

II NOTES ON FRESHWATER SPONGES

By N. ANNANDALE, D.Sc., Superintendent, Indian Museum.

X.—REPORT ON A SMALL COLLECTION FROM TRAVANCORE.

Genus SPONGILLA.

Subgenus Euspongilla.

Spongilla travancorica, sp. nov.

Sponge small, encrusting, without branches, hard but brittle; its structure somewhat loose; colour dirty white. Dermal membrane in close contact with the skeleton; pores and oscula inconspicuous. Surface minutely hispid, smooth and rounded as a whole.

Skeleton consisting of moderately stout and coherent radiating fibres and well-defined transverse ones; a number of horizontal spicules present at the base and surface but not arranged in any definite order. No basal membrane.

Spicules.—Skeleton spicules smooth, pointed at either end, moderately stout, straight or curved, sometimes angularly bent; curvature usually slight. Free microscleres abundant in the dermal membrane, slender, nearly straight, gradually and sharply pointed, profusely ornamented with short straight spines, which are much more numerous and longer in the centre than near the ends. Gemmule spicules stouter and rather longer, cylindrical, terminating at each end in a sharp spine, ornamented with shorter spines, which are more numerous and longer at the ends than in the centre; at the ends they are sometimes directed backwards, without, however, being curved.

Gemmules firmly adherent to the support of the sponge, at the base of which they form a layer one gemmule thick; each provided with at least one foraminal tubule, which is straight and conical; two tubules, one at the top and one at one side, usually present. Granular layer well developed. Spicules arranged irregularly in this layer, as a rule being more nearly vertical than horizontal but pointing in all directions, not confined externally by a membrane; no external layer of horizontal spicules.

Length of skeleton spicule	0.289—0.374 mm.
Greatest diameter of skeleton spicule	0.012—0.016 „
Length of free microscleres	0.08 —0.096 „
Greatest diameter of free microscleres	0.002 mm.
Length of gemmule spicule	0.1 —0.116 „
Diameter of „ „	0.008 mm.
„ „ „ gemmule	0.272—0.374 „

Habitat.—Backwater¹ near Shasthancottah, Travancore, in slightly brackish water ; on the roots of shrubs growing at the edge ; November, 1908.

This species is easily distinguished from its allies of the sub-genus *Euspongilla*, all of which are closely related, by its adherent gemmules with their (usually) multiple apertures and rough external surface.

Genus TUBELLA.

Tubella pennsylvanica, Potts.

Potts, *Proc. Acad. Nat. Sci. Philadelphia*, 1887, p. 251, plate xii.

By the kindness of the authorities of the Smithsonian Institution I have been able to obtain pieces of the freshwater sponges in the collection of the United States National Museum. As the majority of these were named by Potts, the acquisition is an extremely valuable one. It enables me to identify with certainty several Indian species with American forms, amongst others the one of which the name is printed above, viz., *Tubella pennsylvanica*. This species, found by Potts in Pennsylvania, New Jersey and other parts of the Eastern United States, was afterwards reported from the west of Ireland by Hanitsch (*Irish Naturalist*, iv, p. 129, 1895) and from the Inner Hebrides of Scotland by myself (*Journ. Linn. Soc.*, xxx, p. 248, 1908). None of the European specimens as yet discovered, however, have contained gemmules, and their identification has therefore remained a little doubtful. Specimens recently collected in Travancore are full of gemmules and agree more closely in every respect with one of the American specimens examined than this specimen does with a second one from the United States. They have the somewhat slender pointed skeleton spicules and markedly unequal rotules of the gemmule spicules of the typical form of the species. Indeed, the American specimen which they resemble so closely is apparently part of the same specimen as that of which the spicules are figured by Potts in fig. 1 of plate xii of his monograph.

The measurements of the spicules of an Indian specimen and of one from Lehigh Gap, Pennsylvania, are given for comparison :—

	Travancore.	Pennsylvania.
Length of skeleton spicule	0·189 — 0·242 mm. (average 0·203 mm.)	0·16 — 0·21 mm. (average 0·195 mm.)
Breadth „ „ „	0·0084 — 0·0155 mm.	0·0084 mm.
Length of birotulate „	0·0126 mm.	0·0099 „
Diameter of upper rotule „	0·0084 „	0·0084 „
„ lower „	0·0189 „	0·0168 „
„ gemmule	0·243 — 0·348 mm.	0·174 — 0·435 mm.

¹ The backwaters of Cochin and Travancore are a series of lagoons directly connected at intervals with the sea, from which they are separated by a more or less narrow extent of land. They have been artificially joined together by canals and receive a good deal of fresh water. Their salinity varies with the place and the season.

The spicules of the Travancore specimen are, therefore, a trifle larger than those of the American one, but the proportions are closely similar.

The other Indian species I have been enabled by the gift of the Smithsonian Institution to identify with American ones are my *Ephydatia indica*, which becomes a synonym of *E. crateriformis* (Potts), and *Trochospongilla phillottiana*, which is identical with *T. leidy* (Carter).

It is interesting to note that none of these American species is confined in India to the immediate neighbourhood of the sea. *E. crateriformis* has been found not only in Calcutta but also at Igatpuri in the Western Ghats and at a place some miles inland from Moulmein in Lower Burma. *T. leidy* occurs both in Calcutta and in the interior of Tenasserim; while my specimens of *Tubella pennsylvanica* were taken (in November, 1908) in Shasthancottah lake, which is situated about three miles inland from the village of the same name on the backwater and about twelve miles N.-N.-E. from Quilon on the coast of Travancore.

The South Indian specimens were taken on the roots of floating water plants so matted together as to form large floating islands on which shrubs and even trees were growing. The sponges were only found on roots dragged out from under the islands and seemed to shun the light.

Genus PECTISPONGILLA, gen. nov.

Structure of the sponge resembling that of *Ephydatia*. Gemmule spicules bearing at either end, *on one side only*, a double row of spines, so that they resemble, when viewed in profile, a couple of combs joined together by a smooth bar.

This new genus is distinguished, as are most of those previously described in the Spongillinae, by the form of its gemmule spicules. These differ from the spicules of any form hitherto described in having the armature of the extremities bilateral instead of radial. Probably this arrangement is derived from that of a spicule such as the birotulate of *Ephydatia* by a rotation of the axis of the rotules.

Pectispongilla aurea, sp. nov.

Sponge forming small, soft, cushion-like masses of a deep golden colour (dull yellow in spirit) on a solid support; the surface smooth, minutely hispid. One relatively large, depressed osculum usually present in each sponge; pores inconspicuous; dermal membrane in close contact with the parenchyma.

Skeleton consisting of slender and feebly coherent radiating fibres as a rule two or three spicules thick, with single spicules or ill-defined transverse fibres running horizontally. Towards the external surface transverse spicules are numerous, but they do not form any very regular structure.

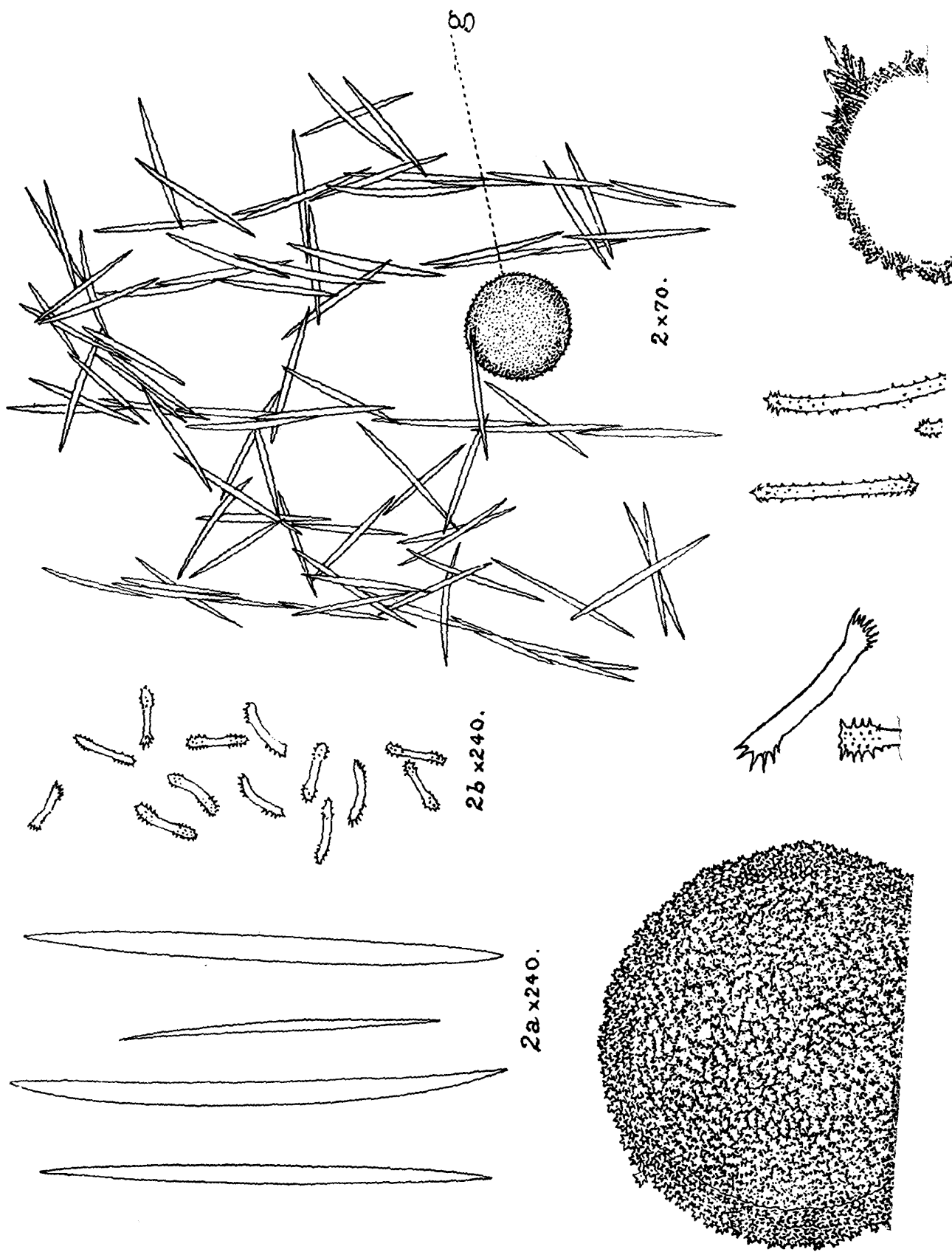
Spicules.—Skeleton spicules smooth, sharply pointed, straight or nearly so. Gemmule spicules minute, with the stem smooth and cylindrical, relatively stout, and much longer than the comb at either end; the two combs equal, with a number of minute, irregularly scattered spines between the two rows of stouter ones. No free microscleres.

