $\frac{11}{12}$ greatly thickened ; after this the thickness rapidly diminishes, $\frac{12}{13}$ being moderately and $\frac{13}{14}$ slightly thickened.

The gizzard is in front of septum $\frac{5}{6}$; between the hinder end of the pharynx and septum $\frac{5}{6}$ the alimentary tube forms an ovoid dilatation, of which the posterior half or rather more has the thick muscular wall which constitutes it a gizzard, while the anterior portion is quite soft ; the gizzard therefore has the shape of a half ellipsoid, and may be compared to an egg-cup. The oesophagus is slightly dilated in each segment from vii to xii, but no calcareous glands are marked off from the tube, though the wall has a lamellated structure (in segment ix, where the tube was cut into). The intestine begins behind the prostates, in segment xx.

The last heart is in xiii.

From segment xxi onwards there are a meganephridium and a row of very small micronephridia on each side in each segment ; the arrangement is the same at the posterior end of the animal, where the meganephridium occupies a lateral position in the segment. In front of xxi only micronephridia are present ; while extremely dense on the body-wall in segments xv, xvi and xvii they are rare or absent on the body-wall elsewhere. They are however found in numbers on the septa; thus they occur plentifully on the posterior surface of the thickened septa from $\frac{9}{10}$ backwards, less abundantly in front of this; they occur as large rosette-like tufts on the anterior surface of septa $\frac{6}{7}$—$\frac{9}{10}$, one on each side, and as smaller tufts on $\frac{10}{11}$ and $\frac{11}{12}$ similarly. There is also a large tuft on each side of the pharynx.

Testes were not identified, but small iridescent funnels were present in segments x and xi. A pair of seminal vesicles are present in xii, attached to the posterior face of septum $\frac{11}{12}$; they are elongated so as to curve round the alimentary canal, and touch each other in the middle line dorsally; their surface is lobulated. There are no seminal vesicles in segment ix.

The prostates are of considerable size, in segment xviii, septum $\frac{17}{18}$ being rather bulged forwards and $\frac{18}{19}$ markedly bulged backwards; they are cut up on the surface into a number of lobules. The duct arises from the middle of the gland, is stout, white and shining, comparatively short and only slightly bent.

The ovarian funnels are small, in segment xiii.

The spermathecae (fig. 4) lie in segments vii, viii and ix. The ampulla is large, irregular in shape and may be bent on itself, its form varies so much that no two seem exactly to resemble each other. A duct can scarcely be described; it is simply the narrowing of the ampulla where it is attached to the body-wall; from this portion spring the two minute diverticula, one on each side of the base of the ampulla, elongated and very slightly club-shaped.

The genital setae (fig. 3) are 1·2 mm. in length and 36μ in maximum breadth; they are gently curved. The distal ·2 or ·3 mm. of their length is armed with a number of triangular teeth, of considerable size, pointing distalwards and set on the shaft at an acute angle; they extend further up the shaft on the side which forms the convexity of its curve than on the opposite one. The free end of the seta is broadened, and may be best described as resembling a horse-shoe with a thin lamella spanning the concavity (thus differing from the condition in *L. mauritii*).

The points which distinguish this species from *L. mauritii*,—the species to which apparently it comes nearest,—are the "web" connecting the limbs of the terminal horse-shoe of the penial setae, as just mentioned; the broad, flat, characteristically shaped papillae on segment xviii; the gizzard in segment v; and the presence of only one pair of seminal vesicles.

Pheretima posthuma (L. Vaill.).

Lyallpur (Punjab); Nov. 1911; Madan Mohan Lal.
Saharanpur (United Provinces); 21-viii-1912; Bishambar Das.
Hoshiarpur; July 1913; Ibrahim.
Mian Mir (near Lahore); 15-xii-1913; Baini Parshad.
Jullundur; Dec. 1913; Ibrahim.

Phagwara (Jullundur District) ; 2-i-1914 ; Ibrahim.

Ferozepore, river side ; 22-ii-1914 ; Baini Parshad.

Lahore ; very common.

This species is one of the commonest in Lahore, and being always procurable it is used as a type of the Oligochaeta in our Zoological classes.

Pheretima heterochaeta (Mchlsn.).

Mardan (Peshawar District, N.-W. Frontier Province) ; 25 and 26-xii-1913 ; Baini Parshad.

Lahore, quite common.

Peshawar (N.-W. Frontier Province) ; 29-xii-1913 ; Baini Parshad.

Pheretima hawayana (Rosa).

Lahore ; not uncommon.

I give below a few of the external characters of this species as it occurs at Lahore.

The setal ring is always broken dorsally, the interval *zz* being usually equal to 2*yz* or rather more. Ventrally also there is a break, which is rather less than the dorsal ; $aa = 1\frac{1}{2} - 2ab$,—rather less in front of the clitellum than behind. Setae are as a rule not visible on the clitellum except ventrally on segment xvi ; in one instance a few were seen ventrally in xiv also.

In two cases out of five it was noted that there was no marked difference in size between the setae of the anterior and subsequent parts of the body ; in one they were smaller behind the tenth segment ; in one the setae of segments v-vii, and in another of iv-viii were enlarged.

The clitellum may or may not include the whole of segment xvi ; in the latter case it is not fully three segments in extent.

The papillae in the neighbourhood of the male pores are variable ; but all specimens agree in the fact that none are situated external to the apertures. They are mostly arranged in two transverse lines, one near the anterior border of xviii, and another similarly placed in xix ; the line in segment xviii may be composed of as many as eight papillae, the one in xix contains fewer. Other papillae may occur on the posterior part of xviii, behind the level of the male apertures ; and less frequently on the anterior part of xvii.

Papillae also occur in the neighbourhood of the spermathecal apertures,—either situated behind the apertures, or in the mid-ventral line on segments vii and viii.

Length of specimens 100 mm., breadth 4 mm.

The specimens thus agree with the typical form of the species in having stouter setae in the anterior part of the body, and in having a broken setal ring. In the distribution of the genital papillae, and in the extent of the clitellum over three segments, or nearly so, they resemble the subspecies *barbadensis*. The above description may be compared with those of specimens from Yunnan (13) and Ceylon (14).

Sub-fam. *OCTOCHAETINAE.*

Octochaetus fermori, Mchlsn.

Saharanpur (United Provinces); 12-viii-1912; Bishambar Das. About a dozen mature specimens, all softened.

Length 50-65 mm.; breadth, maximum $2\frac{1}{3}$-3 mm.; colour light grey with an olive tinge, no difference between dorsal and ventral surfaces, clitellum yellower. Segments 133-139.

Prostomium epilobous $\frac{1}{2}$ or less. Segments vi-vii biannular, viii-xii triannular (or viii-ix quadriannular), post-clitellar segments triannular.

Dorsal pores are present, the first being in furrow $\frac{12}{13}$ just in front of the clitellum; or apparently in another specimen in furrow $\frac{17}{18}$, on the hindermost part of the clitellum.

Setae paired, but the lateral setae widely, i.e. *cd* is not much less than *bc*. In front of the clitellum $ab = \frac{1}{2}aa = \frac{2}{5}$-$\frac{1}{2}bc$; $cd = \frac{3}{4}bc$ or more; behind the clitellum $ab = \frac{2}{5}aa = \frac{1}{2}$-$\frac{4}{7}bc$; *cd* as before; $dd = \frac{3}{5}$ of the circumference.

Clitellum very distinctly marked off by deep constrictions, xiii-xvii or $\frac{1}{2}$xviii = 5 or $5\frac{1}{2}$; setae present, except the ventral pairs of xvii.

The actual male apertures and prostatic pores are too small to be seen. The seminal grooves have the outwardly curved shape shown in fig. 5; the prostatic pores of segment xix may possibly be in the centre of each of a pair of small rounded whitish areas there shown; if so, allowing for the inward trend of the lines of the setae at this place, they would be in, or a little internal to, the line of setae *b*. The clitellum may overhang more than is shown, concealing the anterior part of the seminal grooves, a large part of the ventral aspect of xviii and, laterally, a great part of xix also.

The female pores appear to be situated in a transverse groove in front of the setae of xiv, and to be represented by small dots close together near the middle line.

The spermathecal apertures are in slightly raised and glandular-looking areas mid-ventrally situated on the seta-bearing annuli of segments viii and ix: these cushion-like areas apparently represent the papillae described by Michaelsen, here fused in the mid-ventral line.

The first septum is $\frac{4}{5}$, which is thickened; after which there is an interval, the next being $\frac{8}{9}$, which is not much thickened; $\frac{9}{10}$, $\frac{10}{11}$ and $\frac{11}{12}$ are all thickened, the rest thin. The septa $\frac{8}{9}$-$\frac{11}{12}$ are all rather close together, $\frac{10}{11}$ and $\frac{11}{12}$ especially so,—indeed these are adherent, though they can be separated by needles.