Gemmules minute, spherical, with a single aperture, which is provided with a very short foraminal tubule; the granular coat well developed; the spicules arranged in a slanting position, but more nearly vertically than horizontally, with the combs pointing in all directions; no external chitinous membrane.

Length of skeleton spicule	0.2859 mm.
Greatest diameter of skeleton spicule	0.014 ,,
Length of gemmule spicule	0.032—0.036 mm.
Length of comb of gemmule spicule	0.016 mm.
Greatest diameter of shaft of gemmule spicule.	0.004 ,,
Diameter of gemmule	0.204—0.221 mm.

Habitat.—Artificial pool on the road near Tenmalai on the western side of the Western Ghats, Travancore; on the roots of trees growing at the edge; November, 1908.

I have not been able to detect vesicular cells in the parenchyma of this species, although my specimens are in good condition. *Pectispongilla aurea* is by far the most brilliantly coloured freshwater sponge I have seen.



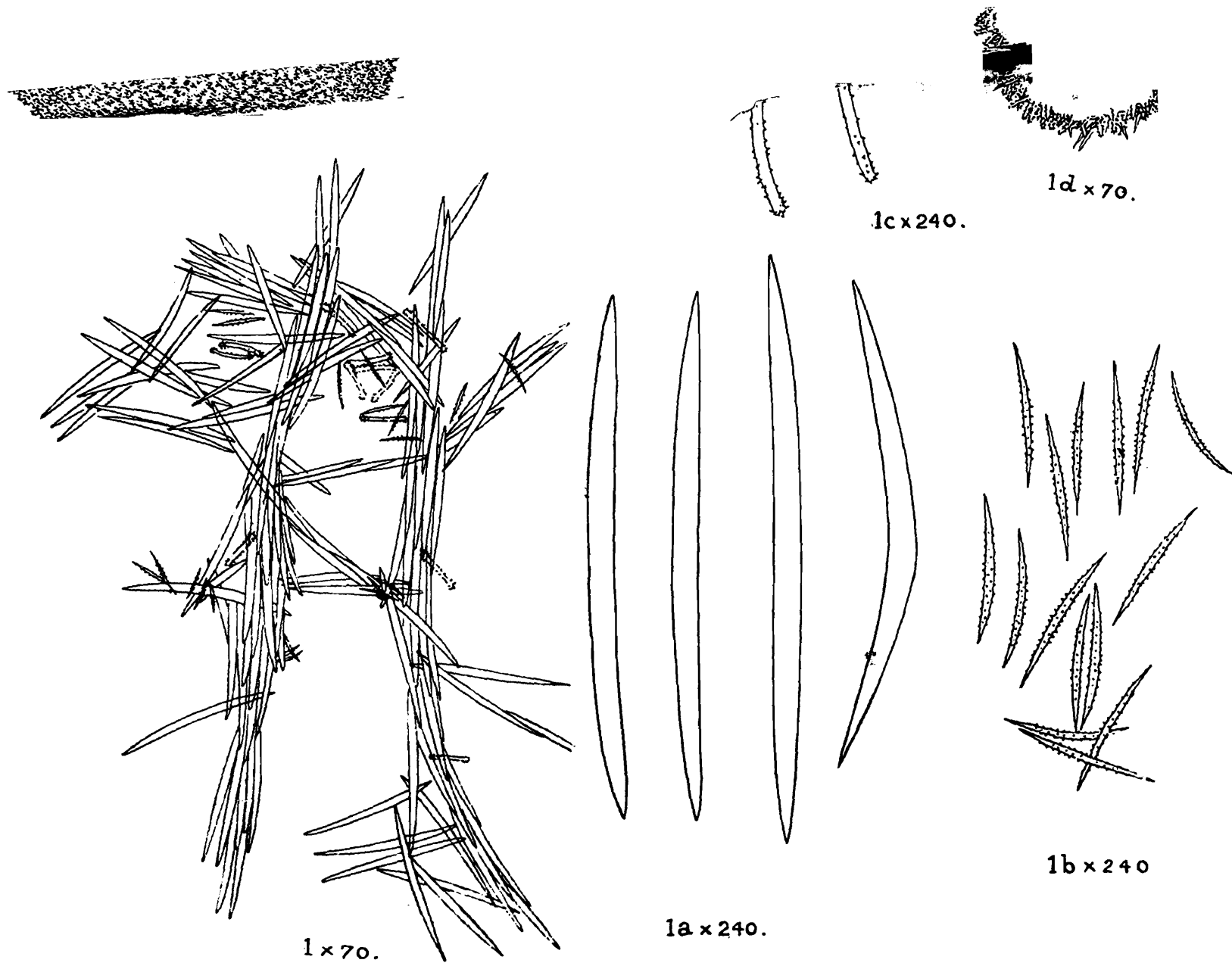


Fig.1. *Spongilla travancorica* sp. nov.

Fig2. *Pectispongilla aurea*, gen. et sp. nov

III REPORT ON A COLLECTION OF
AQUATIC ANIMALS MADE IN TIBET
BY CAPTAIN F. H. STEWART, I.M.S.,
DURING THE YEAR 1907

PART II.—OLIGOCHÆTE WORMS, MOLLUSCA AND
FISH (*Geographical*).

REPORT ON A COLLECTION OF THE SMALLER
OLIGOCHÆTA MADE BY CAPT. F. H. STEWART,
I.M.S., IN TIBET.

By J STEPHENSON, *Major, I.M.S., Professor of Biology,
Government College, Lahore.*

(Plate viii.)

The collection of the smaller Oligochæta, made by Capt. F. H. Stewart, I.M.S., in Tibet during the year 1907, consisted of fourteen tubes, with the contents of which the following report deals.

The specimens were on the whole in a good state of preservation, but the free ends of the setæ of many specimens had suffered severely, and a number of the animals also had apparently been fixed with a brown staining substance, which hindered subsequent staining and seemed to interfere with the section-cutting process.

The contents of two of the tubes were unfortunately incapable of recognition :—

No. 68 (Mang-tsa, Tibet ; 14,500 ft. ; July 1907) contained a considerable number of specimens. These were the largest animals submitted to me ; they measured up to 35 mm. ; the segments numbered up to 175. They were all, however, sexually immature, and I was unable to distinguish either clitellum or genital organs ; possibly this was a young brood of some earthworm, *i.e.*, of one of the larger Oligochæta.

No. 80 (Mang-tsa, Tibet ; 14,500 ft. ; 12-viii-07) contained three specimens, and sections show that they belong to the Tubificidæ ; but the setæ had, in this instance, suffered so severely that I was unable, in any of the specimens, to discover a single sound one in either dorsal or ventral bundles ; further discrimination is therefore impossible.

The contents of the remaining twelve tubes comprised only five distinct species, owing to the large number (seven) which contained the form described below as *Limnodrilus* sp. (?).

Chætogaster orientalis was found three times ; one tube contained both this form and a *Nais*.

It will be seen that the collection is of considerable interest, in spite of the small number of species represented. One form (*Fridericia stewarti*) I have ventured to name as new ; it is possible that two others, the *Nais* and the *Limnodrilus* (?), are also new, though I do not feel justified in giving them distinctive names. Of the remaining two species, one, *Æolosoma hemprichi*, is already well known to be widely distributed (Europe, North America, Africa), and I have also found it at Lahore ; the other has so far been met with only by myself in Lahore ; but since the name which I gave to it had been previously appropriated, its present specific designation (*Chætogaster orientalis*) makes its first appearance here.

The greater part of this investigation was carried out at the Central Research Institute, Kasauli, during the summer vacation of the present year (1908) ; and my best thanks are due to the Director, Lieut-Col. Semple, R.A.M.C., for kindly permitting me to pursue my work there.

Æolosoma hemprichi, Ehrbg.

No. 84. Gyantse, Tibet ; 13,120 ft. ; 27-viii-07.

Three specimens, of which the smallest appeared to be the broken-off posterior end of one of the others.

Length of both the larger specimens, including in each case one bud posteriorly, .7 mm. ; diameter, .09 mm. Colour, a rather dirty green ; the oil-drops in the skin quite disappeared. These latter are apparently incapable of preservation ; according to Capt. Stewart's notes their colour was an orange-brown, nearer an orange-red than a brown, and not unlike that of safranin stain. Segments, 8 or 9 distinguishable in the anterior or parent animal. Setæ commencing a short distance behind the mouth, *i.e.*, in segment ii ; all are fine hair-setæ, in both dorsal and ventral bundles ; length varying, longer and shorter in the same bundle, longest being about .1 mm. ; up to 5 in a bundle.

Prostomium large ; both specimens having curled themselves dorso-ventrally at the moment of fixation are seen in a lateral view in the preparations, and the breadth of the prostomium does not appear. According to a sketch of Capt. Stewart's from the living worm, it was rounded, not pointed in front, and broader than the following segments. The nerve-ganglion is shown as being deeply indented posteriorly ; this also could not be made out in the preserved specimens. The nephridia also are not recognizable.

In all the anatomical characters that can be ascertained this form agrees with *Æolosoma hemprichi*, except that its length is considerably less. The present specimens, probably somewhat contracted, and perhaps also diminished by the loss of some posterior buds, measure .7 mm. ; while *Æ. hemprichi*, according to Michaelsen ("Oligochæta," in *Tierreich*, Berlin, 1900), has a length of

2—5 mm. This can hardly, I think, be accounted a specific difference. I have recently [*Mem. Ind. Mus.*, i, No. 36, p. 277, pl. xx (1908)] given a description of an *Æolosoma* from Lahore, identifying it as *Æ. hemprichi*, which is about the dimensions of these specimens from Tibet, and which is therefore also considerably smaller than *Æ. hemprichi* according to the figures given above.

Chætogaster orientalis, nom. nov.

1907. *Chætogaster pellucidus*, Stephenson, *Rec. Ind. Mus.*, vol. i, p. 237 (1907).

No. 42. Se-chen, Tibet; 13,100 ft.; 22-iv-07.

Three specimens without sexual organs, and one fragment, together with the specimen of *Nais* sp.

No. 49. Gyantse, Tibet; 13,120 ft.; 26-vi-07.

Two specimens without sexual organs; dark brown in colour, probably due to mode of fixation.

No. 83. Gyantse, Tibet; 13,120 ft.; 20-viii-07.

Two specimens without sexual organs, with several fragments consisting of detached buds.

The specimens probably consisted originally of complete chains of four or five individuals, which broke up at the moment of killing and fixing. They correspond closely with the species described by me as *C. pellucidus* from Lahore. Since writing that account (referred to above), however, I have, through the kindness of Dr. Walton, of Kenyon College, Gambier, Ohio, U.S.A., received a copy of his paper "The Naididæ of Cedar Point, Ohio," 1906 (*American Naturalist*, vol. xl, No. 478); he there describes as *C. pellucidus* a species found by him; and since the name belongs by priority to that form, I have chosen *orientalis* for the species now under discussion.

I was at first inclined to see a difference between the present specimens and the form previously described by me in the relative length and thickness of the pharyngeal region as compared with the posterior part of the body. I find, however, that in the processes of fixation, etc., the pharyngeal region contracts both in length and breadth, while the body in the "crop" region appears to become broader than in life; in specimens from Lahore so treated the result is a close approximation to the condition in which the Tibet specimens were found, *e.g.* :—

	Length of pharyngeal region.	Length of body posterior to pharynx.
Lahore form	·25 mm.	·71 mm.
Tibet No. 83	·29 "	·75 "
Tibet No. 49	·088 "	·24 "
Tibet No. 42	·11 "	·35 "

Sketches made during life by Capt. Stewart confirm the above identification, showing the animal to possess about the same proportions as living specimens of the Lahore form.

It will be noted that the individuals of the collections Nos. 42 and 49 are considerably smaller than those of No. 83. Since, however, the size is the only point of difference I can discover, I have not separated them as a distinct form.

Since in distinguishing the species of the various families of the Naididæ so much depends on an exact description of the setæ, I will add here a somewhat more detailed account of those of this species than I gave in my earlier paper. The setæ are ventral only, slender, $\int$ -shaped, unequally forked, the distal prong being somewhat the longer, both prongs of the same diameter at the base, nodulus small, somewhat proximal to the middle of the length of the seta; setæ of segment ii a little stouter and distinctly longer (.14 mm., Lahore specimens) than the rest (average .11 mm., Lahore specimens).

Nais sp.

No. 42. Se-chen, Tibet; 13,100 ft.; 22-iv-07.

A single specimen, without sexual organs, along with specimens of *Chætogaster orientalis*.

Length 2 mm.; segments xviii *plus* a short posterior region without setæ, the seat of budding of new segments. Prostomium rounded. Ventral setæ with a $\int$ -shaped curve, hooked and bifid distally, distal prong longer than proximal; nodulus not distinguishable in the present specimen; beginning in segment ii; 2—3 (perhaps more originally) in bundle. The anterior and posterior bundles differ somewhat; the anterior are composed of setæ about .074 mm. in length, with the distal prong of the forked end of the same thickness as the proximal; in the rest of the body the ventral setæ are about .055 mm. long, or three-quarters the length of those of the first few bundles, and the proximal prong is very considerably stouter than the distal. The thickness of the shaft of the seta is, however, the same throughout the body.

Unfortunately a small quantity of foreign matter adheres to the ventral surface of parts of the animal, and the setæ in these places being obscured, I am unable to say how many segments are comprised in the anterior group; probably, however, as in *N. obtusa*, the setæ of segments ii—v belong to the anterior, the rest to the posterior group.

The dorsal setæ begin in segment vi; each bundle appears to consist normally of one long smooth hair-seta, and one short, straight, singly-pointed needle-seta supporting it at its base, and scarcely projecting beyond the surface. These dorsal bundles, however, have been much damaged.

Two eyes are present as pigmented patches situated laterally at the level of the anterior lip of the mouth.

The pharynx occupies segments iii—v, the œsophagus vi, and a dilatation (stomach) of somewhat irregular shape appears in segments vii—viii. Posterior to this, the intestine is widely and regularly dilated in each segment. The anus is slightly dorsal.

The discrimination of the various species of the genus *Nais* depends largely on the characters of the setæ. Though the present specimen does not agree exactly with any form hitherto described (coming closest perhaps to *N. obtusa*, Gerv.), I prefer not to erect a new species on the basis of a single preserved specimen, especially as the dorsal setal bundles are largely incomplete. I myself examined previously some scores of living examples of a *Nais* common at Lahore before arriving at what I considered an adequate description of the dorsal setal bundles.

Fridericia stewarti, sp. nov.

No. 32. High Hill Gumpa, Gyantse, Tibet; 14,500 ft; 28-iii-07.
Six specimens, mostly with sexual organs (ova and yolk).

Length 8 to 22 mm. Colour yellowish. Segments about 45 (43—46). Prostomium short, rounded; external annulation fairly well marked. Clitellum on segment xii and most of xiii; may spread partly over xi. Epithelium of surface markedly thicker over prostomium. Head pore apparently between prostomium and segment i; dorsal pores not distinguishable in my preparations.

The setæ (v. text-fig. 1) are in four bundles per segment, two ventral and two lateral; they are of the same character in all the bundles, being comparatively small with single blunt point, free extremity very slightly hooked, shaft straight or only curved in the slightest degree. They are arranged in fan-shaped form transversely in each bundle; those in the centre of each bundle are the smallest, and their size increases gradually towards the outermost components of the bundle, these latter being thus the longest. Each bundle is thus typically made up of a number of pairs of setæ, the members of a pair being of the same size, situated one on each side, and separated by the interposition between them of the smaller setæ of the bundle. In cases where the bundle consists of an odd number of setæ it can often be seen that

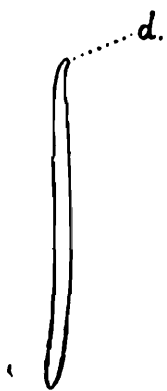


FIG. 1.—A seta of *Fridericia stewarti*; d. = its distal end.

one pair is incomplete, owing to the dropping out of a seta on one side. The arrangement is that peculiar to the genus. The number of setæ per bundle varies; posteriorly there are commonly 4 to 6 or 7 laterally, and 6 or 7 ventrally; anteriorly there are often more, most frequently perhaps 7 laterally, and 8 ventrally; 9 and

10 are also met with in the ventral bundles. The longest setæ are about .08 mm. in length.