The gizzard is relatively large, and is situated in the middle of the interval between septa and $\frac{8}{9}$. A single pair of calcareous glands occupy segments xv and xvi, but in two specimens dissected the arrangement was asymmetrical, as follows:—The greater part of the gland of the right side was contained in xv, a small part only being in xvi; while the reverse was the case on the left side. The glands are white in colour, antero-posteriorly compressed, attached round the side of the oesophagus, and meeting each other in the mid-dorsal line above the oesophagus; they are lobed, the lobes being arranged as a single row around the oesophagus; the lamellae in the interior have an antero-posterior direction. The intestine begins in xvii.

The last heart is in xiii.

The excretory system is micronephric, the nephridia being numerous and small; they are especially abundant on the inner surface of the body-wall in the clitellar segments, on the posterior part of the pharynx and on the first part of the oesophagus.

The male organs show the peculiarity described by Michaelsen. In segment x were found a pair of funnels, comparatively small, and not iridescent, but not testes; in segment xi testes were present, of moderate size, and also relatively large iridescent funnels; these organs in segment xi were enclosed with the testes in testicular sacs, in segment x they were free.

The seminal vesicles and prostates agree with Michaelsen's description.

A pair of ovaries, branched, with a number of finger-like processes, occur in segment xiii, with a pair of funnels. A second pair of ovaries occurs in segment xiv; they are of at least equal size with those in xiii, but are more compact, resembling a bunch of grapes; and (at least in one of the two specimens dissected) are more dorsally situated in the segment, being attached to the septum at its junction with the alimentary canal so that they lie dorso-laterally to the latter. In both specimens microscopic examination confirmed the ovarian nature of the structures. Funnels were absent in segment xiv.

The spermathecae are two pairs, remarkable for their small size; they are situated by the side of the ventral nerve cord. The ampulla is ovoid, and is continued by the duct, which is short and relatively broad. The diverticulum is small, half the length of the ampulla, and dilated at its end; it was overlooked at first, since it arises from the very base of the duct where it pierces the body-wall, and itself lies close on the body-wall.

The penial setae differ in some degree from the previous description of this species (Michaelsen, 4), and are therefore illustrated in fig 6. In length they are 550μ, in breadth 15μ; the shaft is almost straight, except for a simple curve at the distal and a slight bending at the proximal end. The tip is simple, tapering, and pointed. A few teeth lie flat against the shaft in the region of the distal curvature.

There can hardly be any doubt as to the specific identification of these specimens. I have, however, given a pretty full description, because, as Michaelsen says, the species is an interesting one, and because points of difference, in detail at least, are numerous. The presence of two pairs of ovaries is a curious anomaly.

Octochaetus dasi, sp. nov.

Baroda; 2-viii-1912; Bishambar Das. Two mature and one immature specimen.

Length 80 mm.; breadth 4 mm.; colour pale grey throughout, except clitellum which has an orange tinge. Segments 192.

Prostomium small, with a pointed posterior tongue which extends backwards mid-dorsally through half the length of segment i. Segments v–vi biannulate, vii–x triannulate.

First dorsal pore at anterior border of clitellum, in furrow $\frac{12}{13}$.

Setae all on the ventral surface, paired; behind the clitellum $aa = 2\frac{1}{2}ab = bc = 1\frac{1}{2}cd$; $dd = \frac{2}{3}$ circumference. The setae *aa* approach closer together near the clitellum, both in front of it and behind. In the anteclitellar region there is no great difference in the ratios; *aa* and *bc* are relatively a little smaller.

Clitellum xiii–xvii ventrally, xiii–$\frac{1}{2}$xviii dorsally (5 or $5\frac{1}{2}$); according to internal dissection it includes the whole of xviii (perhaps due to non-correspondence of septa with furrows). The clitellum is very distinctly marked off, the body being constricted at its anterior and posterior limits as if by a tightly drawn thread. The body-wall in this region is very thick and friable. Setae and dorsal pores may or may not be visible on the clitellum (visible in one specimen, not in the other).

The genital area is characterized by a midventral, rather small, puckered depression, which takes up the length of xviii and just extends on to the adjacent parts of xvii and xix (fig. 7). Segment xviii, as will be evident, is short. The actual apertures are not certainly discoverable; there seems to be a pair of (prostatic) pores at the antero-lateral 'angles' (if such can be described) of the depressed area; it is possible that the male pores are at the lateral border of the area, in line with the setae of xviii, and the posterior prostatic pores at the postero-lateral 'angles' of the area, but this is really no better than a surmise.

The female pores are apparently situated in a transverse groove on the anterior part of segment xiv, which extends from just external to the line of setae *a* to a corresponding point on the other side.

Spermathecal apertures are not visible; from the internal dissection they must be situated very near the middle line in furrows $\frac{7}{8}$ and $\frac{8}{9}$.

The first septum, which is moderately thick, is $\frac{5}{6}$. This is followed by a long interval, after which come $\frac{8}{9}$–$\frac{12}{13}$, all moderately stout. The rest are thin. Septa $\frac{8}{9}$–$\frac{11}{12}$ are all close together, especially $\frac{10}{11}$ and $\frac{11}{12}$ which are separable with some difficulty.

A considerable length of the oesophagus is in front of the first septum, being bent under the pharynx. The gizzard is short, being compressed antero-posteriorly, and so resembling a stout ring; it is obliquely placed, slanting forwards and upwards, i.e. its upper border is anterior to its lower. The gizzard is situated in the middle of the space between septa $\frac{5}{6}$ and $\frac{8}{9}$; in front of it is a length of oesophagus, behind it a somewhat swollen portion of the tube, from which it is separated by a constriction. Behind septum $\frac{8}{9}$ the canal is narrow as far as xviii, where it becomes the intestine. A very prominent double typhlosole begins in xx.

In segments xv–xvi are a pair of large white lobed calcareous glands, one on each side of the oesophagus. The lamellae in their interior ran transversely in one case, longitudinally in another.

The last heart is in segment xiii. The missing septa between $\frac{5}{6}$ and $\frac{8}{9}$ are indicated by the presence of transverse commissures; so that the numbering of the segments is possible even in the absence of the dissepiments. One pair of commissures (those of segment vi) is situated just behind $\frac{5}{6}$; and there are two pairs close together behind the gizzard and in front of septum $\frac{8}{9}$ (those of vii and viii).

The excretory system is micronephridial throughout the body. The nephridia are extremely numerous and close-set in the clitellar region. There are no tufts at the side of the pharynx; but a considerable number occurs dorsally on the pharynx under cover of the first septum.

Funnels of comparatively small size, but no testes, were found in segment x in each of two specimens dissected. Both funnels and testes are present in xi, the funnels being considerably larger than those in x, and the testes also being comparatively large. Testes and funnels are not enclosed; the testes were, however, united with the mouths of the funnels, from which they can be torn apart.

The seminal vesicles are one pair, in segment xii, attached to the posterior face of septum $\frac{11}{12}$; they are small in size and compact in form.

The prostates varied in the two specimens dissected. In the first they were one pair only, each a small glandular tube in segment xvii transversely placed in the segment; in the second they were two pairs, both very small, elongated in shape, in segments xvii and xix.

Ovary and funnel were identified in segment xiii, the former consisting of a number of moniliform processes.

The spermathecae are minute, egg-shaped, lying by the side of the ventral nerve cord. The duct is short, and there is no diverticulum.

No penial setae were discovered.

Octochaetus bishambari, sp. nov.

Saharanpur (United Provinces); 21-viii-1912; Bishambar Das. Two specimens.

Length 35 mm., breadth 1 mm.; thin, small elongated worms, of an indefinite grey colour. Segments 85.

Prostomium epilobous $\frac{1}{3}$–$\frac{1}{2}$.

Setal ratios estimated as (post-clitellar) $ab = \frac{2}{7}aa = \frac{2}{5}bc = \frac{2}{3}cd$.

Clitellum extends over xiv–xvi = 3. The body is narrower in the segments embraced by the clitellum.

All that could be made out in the genital area was that the setae *a* of segments xvii and xix were enlarged, and running straight between them, longitudinally on each side (i.e. from seta *a* of xvii to seta *a* of xix), was a narrow groove. Setae *b* seem to be absent on xvii and xix, and both *a* and *b* on xviii.

A specimen was sectioned longitudinally in order to study the internal anatomy.

The first septum is $\frac{4}{5}$, which is thin; $\frac{5}{6}$ is slightly thickened, ^{6} moderately, $\frac{7}{8}$, $\frac{8}{9}$ and $\frac{9}{10}$ considerably, and $\frac{10}{11}$ perhaps slightly. The rest are thin. Septa $\frac{6}{7}$ and $\frac{7}{8}$ are much bulged backwards.

Dorsal to the alimentary canal in segments iv and v, stretching back from the roof of the pharynx over the dorsal surface of the oesophagus is a gland which at its hinder end almost reaches the anterior end of the gizzard; laterally also it extends well round the sides of the alimentary tube. The gizzard is in segment vi; it is small, elongated, with not very thick walls. The oesophagus is narrow in vii, and thenceforward dilated in each segment and constricted at the septa; the epithelium is folded in all the oesophageal segments viii–xiii, but there are no calcareous glands. The intestine begins in xiv.

The excretory system is meganephric.

Testes and funnels are both found in segments x and xi. Seminal vesicles are present as three pairs, in x, xi and xii; they are dorsally situated, above the oesophagus; those in x and xi meet their fellows above the tube, those in xii do not quite meet.

The prostates are two pairs; one pair occupying xvii and xviii, the duct ending in xvii, the other occupying xix and xx, the duct ending in xix. The ducts are bent into a gentle **S**-shaped curve.

Ovaries and ovarian funnels, the latter small, are situated in xiii. The oviducts are narrow, and end on the anterior part of the ventral surface of segment xiv, each in front of one of the ventral setae, probably *b*.

The spermathecae are situated in segments viii and ix. The ampulla of each is apparently ovoid, and there is a well-marked stoutish duct, longer than the ampulla and bent in its course; the ducts open in intersegmental furrows $\frac{7}{8}$ and $\frac{8}{9}$. There is a considerable diverticulum, approximately spherical in shape, from the base of the ampulla.

Genital setae are present in segments xvii and xix, at the apertures of the prostatic ducts, in bundles of two or more. Each is curved to nearly a quarter of a circle; in length they are approximately 400 μ, in breadth 9–10 μ. The extremity is simple, and bluntly pointed.

The above description is not as full as could be desired, on account of the small size of the animal and the impossibility of examining it by dissection. A number of sections were also damaged through the presence of matter in the alimentary canal which interfered with the cutting. The description will, however, enable the form to be recognized when it is again met with. Its small size, the presence of the large glandular structure in connection with the pharynx, the complete series of septa from $\frac{4}{5}$ onwards, and the characters of the genital setae will serve to distinguish it.

The species is especially peculiar in being meganephric. As to there being one large (relative to the size of the animal) nephridium on each side in each segment there can be no doubt; in my original notes I find a statement to that effect in the middle of the description of the external characters; which indicates, I think, that the nephridia must have been visible through the thin and probably semitransparent body-wall. The statement is borne out by the sections, which I have again carefully examined for this purpose. That the nephridia are comparable to the meganephridia occurring, for example, in the Lumbricidae, is, however, not certain. I have failed to find, in the sections, any evidence of their attachment to the septa, and especially of their piercing the septa in the typical manner, with the funnel on one side and the bulk of the organ on the other. On the contrary, the trend of the tube, where it can be most distinctly made out, is backwards from the external aperture rather than forwards towards the anterior septum. Owing to a lamentable accident, whereby a number of my most carefully preserved specimens were thrown away by an ignorant laboratory boy, any further examination of the original specimens is impossible, and I am left only with a series of longitudinal sections of the anterior portion of one of my examples.

Eutyphoeus incommodus (Bedd.).

Pusa (Bengal); 10-ix-1912; Bishambar Das. Two specimens.

Basi Muda (Hoshiarpur District, Punjab); Aug. 1913; Md. Ibrahim. Numerous specimens.

Ambala (Umballa); Aug. 1913; Ibrahim. Numerous specimens.

Length 90–112 mm.; breadth 4 mm.; colour brownish olive. Segments 141–162.

The prostomium shows a combination of the pro- and tanylobous characters; there are present both the transverse groove which in prolobous species marks off the prostomium from the first segment, and also the two longitudinal grooves between which, in tanylobous species, the prostomium is continued backwards to furrow $\frac{1}{2}$ (compare Beddard's description of *E. nicholsoni*, 1, p. 197, with which he states *E. incommodus* agrees).

First dorsal pore $\frac{11}{12}$ or $\frac{12}{13}$.

Septum $\frac{4}{5}$ is slightly thickened, $\frac{5}{6}$ moderately; $\frac{8}{9}$, $\frac{9}{10}$, $\frac{10}{11}$ are all slightly, or in the case of the last two it may be moderately, thickened. In most species of *Eutyphoeus* septum $\frac{11}{12}$ seems to be absent as such, and to be represented by a rather dense mass of connective tissue around the oesophagus, which binds down the corresponding lateral vascular commissures; in the specimen from Basi Muda which I dissected, however, septum $\frac{11}{12}$ was present, though thin.

The calciferous glands may certainly, as mentioned by Michaelsen (4), take up two segments (xi and xii). The intestinal glands or diverticula, about the middle of the animal's length, are five pairs; they are all bilobed, the smallest being anterior; they increase in size from before backwards.

The dorsal vessel is continued forwards on to the pharynx. At the posterior border of the pharynx there is a considerable lateral branch on each side; lateral commissures are present in segment v also. The next commissures pass transversely round the side of the gizzard at about the middle of its length; the next are situated at the posterior end of the gizzard, and are closely followed by another pair immediately in front of septum $\frac{8}{9}$. The hearts of segment xi were not, in the example from Basi Muda which I dissected, bound down to the oesophagus as in other species; though in a specimen from Pusa they were noted as being embedded in connective tissue.

Testes and funnels were present in both x and xi, those in x being rather smaller than those in xi (Basi Muda). The example from Pusa which I dissected had large and iridescent funnels in both segments; testes were doubtful, but were perhaps represented by a few thin finger-like processes deep in each of the segments. The sperm-sacs, in ix and xii, correspond to previous descriptions.

The penial setae (fig. 8) are about 1 mm. in length, bluntly pointed, with a very slight bulb-like swelling at the end. The sculpturing consists of short transversely placed rows of very fine points, probably minute prominences, found only near the distal end.

This species was first described by Beddard (1) from specimens from Calcutta. It has since been examined by Michaelsen (4, 6), who has received specimens from Calcutta and Rajmahal. The above short notes will serve to confirm the peculiarities noted by earlier observers, and to add a few details to our knowledge. It is interesting to observe that the species has such a wide distribution.

Eutyphoeus mohammedi, sp. nov.

Allahabad; Dec. 1911; Md. Ibrahim. Seven specimens.

Length 75 mm.; breadth $4\frac{1}{2}$ mm.; colour an equable light grey, with a mid-dorsal purple streak over part of the body anteriorly. Segments 149.

Prostomium combined pro- and tanylobous (*cf. E. incommodus*). Segments iv and v biannulate, the succeeding preclitellar segments triannulate.

First dorsal pore in furrow $\frac{11}{12}$.

The setae are paired; in front of the clitellum $ab = \frac{2}{5}$–$\frac{1}{2}aa = \frac{1}{2}bc = \frac{3}{4}cd$, while behind the clitellum $ab = \frac{1}{4}aa = \frac{1}{3}$–$\frac{2}{5}bc = \frac{3}{4}cd$; dd is rather less than $\frac{2}{3}$ circumference.

The clitellum was invisible in most specimens, though the male pores and spermathecal apertures were present. Where present it is indicated only by a slightly darker colour and by the absence of secondary annulation on the affected segments; its extent is $\frac{1}{2}$xiii–xvii $= 4\frac{1}{2}$ or thereabouts.

The male apertures are in segment xvii, in the line of setae *b*; they are small, with whitish lips, and surrounded outside the lips by a rather darker area.

The female apertures were not seen.

The spermathecal apertures are small, in furrow $\frac{7}{8}$, external to the line *b*.

There are no other genital markings.

The first septum is $\frac{4}{5}$, which is very slightly thickened, and is connected with the posterior surface of the pharynx by many strands and adhesions. Septum $\frac{5}{6}$ is moderately thickened; in the specimen dissected it was not markedly convex backwards, but was folded on itself, and its attachment to the alimentary canal was almost on a level with its attachment to the parietes. Septa $\frac{6}{7}$ and $\frac{7}{8}$ are absent; $\frac{8}{9}$, $\frac{9}{10}$ and $\frac{10}{11}$ are moderately thickened and close together; $\frac{11}{12}$ is present and slightly thickened, and the rest are thin.

The gizzard is of moderate size, marked off from the succeeding part of the alimentary canal by a distinct constriction; the portion of the tube between this constriction and the following septum ($\frac{8}{9}$) is dilated, and has soft walls of a yellow colour.

The oesophagus is swollen in segments xi, xii and anterior part of xiii, forming a pair of calcareous glands. The intestine begins in xv.

The dorsal vessel is continued forwards as far as the pharynx; a transverse vessel is seen in front of septum $\frac{4}{5}$, another in front of $\frac{5}{6}$. There are three lateral commissures between $\frac{5}{6}$ and $\frac{8}{9}$, one crossing the anterior part of the gizzard and two behind it. The heart of segment xi has the usual relations to a normally developed septum $\frac{11}{12}$. The last heart is in xiii.

The micronephridia are few and of moderate size in each of the post-genital segments; they are arranged in a transverse row in each segment. They are numerous round the base of each spermatheca, and there is a tuft on each side anteriorly, by the side of the pharynx.