The alimentary canal (fig. 1) begins as a narrow passage in segments i and ii ; the pharynx occupies iii, having dorsally a marked thickening of its wall from which muscular bands radiate to be attached to the body-wall. The œsophageal glands, three or probably four pairs, are present in segments v, vi and vii ; these are rounded or pear-shaped masses, not branched, attached to the alimentary tube, and also by strands to the body-wall ; the most posterior are the largest. They are composed of large rounded cells which appear to be comparatively loosely connected together ; the loose connection of the cells is also seen in sections.

Surrounding the alimentary tube in segment viii is a spherical structure (fig. 1, *ch.*) through which the tube is continued uninterruptedly ; this structure is itself hollow, its cavity being divided up by a number of septa ; its walls are fairly thick and apparently somewhat similar in character to those of the alimentary tube ; the structure is clothed externally by low peritoneal cells. In a series of (more or less) horizontal sections there appear two lateral dorsalward extensions of this chambered structure, which embrace between them in the middle line what is apparently the thin-walled dorsal vessel containing coagulated blood ; the dorsal vessel appears to communicate with the sinuses of the chambered structure.

There appear (in sections) to be fairly definite blood-sinuses surrounding the alimentary tube, between the tube and the peritoneal cell layer, in segments ix and x ; the sinus in x contains coagulated blood. Further back, behind the genital region, in segments xiii and posteriorly, there is also a fairly well-marked peri-intestinal space, though less definite perhaps than anteriorly in segments ix and x, and possibly of artificial origin.

There is no demarcation between œsophagus and intestine. The peritoneal cells around the tube are very tall in segments ix and x, and again behind the genital region to the posterior end of the body.

The lymph-corpuscles (fig. 2) are mostly oval, with rather sharp ends ; some are round or somewhat irregular in shape. Both kinds are granular ; a faint round vesicular nucleus with a nucleolar spot can be distinguished in them. The blood was apparently colourless ; the distribution of the blood-vessels is unfortunately not recognizable.

The nephridia consist of anteseptal and postseptal portions, the anteseptal being, according to the appearances shown by horizontal sections, about half as thick and two-thirds as long as the postseptal ; it projects forwards into the anterior segment, while the postseptal, appearing as a thick granular mass of oval shape, passes outwards and backwards to open externally in front of the level of the setæ.

The cerebral ganglion is situated in segment i ; its shape is difficult to make out ; it is apparently more deeply indented in

front than behind. The ventral nerve-cord is formed in the second segment by the union of the commissures.

I am unfortunately unable to give a description of the male organs from the specimens at my disposal ; and with regard to the female organs also the account must for the present be incomplete. Clusters of developing spermatozoa (few only) were seen in segment x ; clusters of ova in xi and posteriorly, some even at the extreme posterior end of the animal ; there are thus apparently (as is usual in the family) no egg-sacs formed. Somewhat opaque masses of yolk-matter, in small granules, occupy the clitellar region and part of segment xi. A genital gland, presumably testis, appears attached to the posterior face of septum 10-11.

The spermathecæ (fig. 1, *sp.*) are situated in segment v, opening anteriorly ventro-laterally between iv and v. They are tubular, with narrow lumen, of a much elongated pear-shape, the broader part being anterior. They have thick walls ; the passage of communication with the exterior is short and narrow ; they are attached behind to the dorsal wall of the alimentary canal, but I have not been able satisfactorily to demonstrate a continuity of the lumen of the spermatheca with that of the œsophagus ; such may, however, possibly exist.

The clitellum is seen in sections to consist of two kinds of cells intermingled ; of these some are quite clear, and others granular in appearance. The same distinction is also evident in a superficial view of the whole surface of the clitellum, the clear and granular cells appearing as clear and granular areas.

Systematic position.—The arrangement of the setæ described above is peculiar to the genus *Fridericia*. Of the species of this genus, the larger number present diverticula in connection with the spermathecæ ; and of those (*F. alpina*, *alba*, *bulbosa* and *striata*, according to Michaelsen, "Oligochæta" in *Das Tierreich*, 1900) which have no such diverticula, *F. striata* is the only one which presents anything like so large a number of individual setæ in each bundle. In this form, however, the salivary glands are branched at the extremity, the ampullæ of the spermathecæ are bulbous in shape, and in connection with the passage to the exterior are two somewhat spherical glands ; these characters are absent in the present species.

Though the above account of the present form is incomplete, it would nevertheless appear to be distinguishable by several well-marked characters from the other members of the genus ; and since I think the description will allow of its being recognized when next met with, I have ventured to distinguish it by the specific name *stewarti*. I have placed a type specimen, in balsam, in the Indian Museum, Calcutta, and also a series of longitudinal sections ; the specimen mounted whole shows the characters of the spermathecæ distinctly, and has ten setæ in one of the ventral bundles of the sixth segment.

Limnodrilus sp. (?).

- No. 13. Te-ring Gompa, Tibet ; 14,000 ft. ; 22-i-07.
A single imperfect specimen, immature sexually
- No. 15. Te-ring Gompa, Tibet ; 14,000 ft. ; 22-i-07.
Eleven specimens, mature and immature.
- No. 18. Te-ring Gompa, Tibet ; 14,000 ft. ; 22-ii-07.
Two specimens with some fragments ; some showing sexual organs.
- No. 33. High Hill Gompa, Gyantse, Tibet ; 14,500 ft. ; 28-iii-07.
Two specimens, with two fragments of anterior end ; sexually mature.
- No. 40. Te-ring Gompa, Tibet ; 14,000 ft. ; 14-iv-07.
Ten specimens, some with sexual organs.
- No. 54. High Hill Gompa, Gyantse, Tibet ; 14,500 ft. ; 8-vii-07.
Eight specimens, some with sexual organs.
- No. 57. High Hill Gompa, Gyantse, Tibet ; 14,500 ft. ; 10-vii-07.
Six specimens, some with sexual organs.

I cannot separate the above, taken at various times at two places in the neighbourhood of Gyantse. The specimens were on the whole well preserved ; several batches were stained a deep brown, probably from the fixing agent employed, and these did not stain well nor give good sections ; the setæ of all the batches were very much broken.

Length frequently about 8 mm., specimens up to 20 mm. were met with. Diameter to .4 mm. Segments 40—64. Clitellum on segments xi and xii primarily, spreading to x and xiii and even encroaching a little on ix. Prostomium well marked, bluntly conical, marked off by a distinct groove ; external annulation distinct, double in the anterior segments according to sketches by Capt. Stewart from life ; this double character is recognizable, though apparently somewhat less distinct, in the preserved specimens also.

Setæ dorsal and ventral of same character throughout (v. text-fig. 2), both series beginning in segment ii ; they have the usual $\int$ -shaped curve, are bifid distally, both prongs being of about the same length, the distal prong slenderer than the proximal ; nodulus indistinct, as a slight swelling at the junction of middle and distal thirds, just within the body-wall ; length of setæ about .08 mm., but variable ; number in bundle usually 4—6, occasionally 7.

FIG. 2.—Seta of *Limnodrilus* sp. (?).



The alimentary tube is narrow in segments i, ii ; pharynx in iii ; œsophagus extends to ix, and the tube expands in x to form the intestine, if genital products are not present to compress it.

There is nothing that can be called a stomach ; the intestine is constricted at the septa, and bulges between the septa ; its epithelium is columnar ; the tube is covered externally by roundish, slightly staining granular peritoneal cells, which may be so numerous in places as to obliterate the body-cavity.

Besides these peritoneal cells, there are body-cavity corpuscles of circular shape, nucleated, very coarsely granular, the granules appearing as highly refractive particles similar to those in some species of *Nais*.

The circulatory system is not sufficiently distinct for description ; the same may be said of the nephridia. The cerebral ganglion is in segment i, not in the prostomium, and the nerve-cord has the usual relations.

The testes (fig. 4, *te.*) are in segment x, along with the spermathecæ ; the funnel (fig. 4, *f.*), also in x, is large, regular in shape, sessile on the septum ; the vas deferens (fig. 4, *v.d.*), whose walls are composed of a layer of somewhat cubical cells, passes backwards in xi, presenting itself as a fairly stout tube, with perhaps a gentle curve or two, but not coiled in any way ; a single longitudinal section will sometimes cut nearly the whole length of the tube ; probably in the extended condition of the animal it was almost straight. It opens into the atrium at the inner end of the latter. The atrium (figs. 3, 4, *atr.*), in segment xi, is a somewhat pear-shaped chamber, its broader end being internal ; it is prolonged into the penis (figs. 3, 4, *pen.*), a short and somewhat inconspicuous structure, whose chitinous sheath also is hardly to be made out in my preparations. The prostate (figs. 3, 4, *prst.*) is a well-marked mass of cells surrounding the inner end of the atrium on all sides.