There are two pairs of testes, in segments x and xi, of equal size. Funnels are present in the same segments; they are free, and folded but not iridescent. The vasa deferentia of the two funnels of the same side are separate as far as the level of the prostatic duct; they unite as they pass underneath the transversely placed prostatic duct, and form a tube about as thick as this latter; this single tube then turns inwards and ends just posterior to the ending of the prostatic duct.

The vesiculae seminales are two pairs, small, in segments ix and xii.

The prostates are in segment xviii. Each is a narrow coiled tube, of greyish colour (not opaque white), the whole gland being of comparatively small size. The windings of the glandular tube are simple; on the left side in the specimen dissected they consisted merely of seven simple loops laid closely side by side. The gland is continued at its anterior end into the duct, which lies in xvii, is of about the same diameter as the gland, and is looped once, the convexity of the loop being directed outwards.

The female organs have the usual situation.

The spermathecae are very small. The ampulla is approximately hemispherical in shape, and might be said to be sessile by its base on the body-wall. At any rate there is only a slight constriction there, so that if a duct is described it must be said to be broad and extremely short. There is a complete ring of seven diverticula round the base of the ampulla.

The penial setae (fig. 9) are small, in length up to ·5 mm., in breadth 18μ (maximum). The shaft is very gently curved, the curvature increasing just at the tip, which is bluntly pointed. Sculpturings are to be seen near the free end as a few fine dots here and there,—so fine that they are hardly visible with the ordinary high power; under the oil immersion they are revealed as minute triangular teeth, either singly placed or in very short rows.

The two pairs of testes and funnels, and two pairs of seminal vesicles, mark this as one of the more primitive species of the genus, along with *E. incommodus*. The continuation of the dorsal vessel forwards to the pharynx, and the correlated extension of the series of lateral loops, are also primitive features which occur in both forms. Septum $\frac{11}{12}$, too, is here well-developed, and the heart of segment xi has its normal relations (again compare *E. incommodus*). The great distinction from this latter is the entire absence of genital markings.

Eutyphoeus waltoni, Mchlsn.

Pusa (Bengal); Aug. 1911; Bishambar Das. Several specimens.

Same place; 10-ix-1912; Bishambar Das. Eight specimens.

Baroda; 2-viii-1912; Bishambar Das. Numerous specimens.

Basi Muda (Hoshiarpur District, Punjab); Aug. 1913; Ibrahim. Three specimens.

Lucknow; Aug. 1913; Ibrahim. Two specimens.

Length 160 mm.; breadth 4–5 mm.; colour buff to light brown. Segments 156–195. Prostomium as in *E. incommodus* (v. ant.).

First dorsal pore $\frac{11}{12}$ (only once $\frac{12}{13}$).

Curiously, the clitellum began with segment xii in one of the Baroda specimens.

Copulatory areas vary considerably; those in $\frac{18}{19}$ are the only quite constant ones, though the pair in $\frac{15}{16}$ are almost so. The marks in $\frac{9}{10}$ (or rather on the posterior border of segment ix, abutting on furrow $\frac{9}{10}$) were constant in the second batch of Pusa specimens, but only occasional otherwise. The areas in $\frac{14}{15}$ are found occasionally, in $\frac{19}{20}$ were seen altogether three times only; once there was a similar pair in $\frac{20}{21}$.

I differ a little from Michaelsen (4) in the estimation of the septa in the anterior part of the body. This author mentions septum $\frac{6}{7}$ as being thickened, and since he does not refer to any septum in front of this, it is to be inferred that this is the first. I find two septa, both thick and muscular, in this region (i.e. in front of the space in which the gizzard is lodged); and these are apparently $\frac{4}{5}$ and $\frac{5}{6}$; so that $\frac{6}{7}$ and $\frac{7}{8}$ are both absent, not $\frac{7}{8}$ only. Septum $\frac{5}{6}$, as I have called it, is attached distinctly in front of the intersegmental furrow $\frac{6}{7}$, though it does not correspond to furrow $\frac{5}{6}$. From the eighth to the twelfth segment also the internal and external segmentation do not correspond; septum $\frac{8}{9}$ is actually situated in segment x as delimited externally by the furrows, if not on a level with groove $\frac{10}{11}$; septum $\frac{9}{10}$ is in the anterior part of xi; and $\frac{10}{11}$ is further back in xi or at furrow $\frac{11}{12}$; septum $\frac{11}{12}$, in this as in most species of the genus is not well marked; correspondence between internal and external segmentation is however re-established with the thirteenth segment. The above refers especially to the insertion of the septa into the dorsal body-wall; ventrally, septa $\frac{8}{9}$ and $\frac{9}{10}$ are a little further forward.

There is thus a wide interval between septa $\frac{5}{6}$ and $\frac{8}{9}$, equal to four external segments or more, but the internal segments ix, x, xi and xii (i.e. as delimited by the septa) on the contrary are narrow from front to back. Septa $\frac{8}{9}$, $\frac{9}{10}$, $\frac{10}{11}$ are all thick A pair of very definite longitudinal muscular bands, one on each side of the alimentary canal, and nearer the ventral than the dorsal surface, stretch from septum $\frac{5}{6}$ near its insertion into the oesophagus backwards to septum $\frac{8}{9}$.

It has been mentioned that septum $\frac{11}{12}$ is not well marked. It might indeed, as in a number of other species of the genus, be called absent; it is however represented by a mass of connective tissue, which binds down the heart or lateral commissural vessel of segment xi to the oesophagus; this member of the series of commissural vessels is in a number of species less obvious on dissection than the others, since it both lies at a deeper level and is covered over by the thick investment mentioned above.

The numbering of the segments during the dissection of most of the species of *Eutyphoeus* is, as will be seen, not without some difficulty, at least until some familiarity with the genus has been obtained; for in spite of external dissimilarities the main points of the internal anatomy are very uniform. The confusion arising from the absence of some septa and approximation of others can, however, be avoided by observing the lateral vascular commissures. Starting behind in the ovarian segment, xiii, they form a regular series as far forwards at least as the gizzard. Here, however, in many species they stop, as indeed does the dorsal vessel itself; in the present species, for example, the lateral commissures of viii are situated in front of $\frac{8}{9}$, in the normal manner; and just in front of this the dorsal vessel itself comes to an end by dividing into two branches, one to each side, the equivalents of the lateral commissures of vii, which pass laterally round the alimentary canal. In *E. incommodus* and *E. mohammedi*, more primitive in this respect, the dorsal vessel is continued on to the pharynx, giving off a complete series of commissures; three pairs of which, situated in the long free space which contains the gizzard, indicate the three segments (vi, vii, viii) of which this is composed.

Few other points require remark. About the middle of the length of the body, situated dorsally on the intestine and on each side of the longitudinal vessel, is a series of five pairs of alimentary glands or diverticula, white in colour, each bilobed, and increasing in size from before backwards. Such diverticula are known in certain other species, and might not improbably be found in all, if looked for.

In one specimen the penial setae reached the great length of 4·7 mm. I could not identify the fine sculpturings near the free end as distinct spines, even with the oil-immersion lens.

The calcareous glands are of the nature of those described for *E. bishambari* (v. post.)—lateral projections into the oesophagus, which leave a T-shaped lumen in a transverse section of the tube.

Eutyphoeus nicholsoni (Bedd.).

Saharanpur (United Provinces); 21-viii-1912; Bishambar Das. Numerous specimens.

Lucknow; Aug., 1913; Ibrahim. Four specimens.

This species varies within rather wide limits; the chief character which distinguishes it externally is the presence of the large raised circular or oval papillae in $\frac{15}{16}$. If oval, the long diameter may be transverse or longitudinal; each papilla may or may not be surrounded by a "wall."

The male apertures and field show very considerable variations. The pores may appear as two slits; or the two may be fused into a single slit, transverse or slightly convex backwards or forwards, with slightly puckered margins, extending from between the lines of setae *a* and *b* on one side to a corresponding point on the other; or the separate apertures may be visible near the ends of a common groove,—may indeed be indicated by papillae sunk below the surface in the groove. The Lucknow specimens were different; here the apertures were present as large and conspicuous pits, extending somewhat beyond the lines *a* and *b*, i.e. somewhat internal to *a* and external to *b*; a papilla, bearing the penial setae, was seen projecting upwards from the depth of each pit; each pit had puckered margins, and the pair were situated in a whitish circular area, with slightly raised margin, which extended from the setal zone of xvi to that of xviii.

Twelve of the Saharanpur specimens, examined for the female apertures, gave the following result: the aperture of the left side was present alone in 9, there was a large left aperture and a very small right aperture in 2, and no female pore could be distinguished in one (cf. Beddard, 1).

The penial setae vary from 2 to 3 mm. in length. The distal portion may be bent on itself to form a loop. I saw no ornamentation on the setae of the Saharanpur specimens; those of the Lucknow specimens seemed all to be corroded.

The septa agree exactly with what has been said concerning *E. waltoni*. The dorsal vessel stops behind the gizzard, there dividing to form the first pair of commissural vessels (those of segment vii).

Eutyphoeus bishambari, sp. nov.

Pusa (Bengal); 10-ix-1912; Bishambar Das. A single specimen.

Length 180 mm.; breadth maximum $5\frac{1}{2}$ mm.; colour dark brown dorsally, with a purplish strip in the middle line except at anterior and posterior ends, pale grey ventrally. Segments 164.

Prostomium a minute projection, within the mouth aperture; a pair of longitudinal grooves dorsally on the first segment, slightly diverging as they approach furrow $\frac{1}{2}$.

Secondary annulation in front of clitellum; segment iii is biannulate, but dorsally only; segment iv biannulate all round, v–vi triannulate, vii indistinctly 5-annulate, viii–ix have six annuli or even more; xii and xiii are smooth, and behind the clitellum also the segments are not divided.

The first dorsal pore is in furrow $\frac{11}{12}$; none are visible on the clitellum.

Setae are present on the clitellum; behind the clitellum their position may be expressed as $ab = \frac{2}{5}aa = \frac{4}{7}bc$, while $bc = cd$ and $dd = \frac{2}{3}$ circumference; in front of the clitellum $ab = \frac{5}{8}aa$, and is somewhat less than cd.

The clitellum extends from $\frac{2}{3}$xiii to $\frac{2}{3}$xvii = 4 dorsally; ventrally the anterior border is at the level of the setae of xiii ($\frac{1}{2}$xiii).

The male apertures (fig. 10) are conspicuous, somewhat triangular in shape, with base anterior and narrowest angle internal; their margins are puckered. Each extends between and rather beyond the lines of setae a and b, and the centre of the pore is thus between the two lines. The penial setae project close to the outer margin of the aperture.

The female apertures were not recognized.

The spermathecal apertures are slit-like, in furrow $\frac{7}{8}$; the whole slit takes up the space between the lines of setae b and c

and extends inwards a little beyond *b* (internal to *b*); the centre of the slit is thus between *b* and *c*, slightly nearer to *b*.

The genital markings are characteristic (fig. 12). On the ventral surface of segment xvi behind the setae, is an unpaired shallow V shaped depression, the legs of the V being wide apart, and rather broadened at their anterior, separated, ends. In these swollen ends small rounded papillae are present, projecting sufficiently to reach the level of the general surface: these anterior broadened ends of the V are situated just behind the setae *ab* on each side.

There are also three pairs of rather indistinct eyelike markings in furrows $\frac{18}{19}$, $\frac{19}{20}$ and $\frac{20}{21}$, transversely oval, with their centres in or just internal to *b*, extending inwards to *a* and outwards to a corresponding distance on the other side of *b*.

Septa $\frac{4}{5}$ and $\frac{5}{6}$ are stout and muscular; $\frac{6}{7}$ and $\frac{7}{8}$ are absent; $\frac{8}{9}$, $\frac{9}{10}$ and $\frac{10}{11}$ are all thick and placed close together; $\frac{11}{12}$ is absent as a septum, being represented by a mass of connective tissue between the seminal vesicle and intestine, which binds down the heart of segment xi; the rest of the septa are thin.

The oesophagus is moderately broad behind the pharynx and in front of septum $\frac{4}{5}$, narrow between $\frac{4}{5}$ and $\frac{5}{6}$; it is again wider in the anterior part of the space between $\frac{5}{6}$ and $\frac{8}{9}$, where it is situated between the spermathecae; this portion is followed by a comparatively small subglobular gizzard. The rest of the oesophagus is narrow, except in segment xii where it is slightly dilated. This dilatation corresponds to the calciferous glands of some of the other species of the genus; on opening the tube an elongated mass is seen to project on each side into the lumen of the oesophagus from its lateral and ventral wall; a narrow vertical cleft is left between them in the middle line, and a continuous passage above them, between the projecting masses and the dorsal oesophageal wall, so that in transverse section the lumen of the tube here appears T-shaped; calcareous particles occur in the oesophagus in this region, dorsal to the projecting masses, i.e. in the cross limbs of the T.

The intestine begins in segment xv.

The circulatory system resembles that of *E. waltoni.* The dorsal vessel ends anteriorly by dividing to form the lateral commissures of segment vii; the last heart is in segment xiii.

The excretory system is micronephric; tufts of micronephridia are present one on each side anteriorly by the sides of the pharynx; behind this they are irregularly scattered as far as segment xii, but beyond this point they are arranged in transverse lines in each segment.

The testes were not identified. There is a single pair of large, folded, iridescent funnels in segment xi, touching each other in the middle line, and contained in a common sac continous from side to side beneath the alimentary canal. The vesiculae seminales, a single pair, are flattened against the sides of the alimentary canal, and are deeply lobed; they are doubtless to be considered as arising from septum $\frac{11}{12}$, and as contained in segment xii; septum $\frac{11}{12}$ however does not exist as a definite septum (*v. ant.*), and actually the seminal vesicles extend forwards as far as $\frac{10}{11}$; backwards they reach $\frac{13}{14}$, which is bulged posteriorly by the vesicles so as to reach the level of $\frac{14}{15}$.

The vas deferens is conspicuous, on the body wall. The prostates are large, tubular, and occupy xvii–xx. The duct is narrow at first, but soon becomes stouter, more shining and more muscular; it is much coiled and of considerable length; its middle part is the widest.

Ovaries and funnels have the usual position.

Each spermatheca has an elongated egg-shaped ampulla, the end opposite the duct being the narrower. The duct is broad and very short, so that the ampulla is almost sessile on the body-wall by an attachment at the middle of its under surface. There are two diverticula; one, the smaller, on the posterior and inner side of the duct, with about six chambers; the other on the outer side, larger, with more numerous chambers. The chambers are only slightly separated from each other externally, though they can be distinguished by means of their contents.

The penial setae (fig. 11) are 4 mm. in length, and 36μ in breadth about the middle of the shaft. For the greater part of their length they are almost straight; the terminal quarter of a millimetre is bent at an angle of 120°; and at the distance of only ·1 mm. from the pointed tip there is a second, much sharper kink, in such a way that this terminal portion is not in the same plane as the rest of the seta. There are short transverse rows of very fine sculpturings near the free end.

Eutyphoeus ibrahimi, sp. nov.

Kapurthala (Punjab); July 1913; Ibrahim. A single specimen, in bad condition.

Length 70 mm.; breadth, maximum 3 mm.; colour light olive green with a browner tinge anteriorly. Segments 185.

Prostomium tanylobous, the longitudinal grooves traversing the first segment dorsally being parallel to each other.

The first dorsal pore is in furrow $\frac{12}{13}$.

The intersetal distances may be expressed as follows:—behind the clitellum $ab = \frac{1}{3}$-$\frac{2}{5}aa = \frac{4}{7}bc$ and approximately $= cd$; in front of the clitellum $ab = \frac{1}{2}aa = \frac{2}{3}bc$ and is slightly less than cd,—i.e. the setae of the respective pairs are rather closer together, rather more definitely paired, behind than in front of the clitellum; $dd = \frac{3}{5}$ circumference.

The clitellum was indefinite.

The male apertures, on segment xvii, are just external to the line of setae b; they are represented by small papillae, on the outer side of each of which is a slightly raised whitish horseshoe-shaped ridge, partially surrounding the papilla, with the concavity of the horseshoe directed internally.

A female pore appeared to be present on the left side, in front of seta *a* of segment xiv.

The spermathecal apertures are small, with tumid lips, in furrow $\frac{7}{8}$ in the lines of setae *c*.

There were no other genital markings.

The first septum is $\frac{5}{6}$, and the next $\frac{6}{7}$, both being strong; $\frac{7}{8}$ is absent, and $\frac{8}{9}$, $\frac{9}{10}$ and $\frac{10}{11}$ are thick and close together.

The gizzard is of moderate size, cylindrical in shape, and situated in the interval between septa $\frac{6}{7}$ and $\frac{8}{9}$. Calciferous glands are represented by a pair of ovoid swellings, not sharply set off from the oesophageal wall, in segment xii; on being cut into these show a structure of transverse lamellae. The intestine begins in xv.

The last heart is in xiii; the series is continued forwards to segment vii.

Testes were not identified. Funnels are present in xi, each enclosed, to the best of my observation, in a separate sac. The vesiculae seminales are a single pair, in the usual situation, flattened against the alimentary canal on each side. The prostates are tubular, of moderate size, but so softened and transparent in this specimen that they were actually in some little danger of being overlooked.

The spermathecae are small; the ampulla small and ovoid in shape, the duct short, broad, about as long and nearly as broad as the ampulla. The diverticula were, in the organ of one side, two rounded knobs at the upper part of the duct rather towards its posterior side; on the other side there were four, surrounding the duct except on its anterior aspect.

The penial setae (fig. 12) are approximately 2 mm. in length, measured across the curve,—the whole seta being curved through about a quarter of a circle. The breadth is rather variable, maximum 20μ. The end is spoon-shaped, with a curved tip; there is a slight constriction some little distance proximal to the spoon. The ornamentation consists of very fine hairs, which occur both distal and proximal to the slight constriction just mentioned, though mainly on the proximal side. There is also apparently a faint longitudinal grooving immediately distal to the constriction.