The spermathecæ (fig. 3, *sp.*) are in segment x, not extending beyond this segment ; they may be bilobed or not, or that of one side may be bilobed, the other spherical. The lining epithelium is much elongated near the external aperture, and some of these elongated cells show clear spaces in their substance ; the same condition of the epithelium is seen over the projection of the wall into the cavity of the spermatheca where this organ is bilobed. A hyaline non-staining material fills the spermathecæ, aggregated frequently into oval or elongated masses (? spermatophores).

The ovaries (fig. 3, *ovy.*) are in segment xi, in close connection with the vas deferens of each side. I have not identified the oviducts.

The genital sacs (sperm-sac and ovisac) are large ; the male products may extend forwards as a well-marked rounded mass into segment ix. The combined sacs extend backwards through a large number of segments, often to xviii, and even to xxv. The male products are the more conspicuous and usually more bulky ; the female products, ova with granular yolk, are usually posterior, though they may have sperm-morulæ behind as well as in front of them.

In a few specimens the ventral setæ of segment xi are

modified (genital setæ), the prongs of the distal end being much shorter, and the nodulus more distinct (v. text-fig. 3).



FIG. 3.—Genital setæ of *Limnodrilus* sp. (?); by the side of the fully-formed seta is a young one in process of formation: compare with text-fig. 2.

Of the three genera of Tubificidæ which possess only forked setæ in the dorsal as well as in the ventral bundles,—*Limnodrilus*, *Clitellio* and *Vermiculus*,—the two latter are immediately excluded by the characters of their genital apparatus, since *Vermiculus* possesses single male and spermathecal pores, and *Clitellio* has no prostate. It seems probable that the present form is a *Limnodrilus* and that the differences from the usual descriptions of that genus are, in part at least, due to the fact that the examination has been made on preserved material. A few points may, however, be further mentioned.

One would not expect the integumental blood-vessels, which form one of the characteristics of *Limnodrilus*, to be recognizable in preserved specimens; but I am a little surprised that the “ hearts ” of segment viii, or viii and ix, give so little evidence of their existence; they are immediately visible, for example, in preparations of a small *Limnodrilus* from Lahore (species undetermined, as I have not yet met with mature specimens), in which also the main vessels can be followed with ease; this is by no means the case with the Tibet specimens. It is to be remembered, however, that the “ hearts ” need not be specially enlarged vessels; their contractility is their special characteristic.

The vas deferens, again, is in *Limnodrilus* distinguished by its great length, and by being narrow and much coiled (Beddard, *Oligochaeta*, p. 249). This cannot be said of the present form, in which it is comparatively short and stout, and is not coiled; and this difference does not seem to be due to the fact of the animals being examined in the preserved state.

I have not been able to observe the character of the spermatophores mentioned by Beddard, namely that the free ends of the spermatozoa form a spiral on the outer surface.

Admitting, however, this form to a place in the genus *Limnodrilus*, the species must, I fear, remain undetermined; the discrimination of the various species depends largely on the characters of the penis and its sheath, and to some extent also on the shape of the brain,—organs of which unfortunately I can only give incomplete descriptions. I may refer to Beddard's words (p. 251, *op. cit.*), referring to the occurrence of the genus in Hawaii: “ I cannot distinguish any marked peculiarities which justify me in giving it a new name, though on the other hand I have not yet identified it with any of the known forms. Living material is essential for the proper description of these Tubificids.”

REPORT ON A SMALL COLLECTION OF FRESHWATER
MOLLUSCA (*LIMNÆA* AND *PISIDIUM*)
FROM TIBET.

By H. B. PRESTON, F.Z.S.

The Mollusca dealt with in the present paper were recently collected by Captain F. H. Stewart of the Indian Medical Service at high altitudes in Tibet, and were placed in my hands for identification by Dr. N. Annandale, Superintendent of the Indian Museum, Calcutta.

Though there are a good number of specimens, only three species appear to be represented, all belonging to the genera *Limnæa* and *Pisidium*, and I would take this opportunity of tendering my thanks to the Rev. E. W. Bowell and Mr. B. B. Woodward, who have kindly assisted me in working at these difficult groups.

Limnæa hookeri, Reeve.

From the following localities: Gyantse, 13,120 feet, in a pond which dries up in winter, two lots, adult and young; Mang-tsa, 14,500 feet, in a stream from a warm spring which only freezes during the coldest months (February and March; during the rest of the winter there is only a little ice at the edge), two lots, adult and young; Se-chen, 13,100 feet, in marshy pools, a number of specimens, mostly adult;—large quantities of spawn were observed under stones in this locality.

Though the shells vary somewhat in size and form, I am quite able with the series before me to link them all up into the present species.

With regard to the soft parts: Mr. Bowell reports that the genitalia are very similar to those of the common European form *L. auricularia*, Lin. The vas deferens is, however, markedly shorter, and the radula is remarkable for the length of the cusps and their subulate appearance, and also for there being no great distinction in type between the laterals and marginals.

Limnæa bowelli, sp. nov.

Shell rimate, acuminate ovate, rather solid, polished, shining, pale yellowish horn colour; whorls 4, shouldered above, marked with rather coarse lines of growth; sutures deeply impressed; columella descending obliquely and diffused above into a thick callus which joins the upper margin of the peristome; peristome simple; aperture ovately, inversely auriform.



FIG. 1.—*Limnæa bowelli*,
Preston.

Altitude	8.5 mm.
Diam., major	5.25 „
Aperture, alt.	5 „
„ diam.	3.75 „

Mr. Bowell informs me that the radula bears a strong resemblance to that of *L. glabra*, Müll., but has fewer laterals, the general appearance being more suggestive of the radula of a *Planorbis* than that of a *Limnæa*; the maxilla is also very remark-

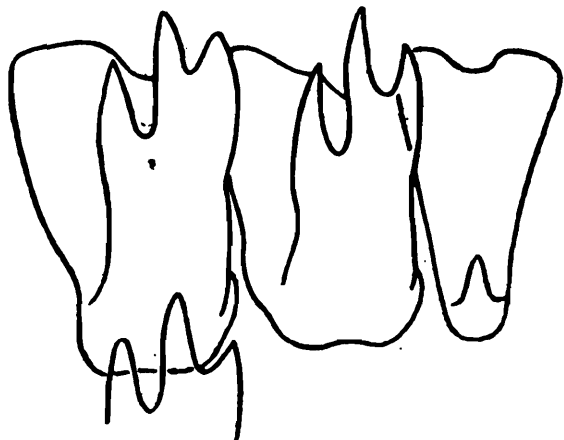


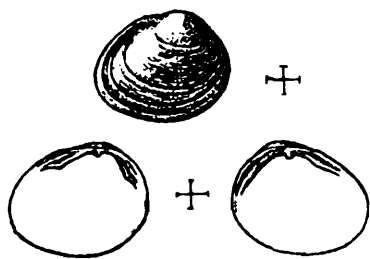
FIG. 2.—Radula of *Limnæa bowelli*, Preston.

able, with a large blunt beak arising from the centre of the semi-circular piece, and he goes so far as to suggest that this last character might possibly form the basis of a new genus.

Habitat—Te-ring Gompa, in a small hill stream arising from a spring, 14,000 feet (this stream does not freeze in winter); also from Mang-tsa, 14,500 feet; High Hill Gompa, Gyantse valley, in a small hill stream, among moss and stones, 14,500 feet; and Gyantse, 13,120 feet.

Pisidium stewarti, sp. nov.

Shell sub-trigonal, rather inflated, pale yellowish horn colour, marked with fine concentric lines of growth; umboes large; anterior lateral teeth somewhat curved with broad groove between, posterior lateral teeth long and straight; cardinal teeth broad and somewhat projecting in right, strong and sharply curved in left valve.



Long.	..	2.25 mm.
Lat.	.	3 „

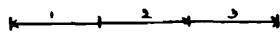


FIG. 3.—*Pisidium stewarti*, Preston.

Habitat—High Hill Gompa, Gyantse valley, in a small hill stream, among moss and stones, 14,500 feet (two specimens only).

Mr. B. B. Woodward, who very kindly examined this species, tells me that he has seen no recent form resembling it, its nearest ally being a fossil from the tertiary deposits of Belgium which, I understand, still awaits description.

NOTE SUR LES PLANORBES RECUEILLIS PAR LE
CAPITAINE F. H. STEWART EN TIBÉT.

Par LOUIS GERMAIN.

Au cours de son voyage dans les montagnes du Tibet, M. le Capitaine F. H. STEWART a recueilli une intéressante collection de Mollusques. M. N. ANNANDALE, Superintendant du Musée Indien, a eu l'aimabilité de me confier l'étude des Planorbes. Je suis heureux de l'en remercier ici.

Les récoltes de M. F. H. STEWART, bien que peu nombreuses, renferment cependant des espèces rares et même un Planorbe nouveau.

Planorbis saigonensis, Crosse et Fischer.

- 1834. *Planorbis*, No. 12, HUTTON, Journ. Asiatic Society of Bengal, iii, p. 91.
- 1834. *Planorbis compressus*, HUTTON, *ibid.*, iii, p. 93 (non MICHAUD).
- 1836. *Planorbis compressus*, BENSON, *ibid.*, v, p. 743, No. 21.
- 1844. *Planorbis Tondanensis*, MOUSSON, *Land- und Süßwasser Mollusken von Java*, p. 44, Taf. v, fig. 4 (non QUOY et GAIMARD).
- 1863. *Planorbis saigonensis*, CROSSE et FISCHER, *Journal de Conchyliol.*, xi, p. 362, pl. xiii, fig. 7.
- 1867. *Planorbis compressus*, VON MARTENS, *Malakozool. Blätter*, xiv, p. 213.
- 1875. *Planorbis compressus*, MORELET, *Séries Conchyliologiques*, iv, Indo-Chine, p. 276.
- 1878. *Planorbis compressus*, SOWERBY, Monogr. of *Planorbis*, in REEVE, *Conch. Iconica*, xx, sp. 118, pl. xiv.
- 1881. *Planorbis confusus*, DE ROCHEBRUNE, *Bullet. Soc. Philomat. Paris*, p. 32.
- 1886. *Planorbis compressus*, CLESSIN, Die Familie der Limnaeiden in MARTINI und CHEMNITZ, *System. Conchyl. Cabinet*, xvii, p. 107, No. 71, Taf. xvii, fig. 10 [indiqué, par erreur, Taf. xvi, dans le texte].
- 1886. *Planorbis saigonensis*, CLESSIN, *ibid.*, p. 191, Taf. xxix, fig. 3.
- 1904. *Planorbis saigonensis*, H. FISCHER et DAUTZENBERG, Catalogue Moll. Indo-Chine, in *Mission Pavie*, p. 414 (tiré à part, p. 44).
- 1904. *Planorbis confusus*, H. FISCHER et DAUTZENBERG, *ibid.*, p. 414.
- 1905. *Planorbis saigonensis*, DAUTZENBERG et H. FISCHER, *Journ. de Conchyliologie*, liii, p. 117.

Cette espèce est certainement voisine du *Planorbis thibeticus* décrit par DESHAYES en 1870.¹ Cependant les exemplaires du Muséum de Paris, sur lesquels DESHAYES a décrit son espèce, diffèrent du *Planorbis saigonensis* par leur forme plus convexe en dessus, par leur dernier tour plus nettement caréné, par leur ouverture plus allongée transversalement, et, généralement, par leur test plus mince, pellucide.

Ainsi que l'a fait remarquer A. MORELET,² le *Planorbis saigonensis*, Crosse et Fischer, est le jeune âge du *Planorbis compressus*, Hutton. Ce dernier nom ayant été antérieurement donné à un Planorbe de la faune française,³ MM. DAUTZENBERG et H. FISCHER⁴ ont, avec raison, adopté le vocable de *saigonensis* pour désigner, sans confusion possible, l'espèce tout d'abord décrite par HUTTON.

Le *Planorbis saigonensis* a une aire de dispersion considérable. Il vit, non seulement dans une grande partie de l'Asie orientale, mais encore au Japon (variété *japonicus*, von Martens⁵) et dans les îles de la Sonde. C'est à une variété, habitant l'île de Java, que MOUSSON⁶ a donné le nom de *Planorbis tondanensis*, confondant ainsi deux espèces bien différentes. Le véritable *Planorbis tondanensis*, décrit par QUOY et GAIMARD,⁷ diffère, en effet, du *Planorbis saigonensis* : par sa spire à croissance plus rapide ; par son dernier tour plus dilaté, à carène très émoussée, à peine sensible ; par sa surface inférieure plus étroitement et plus profondément ombiliquée ; par son ouverture plus oblique, moins anguleuse, présentant un fort encrassement submarginal simulant un bourrelet blanchâtre ; enfin par ses bords marginaux très convergents, réunis par une callosité blanche.⁸ Ces deux derniers caractères sont parfaitement rendus dans les figures de cette espèce données par le Dr. W. KOBELT.⁹

Gyantse (Tibet), à 13,120 pieds, dans une mare desséchée pendant l'été ; 10 Septembre, 1907 [No. 90].

¹ DESHAYES (G. P.). Diagnoses d'espèces nouvelles de Mollusques terrestres et fluviatiles de la principauté de Moupin, Thibet oriental, envoyées au Muséum d'hist. natur. de Paris par M. l'abbé Armand David, *Bulletin des Nouvelles Archives du Muséum*, vi, 1870, p. 27. [*Planorbis thibetanus*.]

² MORELET (A.). *Séries Conchyliologiques*, etc., iv Livraison ; Indo-Chine ; 1875 ; p. 276.

³ MICHAUD (G.). *Complément à l'hist. natur. des Mollusques terr. et fluvi. de France, par Draparnaud* ; 1831, p. 31, pl. xvi, figs. 6—8.

⁴ DAUTZENBERG (PH.) et FISCHER (H.). Liste des Mollusques recoltés par M. le cap. de fregate BLAISE au Tonkin et description d'espèces nouvelles ; *Journal de Conchyliologie* ; liii, 1905, p. 118.

⁵ MARTENS (Dr. E. von). Ueber die ostasiatischen Limnaeacens ; *Malakoz. Blätter* ; xiv, 1867, p. 214.

⁶ MOUSSON (ALBERT). *Die Land- und Süßwasser Mollusken von Java* ; 1849, p. 44, Taf. v, fig. 4.

⁷ QUOY et GAIMARD. *Voyage de découvertes de l'Astrolabe* ; Zoologie ; t. ii, 1833, p. 209 ; Atlas, pl. lviii, fig. 39.

⁸ Je donne ces caractères d'après le *type figuré*, qui appartient aux collections du Muséum d'histoire naturelle de Paris. Son test, un peu brillant, assez solide, est d'un jaune légèrement rougeâtre ; il présente des stries très fines, bien régulières, un peu serrées, à peine plus fortes aux environs de l'ouverture, plus apparentes en dessus qu'en dessous.

⁹ KOBELT (Dr. W.). Land- und Süßwasserkonchylien ; *Abhandl. der Senckenb. naturforsch. Gesellsch.*, Frankfurt ; Bd. xxiv, 1897, p. 82, Taf. xi, fig. 3.

Te-ring Gompa (Tibet), à 14,000 pieds ; 26 Avril, 1907 [No. 43]

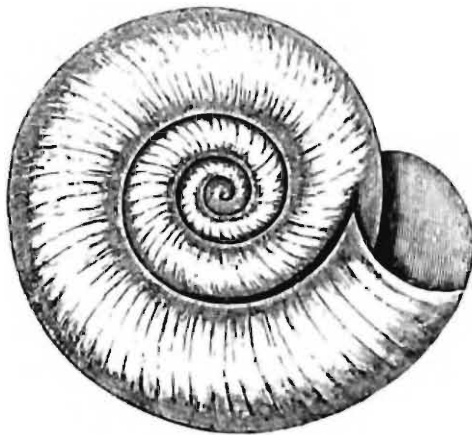
Mang-tsa (Tibet), à 14,500 pieds, dans un lac non gelée en hiver ; Juillet 1907 [No. 65].

Planorbis stewarti, Germain, sp. nov.

Coquille légèrement bombée en dessus, largement et très profondément ombiliquée en dessous, spire composée de $4\frac{1}{2}$ tours à croissance régulière et médiocrement rapide ; dernier tour médiocre, notablement plus bombé dessous que dessus, un peu descendant à son extrémité, nettement arrondi ; sutures bien marquées ; ouverture oblique, ovulaire-arrondie, à bords très convergents.

Diamètre maximum, $4\frac{3}{4}$ millimètres ; diamètre minimum, $3\frac{3}{4}$ millimètres ; épaisseur maximum $1\frac{1}{2}$ millimètres.

Test solide, un peu épais, brillant, d'un jaune ambré un peu grisâtre, orné en dessus de stries très fines, très serrées, assez irrégulières, bien obliques et légèrement onduluses. En dessus les stries, également serrées et irrégulières, sont plus finement marquées.



Planorbis stewarti, Germain, sp. nov.

Cette belle espèce, que je suis heureux de dédier au Capit. F. H. STEWART, rappelle, par sa forme, le *Planorbis sibericus*, Dunker, var. *major*, von Martens.¹ Mais il est surtout voisin du *Planorbis saigonensis*, Crosse et Fischer, dont on le séparera : par sa coquille plus bombée en dessus et beaucoup plus profondément ombiliquée en dessous ; par sa spire à croissance plus régulière ; par son dernier tour bien moins grand proportionnellement, et nettement arrondi ; par ses sutures plus profondes ; enfin par son ouverture plus ovulaire-arrondie, à bords plus rapprochés.

Rham-Tso (Tibet), à 14,700 pieds, dans les herbes d'un lac, avec le *Planorbis himalayaensis*, Hutton ; 12 Août, 1907 [No. 76].