I am not thoroughly satisfied of the value of the above description, seeing that the specimen was in a bad condition of preservation, and may (on account of the absence of genital markings and of a distinct clitellum) be thought to be immature. Still well developed male organs were present, and penial setae also; and since these latter are of principal importance in the discrimination of species in this genus I have decided to include the present account.

Subfam. *TRIGASTRINAE.*

Eudichogaster barodensis, sp. nov.

Baroda; 2-viii-1912; Bishambar Das. A number of specimens.

Length 74–100 mm.; breadth $3\frac{1}{4}$–4 mm.; colour pale yellowish brown, uniform all over, except clitellum which is darker in colour. Segments 163–167.

Prostomium small, under cover of and marked off by a groove from the first segment. There is a slight cleft running backwards from this groove for a short distance on the dorsal surface, not long enough however to divide the first segment completely. The fourth segment is biannulate, segment v triannulate, vi–xi have four annuli, xii has three principal annuli but six in all; behind the clitellum the segments are triannulate.

Dorsal pores begin immediately in front of the clitellum, in furrow $\frac{12}{13}$; they are quite conspicuous on the clitellum in some specimens, but not to be seen in others.

The setae are closely paired. In general $ab = \frac{1}{3}$–$\frac{1}{4}aa = \frac{2}{5}bc = cd$; and dd = about $\frac{4}{7}$ of the circumference.

The clitellum extends over xiii–$\frac{1}{3}$xviii = $5\frac{1}{3}$ (xiii–xvii = 5, or $\frac{1}{2}$xiii–xvii = $4\frac{1}{2}$). The region is uniformly arched and smooth laterally and dorsally (unless a few sharp-cut oblique cracks have appeared), flat ventrally and wrinkled in its posterior half.

The male genital field (fig. 13) is constituted by four flat cushions or pads; one of these, transversely elongated, occupies $\frac{17}{18}$, from a point between lines *a* and *b* on one side to a corresponding point on the other; another of the cushions has a similar position in $\frac{18}{19}$; the two remaining cushions form a pair, on xviii, between the ends of those first mentioned, much smaller than these latter, and embracing each the situation of the ventral setal couple of its side. There is thus left a rectangular space in the middle of these four cushions, which represents the ventral portion of segment xviii; in one specimen this rectangular space was reduced to a mere transverse fissure by the encroachment of the pads in front and behind.

The only apertures that can be made out in this region are a pair on segment xviii, just in front of the site of setae *a*, which are absent The setae of xvii and xix are all present; no prostatic pores separate from those just described are even indicated; and indeed these cannot be said to be distinct, since they are little else than minute dots slightly darker than their surroundings.

The female aperture is indicated by a small whitish area midventrally in xiv, in front of the level of the setae.

What might be called an anterior genital area is present in the neighbourhood of the spermathecal apertures. In furrow $\frac{7}{8}$ is situated a transversely much elongated, slightly raised and flat pad, somewhat rectangular in shape, extending laterally on each side beyond the line of setae *b*, and including the hinder annulus of vii and anterior annulus of viii. The second annulus of viii is also distinctly thickened for some distance on each side of the mid-ventral line. The spermathecal apertures are very probably indicated by a pair of minute white dots, in line with *b*, on the pad described as occupying the ventral portion of furrow $\frac{7}{8}$.

A row of small darkish spots may be present, in a transverse line, over the middle part of the pad in $\frac{7}{8}$; similar minute spots were seen, also in a transverse line, on the anterior of the four pads in the male genital field.

Septum $\frac{5}{6}$ is the first; this, and all the following septa as far as $\frac{10}{11}$ are moderately to considerably thickened.

The first gizzard is in front of the first septum, i.e. in segment v, of considerable size, subglobular and not very hard; a second gizzard resembling the first occupies segment vi. Calcareous glands are two pairs, in segments xi and xii; they are more or less globular, yellowish in colour, and set off from the oesophagus. The intestine begins in xv.

The dorsal vessel gives off a regular series of commissural vessels ('hearts') from xiii to v and can be traced forwards on to the pharynx.

Regular lines of micronephridia are found in all the post-clitellar segments. In front of the clitellum they are less regular in disposition; in segments ii and iii they are numerous and close-set on each side of the pharynx.

Considering in more detail the post-clitellar nephridia:—in the anterior portion of this region, which is exposed during the ordinary dissection, there are eight, or about eight, micronephridia on each side, arranged in a row of which the ventralmost member lies by the side of the ventral nerve cord; the most dorsally situated nephridium in each segment is at some distance from the mid-dorsal line, so that there is a dorsal tract of the body-wall which is free from nephridia. Of the eight (or so) nephridia on each side, the three most dorsally situated are larger than the rest, and consist each of a transversely directed loop, lying in the middle of the length of the segment and without connection with the septa. The inner five or thereabouts of the row of nephridia are considerably smaller; there is no very constant diminution in size on passing ventralwards along the row; still it may perhaps be said that the nephridium which is placed most ventrally, by the side of the nerve cord, is on the whole the smallest of the series.

If now the posterior end of the animal be opened, a difference is found. For the most part the nephridia have the same relations and sizes; but the most ventral nephridium on each side is here much larger than further forward. While anteriorly the ventralmost nephridium was the smallest, here it is, I will not say the largest, but as large as any of the series. It is not, in fact, larger than the dorsalmost of the series; though its tube is thicker and more opaque, and it is coiled more compactly than the transversely elongated loop of the dorsally situated organs. I could not make out that these ventral nephridia are attached to the septa, or pass through to end in a funnel on the other side.

Testes and seminal funnels are present, free, in segments x and xi. Large lobed seminal vesicles are situated in ix and xii, with the usual relations to the septa In one of the three specimens dissected, what I take to be rudimentary seminal vesicles were present in x also; these were a pair of small roundish excrescences, on the anterior face of septum $\frac{10}{11}$, to which they were attached by a comparatively broad base.

The vasa deferentia from the two funnels of the same side soon converge and run alongside, but do not unite; they pierce the body wall, still ununited, close to, and on the anterior side of, the end of the prostatic duct.

There is a single pair of prostates, which occupy segments xviii–xix, bulging back septum $\frac{19}{20}$. Each is tubular, and much coiled. The duct is gently looped once or twice, and passing on the whole with a forward direction ends on the inner surface of the body-wall of segment xviii.

The ovaries, composed of a number of moniliform strands, and the small female funnels are in xiii.

The single pair of spermathecae (fig. 14) lie in segment viii. The ampulla is somewhat conical, directed with its apex backwards and inwards, and continued forwards at its base into the comparatively narrow and shining duct. The duct is gently bent into an **S**-shape, in length it is about $\frac{2}{3}$ that of the ampulla, and has a curious diverticulum on its posterior side. This is a large cauliflower-like aggregate of small chambers, bound down to the duct and the base of the ampulla by connective tissue; on the other side of the same specimen the chambers were in two aggregates instead of a single one, the two aggregates being separated by a narrow interval along the posterior side of the duct.

No penial setae were discoverable.

The peculiarity of the above form lies in the disposition of the posterior male organs. I have examined several specimens, and it is unfortunate that the actual apertures are invisible, or almost so, externally; they could be distinguished, and that not with absolute certainty, in one only. In any case there seems to be no more than one pair of pores. The absence of setae *a* of segment xviii seems constant. As seen internally the prostatic duct certainly pierces the body-wall in xviii; but in two out of three specimens the vasa deferentia could not be traced to their end, and the relation of vas deferens to prostatic duct above described was seen in one specimen only.

Subfam. *OCNERODRILINAE.*

Ocnerodrilus (Ocnerodrilus) occidentalis, Eisen.

Rawal Pindi, March 1911; Ibrahim.

Mardan (N.-W. Frontier Province); 26-xii-1913; Baini Parshad.

Length 36 mm. when living and moderately extended; diam. 1 mm.; segments 70. The following points, certain of which confirm Michaelsen's opinion regarding the non-validity of the var. *arizonae*, Eisen, are worthy of mention:—

Of the septa, the first, $\frac{4}{5}$, is thin; $\frac{5}{6}$–$\frac{11}{12}$ are thickened, —$\frac{5}{6}$ slightly, $\frac{6}{7}$ more so, $\frac{7}{8}$–$\frac{10}{11}$ markedly, $\frac{11}{12}$ slightly. The septal gland of segment viii is somewhat smaller than those of the foregoing segments, but not very markedly so. A large amount of glandular tissue similar to that of the septal glands exists in front of septum $\frac{4}{5}$, lying on the pharynx and mingling with the muscular strands of this region; the whole forms a considerable mass in front of the first septum, and it therefore seems hardly correct, in the specific definition, to limit the septal glands to segments v–viii. The clitellum extends from $\frac{1}{2}$xiii to xix or $\frac{1}{2}$xx (= $6\frac{1}{2}$ or 7). The prostates extend backwards only a short distance behind the male pore, and do not reach the posterior limit of the clitellum.