¹ MARTENS (Dr. E. von). Über centralasiatische Mollusken, *Memoires de l'Académie impér. sciences Saint-Petersbourg*, xxx, No. 11, 1882, p. 43, Taf. iv, figs. 13a, 13b, 13c.

Planorbis himalayaensis, Hutton.

1886. *Planorbis himalayaensis*, HUTTON, in CLESSIN, Die Familie der Limnaeiden; in MARTINI und CHEMNITZ, *System. Conch. Cabinet*, xvii, p. 141, No. 118, Taf. xx, fig. 8.

Les exemplaires recueillies par le Capit. F. H. STEWART correspondent bien à la description et à la figuration de CLESSIN; ils sont seulement de taille plus faible, leur diamètre maximum n'atteignant que 4 millimètres.¹ Le test, relativement solide, est mince, d'un jaune ambré clair, orné de stries assez arquées, plus serrées et plus fortes en dessous qu'en dessus.

Cette espèce présente d'étroits rapports avec le *Planorbis nanus*, Benson,² et il est fort possible que la possession de matériaux suffisants conduise à la réunion de ces deux coquilles.

Te-ring Gompa (Tibet), à 14,000 pieds, près de la source de la rivière; 15 Juillet, 1907.

High Hill Gompa, Gyantse (Tibet), à 14,500 pieds, sous les pierres et les herbes aquatiques d'un rivière; 10 Juillet, 1907 [No. 58].

Rham-Tso (Tibet), à 14,700 pieds, dans les herbes d'un lac d'environ 10 mile de long sur 6 de large; 12 Août, 1907 [Nos. 575 et 76].

Planorbis barrakporensis, Clessin.

1886. *Planorbis Barrakporensis*, CLESSIN, Die Familie der Limnaeiden, in MARTINI und CHEMNITZ, *System. Conchyl. Cabinet*, xvii, p. 125, Taf. xvii, fig. 7.

Les exemplaires de cette espèce recueillis au Tibet ont un test assez clair, ambré un peu fauve, plus brillant dessous que dessus, peu épais, orné de stries fines, serrées, bien obliques, moins accusées dessous.

Le *Planorbis huttoni*, Benson,³ n'est qu'une variété de cette espèce se distinguant du type par son enroulement plus rapide, son dernier tour plus dilaté, plus arrondi, un peu descendant à son extrémité, enfin par son ouverture plus ovale.

Mang-tsa (Tibet), à 14,500 pieds, dans les herbes d'un étang qui n'est pas gelé en été; 2 Juillet, 1907 [No. 52].

Gyantse (Tibet), à 13,120 pieds; 5 Décembre, 1906 [No. 4].

¹ La type de CLESSIN mesure 5½ millimètres de diamètre maximum. Il provient de Tinjori Valley, Inde.

² BENSON, *Proceed. Zoolog. Society, London*, 1856, p. 186. Ce Planorbe a été figuré par SOWERBY, *Monograph of the genus Planorbis*, in REEVE, *Conch. Iconica*, xx, 1878, sp. 75, pl. ix, figs. 75a—75b.

³ BENSON in CLESSIN, *loc. supra citat.*, xvii, 1886, p. 139, Taf. xviii, fig. 4.

COMPARISON OF THE FISH FAUNA OF THE NORTH AND THE SOUTH FACES OF THE GREAT HIMALAYAN RANGE.¹

By F. H. STEWART, M.A., D.Sc., M.B., *Captain, I.M.S.*

In the area of the "North face of the Great Himalayan Range" it is intended to include not only the north face of the great range proper, but the whole area bounded on the south by the crest of the Himalayas, and on the north by the Karakorum range and its continuation eastward. This area is composed of the Trans-Himalayan portions of the catchment-areas of the Brahmaputra on the east and of the Indus on the west, with the Mansarowar and the Trans-Himalayan Sutlej areas lying in the centre. It extends through twenty degrees of longitude and has an area of about 203,000 sq. miles.

As far as our present subject is concerned the principal physical characteristics of this region are—

1. Its great elevation above sea-level (Chaksam ferry on the Brahmaputra, longitude $90^{\circ} 45' E.$, 11,550 feet; Rhams-tso, near the crest of the range, $89^{\circ} 30' E.$, 14,700 feet; Shigatse on the Brahmaputra, $89^{\circ} E.$, 12,800 feet; sources of the Brahmaputra, between 82° and $83^{\circ} E.$, 16,000 feet; Lake Mansarowar, $81^{\circ} E.$, 14,900 feet; Gartok on the sources of the Indus, $80^{\circ} 25' E.$, 15,100 feet; Leh on the Indus, $78^{\circ} E.$, 11,300 feet; Indus at Skardo, $75^{\circ} 30' E.$, 8,900 feet).

2. Its very low rainfall. The greater portion of the water appears to be derived from springs.

3. The very sparse vegetation.

4. The rapidity of flow of the streams.

The south face of the great chain on the other hand includes the catchment-areas of the Manas, Raidak, Tista, Kosi, Bagmati, Rapti, Karnali, Kali, Ramganga, Ganges, Jumna, Beas, Ravi, Chenab and Jhelum, and the Cis-Himalayan portions of the areas of the Brahmaputra, Sutlej and Indus.

In regard to the elevation of this area from the zoologist's point of view, it must be remembered that most specimens have been taken from rivers running in the depths of the valleys at probably not more than 3—4,000 feet above sea-level.

In contrast to the north face the south face is, of course, a region of heavy rainfall and abundant vegetation.

It should be noted that the crest of the Himalayan range does not correspond with the watershed, but that the former lies considerably to the south of the latter. As will be pointed out below, we have at present no data which would enable us to decide which of these two lines forms the zoological boundary between the two regions.

¹ For the geographical facts in this note I am chiefly indebted to Burrard and Hayden [2].

The records of fish obtained from the northern area are, of course, still somewhat scanty. They are to be found in the *Fauna of British India* (comprising fish from Leh and Ladak), Tate Regan's reports on the fish collected during the Tibet mission, and Lloyd's report in the present series.

From the northern area seventeen species of fish are at present known, belonging to the families Siluridæ and Cyprinidæ.¹ From the southern area thirty-six species of these two families are recorded in the *Fauna of British India*. These two groups have only two species in common (*Schizothorax esocinus* and *Diptychus maculatus*). (These two species are also the only forms from the Trans-Himalayan Indus which have not hitherto been found in the Trans-Himalayan Brahmaputra. Thus there are no species common to the latter and to the rivers of the south face of the Himalayas.) Thus of these two families there are fifteen species confined to the northern region, thirty-four to the southern, and two are found in both.

The separation of the two groups may be chiefly due to (1) a physical obstacle separating the two water-systems and preventing the passage of fish from one system to another, or (2) some difference in the biological environment in the two systems.

(1) It would appear that the importance of a watershed as a barrier might be very easily exaggerated. The Tang-la is the watershed between the Nyang-chu, which runs into the Brahmaputra, and the Amu-chu, which runs into the Raidak. With a height of 15,200 feet it might be expected to form a fairly efficient obstacle. We find, however, that the streams on the two sides of the pass are separated by a distance of at the most one mile, and that this mile consists, not of abrupt cliffs, but of gently sloping open ground. In the rainy season the smallest rivulets doubtless approach each other much more closely. To the north of the Tang-la a series of rivulets and marshes extends throughout the twenty miles which separate the pass from the Rham-Tso. Such a watershed is not likely to prove a more efficient barrier in its purely physical aspect, than, for instance, the watershed separating the Clyde and the Tweed.

In this connection it may be noticed that the young of these river fish are extremely fond of intruding themselves into the smallest and shallowest streams.

(2) With no further data than those at present at our disposal, it is not possible to discuss differences in biological surroundings

¹ Salmonidæ are not known from the basins of either the Indus or Brahmaputra. In the collections of the Indian Museum are specimens of a *Salmo* which have been identified by Tate Regan as *S. oxianus*, Kessler. Tate Regan considers this species to be only doubtfully distinct from *S. fario*, the common British brook trout. These specimens come from (1) the Koksha river, Zila, Chitral, at a height of 8,000 feet above sea-level, and (2) from small tributaries of the Bammian river in Northern Afghanistan at a height of 10,000 feet. Both the Koksha and Bammian rivers run northward into the Oxus.

These are the two points at which the Salmonidæ approach most closely to the rivers of the Himalayas.

between the two regions. One fact may, however, be worth recording, namely, the remarkable quantity of mud and decomposable organic matter suspended in the water of the Nyang-chu. Water placed in a bottle deposited a considerable layer of mud, and if allowed to stand for more than a day, began to give off a most objectionable odour.

It is much regretted that no collections were made from streams to the south of the Tang-la, especially in the plains of Phari and Ling-matang, where the character of the surroundings is still largely Tibetan. As far as I am aware no collections have ever been made from the rivers of the south face of the Himalayas near their sources between the watershed and the crest of the range. It is, therefore, not possible to say with which of these two lines the line of separation of the faunas corresponds.