The circulatory system was examined in the living worm by the microscope; and many of the results were checked by serial sections.

The dorsal vessel lies above and separate from the gut-wall; it is however invested by chloragogen cells above the intestine. It is contractile; the contractions in its anterior part (segments ii–vii) are often antero-posterior in direction.

There is a very short supra-intestinal vessel, connected with the upper ends of the hearts. It extends only over two segments or a little more, appearing posteriorly just behind the second heart, and becoming lost on the oesophagus anteriorly about the place where the oesophageal diverticula are connected with the alimentary tube (segment ix).

Lateral oesophageal vessels are present; they appear, in an examination of the living animal, to be continued back as lateral channels in the intestinal wall, but these are not discoverable in sections. They are connected with the copious plexus on the oesophageal diverticula; they are continued forwards, with a sinuous course, as far as segment ii; they give numerous branches, and in the region of the septal glands run on the inner face of the glands, in the gland capsule, and unconnected with the oesophageal wall.

The ventral vessel is very small in the anterior part of the body, as far back as the hearts; and its connection with the point of junction of the anterior hearts is very narrow. Posteriorly it has the usual relations.

The hearts are in segments x and xi, on the posterior septa of these segments (septa $\frac{10}{11}$ and $\frac{11}{12}$). The hearts of the same side contract as a rule alternately, but irregularly (under chloretone), —seldom simultaneously. Those of opposite sides but of the same pair also seldom contract simultaneously, but here again there is no rule. The contraction of the hearts is independent of that of the dorsal vessel. The hearts are connected below with the ventral, above with both dorsal and supra-intestinal vessels.

There are six loops on each side in front of the hearts, in segments iv–ix; they run in the substance of the septal glands, or on their outer surface. It is possible however that the number is not constant; in one specimen there were five obvious loops on one side, in segments ix to v, of which that in v was the largest;

on the other side there were six loops, of which the anterior, from viii to iv, diminished regularly in size.

These loops are contractile, but only in their dorsal portions. In the case of the loops in segments ix–vii, about the dorsal third is contractile; in the anterior loops, vi and v at least (I have no definite note regarding iv), it is a still smaller portion. The contraction of these vessels is synchronous with the contraction of the dorsal vessel in this region; thus the dorsal vessel and the contractile portions of the loops are all simultaneously invisible during contraction, and the loops seem to start, of full size, from nowhere, so to speak.

A marked red blush in segment ix in the living worm is seen on closer examination to be a network of fine vessels clothing the oesophageal pouches.

Fam. LUMBRICIDAE.

Helodrilus (Eisenia) foetidus (Sav.)

Simla; 12-viii-1913; Bishambar Das. A single specimen.

Helodrilus (Bimastus) parvus (Eisen).

Lyallpur (Punjab); Nov., 1911; Madan Mohan Lal.

Lahore, Lawrence Gardens; Feb. 1912; B. L. Bhatia. Also near the river Ravi; 15-xii-1913; Baini Parshad.

Peshawar (N.-W. Frontier Province); April, 1913; Baini Parshad. Also same place and collector; 29-xii-1913.

Mardan (Peshawar District); 25-xii-1913; Baini Parshad.

Ferozepur; 10-i-1914; Baini Parshad.

Many of the specimens were (for this species) very large and well-grown; length 40 mm., breadth maximum $2\frac{1}{2}$ mm. The clitellum extended over the normal seven segments (xxiv-xxx), xxiii being in some cases however (Mardan specimens) slightly altered also. There were no ridges or tubercles in association with the ventral borders of the saddle-shaped clitellum in any of the specimens that were closely examined.

Helodrilus (Allolobophora) caliginosus (Sav.).

forma *trapezoides* (Ant. Dug.).

Lahore; common.

Mardan (Peshawar District); 25-xii-1913; Baini Parshad.

Peshawar (North-West Frontier Province); 29-xii-1913; Baini Parshad. Also April, 1913; Ibrahim.

Ferozepur; 8-ii-1914; 22-ii-1914; Baini Parshad.

The variations from the usual condition mainly concern the clitellum. This very frequently embraces xxvi, and may encroach slightly on xxv; its extent therefore may be as much as $9\frac{1}{2}$ segments (xxvi–$\frac{1}{2}$xxxv). The ridges on segments xxxi–xxxiii may be formed of imperfectly fused tubercles; or they may extend forwards on each side to the anterior limit of the clitellum, becoming more and more distinctly cut up into separate tubercles in the anterior segments. In the clitellar region a number of ventral setal pairs may be situated in the middle of flat, broadly oval, glandular-looking patches, which take up the length of a segment, and transversely extend from the inner border of the ridge to the mid-ventral line (or a corresponding extent in the region in front of the ridges); as an example, such patches occurred in one specimen in segments xxxii and xxx on the right, in xxxi, xxix xxviii and xxvi on the left.

Octolasium lacteum (Örley).

Simla; 12-viii-1913; Bishambar Das.

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EXPLANATION OF PLATE XXXVI.

FIG. 1.—*Enchytraeus harurami*; horizontal section, through segment xi and portions of x and xii, to show funnels and sperm- or testis-sacs. × *ca.* 206.

Clit., clitellar epithelium; *corp.*, coelomic corpuscles being budded off from septum $\frac{10}{11}$; *f.*, funnel; *hiat.*, hiatus in septum $\frac{10}{11}$, through which the testis in its sac is, in this case, turned forwards into segment x; *ov.*, ovary; *spz.*, spermatozoa entering mouth of funnel; *s. s.*, sperm-sac, on the one side cut near its attachment to the septum round the base of the testis; on the other at some distance from its attachment, the testis having given place to sperm-morulae and ripening spermatozoa; *t.*, testis, attached to the posterior face of septum $\frac{10}{11}$, but turned forwards through a vacuity in the septum; *v. def.*, vas deferens; *v. v.*, ventral vessel.

,, 2.—*Lampito trilobata*; area of male pores.

,, 3.—The same; distal end of penial seta, × *ca.* 133.

,, 4.—The same; spermatheca.

,, 5.—*Octochaetus fermori*; male genital area. *Clit.*, clitellum; *sem. gr.*, seminal groove.

,, 6.—The same; penial seta. *a*, whole seta, × *ca.* 86; *b*, distal end × *ca.* 300.

,, 7.—*Octochaetus dasi*; male genital area.

,, 8.—*Eutyphoeus incommodus*; distal end of penial seta.

,, 9.—*Eutyphoeus mohammedi*; penial seta. *a*, whole seta × 100; *b*, distal end × *ca.* 400.

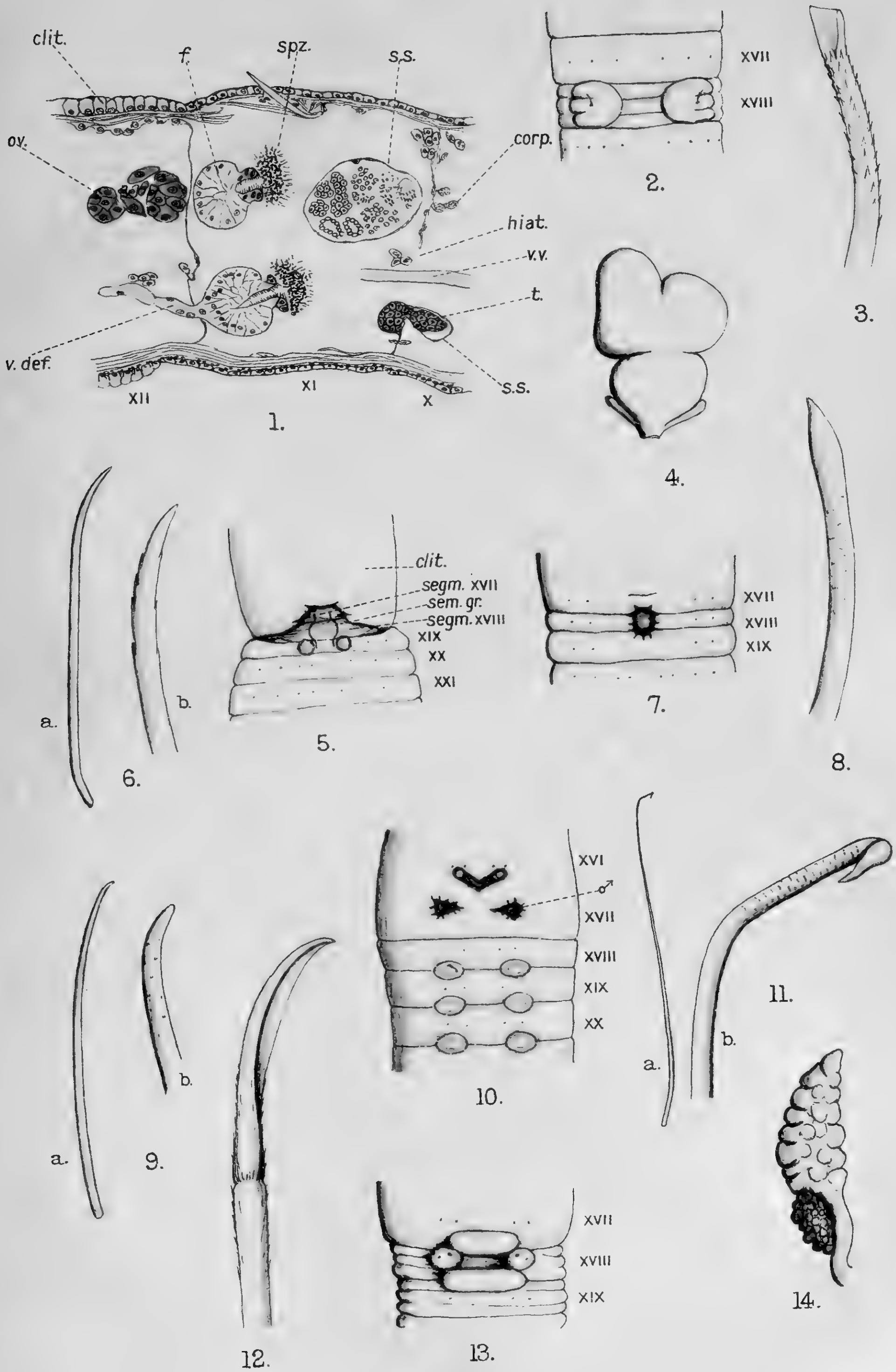
,, 10.—*Eutyphoeus bishambari*; male genital area. ♂, male pore.

,, 11.—The same; penial seta. *a*, whole seta × 12; *b*, distal end × *ca.* 100.

,, 12.—*Eutyphoeus ibrahimi*; distal end of penial seta × *ca.* 266.

,, 13.—*Eudichogaster barodensis*; male genital area.

,, 14.—The same; spermatheca.



J. S., del.

Bemrose, Collo., Derby

INDIAN OLIGOCHAETA.

MISCELLANEA.

REPTILES.

Lizards of the Simla Hill States.—As originally written this paper consisted of some notes on the various lizards collected during the months of July, August and September 1914; but later on, in accordance with a suggestion received from Dr. N. Annandale, a list of all the lizards known from the region, with references to the literature, is also given. In all, lizards belonging to the families *Geckonidae*, *Agamidae*, *Anguidae* and *Scincidae* have been taken from this region. Of these the collection contains representatives of only the *Agamidae* and *Anguidae*. The family *Anguidae*, a single representative of which, *Ophiosaurus gracilis* (Gray), was taken at Simla at an altitude of about 8000 ft., has not been found previously in the Western Himalayas, and has not apparently been recorded from any place the altitude of which exceeded 6000 ft. The occurrence of *Calotes versicolor* (Daud.) is also interesting, as in Dr. Annandale's recent note (*Rec. Ind. Mus.*, vol. x, p. 320) the species is only said to occur in the foothills of the Himalayas.

My sincere and hearty thanks are due to Major J. Stephenson, I.M.S., Professor of Biology, and Principal, Government College, Lahore, for the facilities given me in working out this collection, and for the great help in obtaining the literature. I have also to thank Dr. Annandale for his valuable suggestions and kind help given at all times.

List of species known to occur in the Simla Hill States :—

1. *Alsophylax himalayensis*, Annandale.
2. *Gymnodactylus fasciolatus* (Blyth).
3. *Acanthosaura major* (Jerdon).
4. *Calotes versicolor* (Daud.)
5. *Agama tuberculata*, Gray.
6. *Ophiosaurus gracilis* (Gray).
7. *Lygosoma himalayanum* (Günther).
8. *Lygosoma punctatum* [1] (Linn.).

Fam. Geckonidae.

1. *Alsophylax himalayensis*, Annandale.

Annandale, *Rec. Ind. Mus.*, vol. ix, p. 305, pl. xv, fig. 1 (*a–c*); vol. x, p. 319.

[1] There is a specimen from Subathu in the Indian Museum.

2. *Gymnodactylus fasciolatus* (Blyth).

Theobald, *Cat*, p. 92; Boulenger, *Fauna*, p. 71; Annandale, *Rec. Ind. Mus.*, vol. ix, p 325, pl. xvi, fig. 3.

Fam. AGAMIDAE.

3. *Acanthosaura major* (Jerdon).

Theobald. *Cat.*, p. 113; Boulenger, *Fauna*, p. 128; Annandale, *Rec. Ind. Mus.*, vol. I, p. 152, and x, p 321.

4. *Calotes versicolor* (forma typica) (Daud.).

Theobald, *Cat.*, p. 109; Boulenger, *Fauna*, p. 135, fig. 42; Annandale, *Rec. Ind. Mus.*, vol. i, p. 153; vol. vii, p. 46; vol. viii, p. 41; vol. x, p. 320.

Dr. Annandale adds as a footnote to his recent note on "Three rare Himalayan Lizards" (Rec. Ind. Mus., vol. x, p. 320), that the typical form of the species occupies the foothills of the Himalayas, the Gangetic plain, Assam, Burma, Siam, the northern part of the Malay Peninsula, etc., according to his investigations then the form does not occur in the higher mountains, but specimens of this form were caught by me in the following places:—

1. Three at Saujauli (about two miles from Simla).
2. Two at Kufri (about eight miles from Simla on the Kulu Road).

The altitudes of the two places is approximately 8000 feet. The specimens are not very large and do not show any well marked sexual characters.

5. *Agama tuberculata*, Gray.

Stellio tuberculatus, Theobald, *Cat.*, p. 116; Boulenger *Fauna*, p. 148; Dodsworth, *Journ. Bombay Nat. His. Soc.*, vol. xxii, pp. 404, 405. Annandale, *Rec. Ind. Mus.*, vol i, p. 154.

This rock lizard is very common at Simla as has been recorded by Mr. Dodsworth (*op. cit.*). Dr. Annandale also obtained two specimens of this form at Simla, while I have always seen them basking on stones on sunny days; specimens were also seen at Kasauli though none were secured.

A female specimen caught on the 22nd of August had five eggs in it, the eggs were quite ready for laying. According to Mr. Dodsworth the breeding season is May, June, July, and probably the first half of August, but my specimen which showed these ripe eggs was taken in the third week of August, hence the breeding season seems to extend up to the end of August. In all, eight specimens of this form were obtained on the Mashobra-Tibet Road, from underneath large stones about four miles from Simla

Fam. ANGUIDAE.

6. *Ophiosaurus gracilis* (Gray).

Pseudopus gracilis, Theobald, *Cat.*, p. 47; (*Ophiosaurus*) Boulenger. *Fauna*, p. 71, fig. 47; Annandale, *Rec. Ind. Mus.*, pp. 42 and 857.

The distribution of the Genus *Ophiosaurus*, Daud., according to Dr. Boulenger, is "South-Eastern Europe, North Africa, South Western Asia, Himalayas and Burma, Central America"; while the habitat of the species is "Eastern Himalayas, Khasi hills, Eastern Bengal, Rangoon, Western Yunnan". The species has been recorded by Dr. Annandale also in the "Zoological results of the Abor expedition" and parts i and iv (*op. cit.*). According to him the range is as follows: "A common species in the Eastern Himalayas at altitudes of between 4000 and 5000 ft.; it also occurs in the Khasi hills in Upper Burma and Yunnan, and probably in the hills of Pegu." Some of his specimens were taken at an altitude of 2000–2150 ft., and others at an altitude of 4000 ft. The single specimen about which the following notes are appended was taken on the 22nd of August on the Mashobra-Tibet Road about three miles from Simla. Now Simla is situated in the South-Western slopes of the Himalayas at an altitude of 7156 ft. This slow-worm then is not confined to the Eastern Himalayas as has been supposed up till now, but occurs in the Western Himalayas as well.

Measurements of the specimen.

Length 22·5 cm. Tail 8·1 cm.

The colour is yellowish brown above while ventrally it is uniform yellow, so also is the posterior one-third of the tail dorsally. The lateral blue-black stripes mentioned by Dr. Annandale are absent; dorsally a large number of black spots, during life rather bluish, which in some parts are like half hoops, are very distinctly seen

Fam. SCINCIDAE.

7. *Lygosoma himalayanum* (Günther).

Mocoa himalayana and *M. blythii*, Theobald, *Cat.*, pp. 57 and 59; (*Lygosoma*) Boulenger, *Fauna*, p. 200; Annandale, *Rec. Ind. Mus.*, vol. i, pp. 154, 155.

According to Dr. Annandale this skink is very abundant in the gardens in the town of Simla in the neighbourhood of which it is common at least as high as 9000 ft. Skinks were seen by me twice at Simla which probably might have belonged to this species but could not be secured.

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[END OF VOLUME X.]