Dr. Annandale informs me that *Rana pleskii*, the only amphibian at present known from the provinces of Tsang and Ü, is not known to occur on the south face of the Himalayas. This animal, in addition to frequenting the marshes of the valleys, penetrates into the most minute streams on high and bare hillsides. A watershed would, therefore, be no obstacle to it.

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1. Boulenger, G. A. "On some Batrachians and Reptiles from Tibet," *Ann. Mag. Nat. Hist.* (7), vol. xv (1905), p. 378.
2. Burrard, S. G., and Hayden, H. H. *A sketch of the Geography and Geology of the Himalaya Mountains and Tibet*, Calcutta, 1907.
3. Tate Regan, C. "Descriptions of five new Cyprinid fishes from Lhasa, Tibet," *Ann. Mag. Nat. Hist.* (7), vol. xv (1905), p. 185.
4. Tate Regan, C. "Descriptions of two new Cyprinid fishes from Tibet," *Ann. Mag. Nat. Hist.* (7), vol. xv (1905), p. 300.

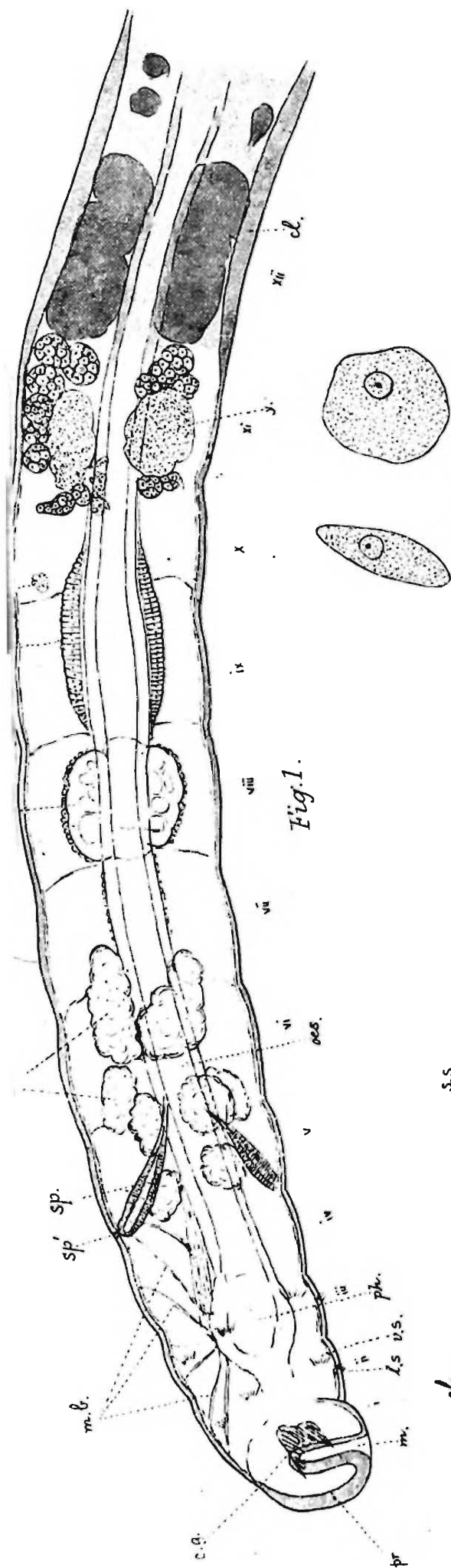


Fig. 1.

Fig. 2.

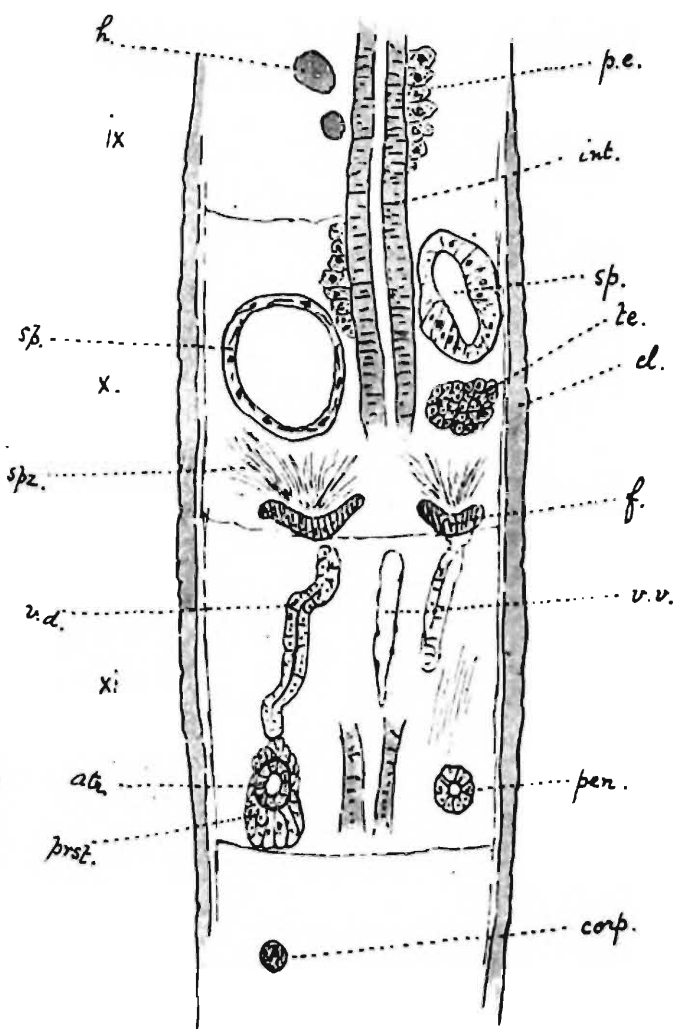


Fig. 4.

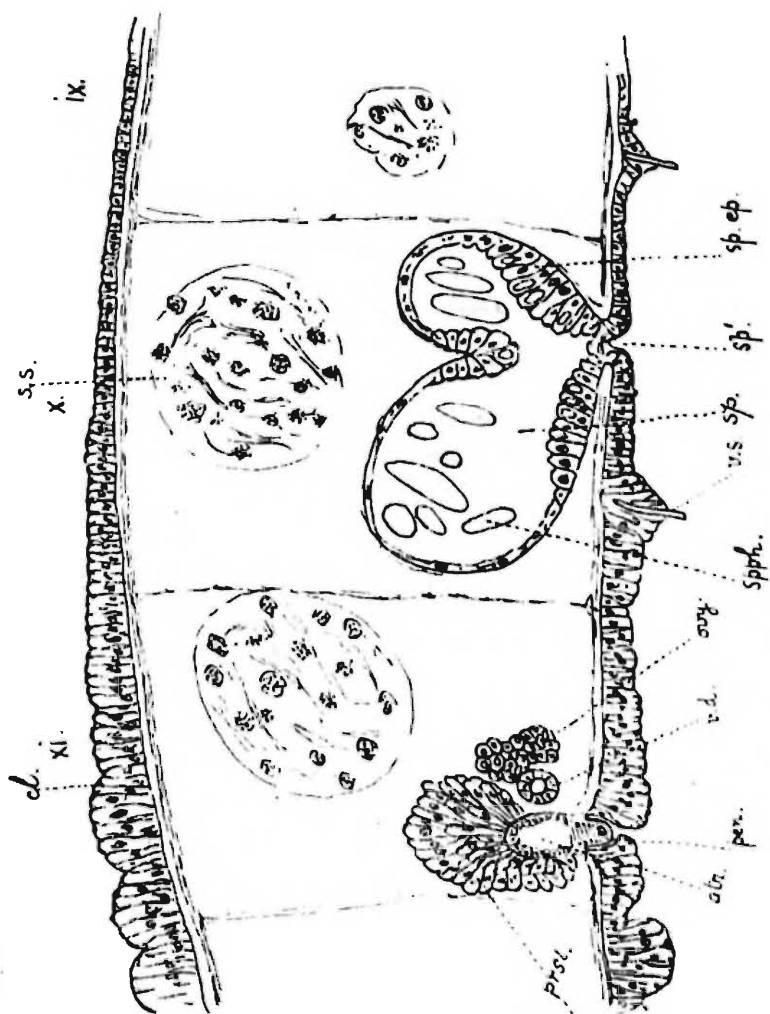


Fig. 3.

IV NOTE ON SOME AMPHIBIOUS COCKROACHES.

By R. SHELFORD, M.A., F.L.S.

Early in 1908, Dr. Nelson Annandale forwarded to me a tube of spirit containing four examples of cockroaches which he had found in a jungle stream in the Dawna Hills of Lower Burma and asked me to report on them. Three of the specimens are larval forms of a species of *Epilampra*, and the fourth is an adult winged male, also of the genus *Epilampra* and apparently new to science. Dr. Annandale, in a letter to me on the subject of these cockroaches, writes:—"The wingless specimens were under stones in a small jungle stream and behaved just as the one I obtained in Chota Nagpur did.¹ The winged specimen was under a stone at the edge of the stream, but swam readily when pursued. It did not seem so much at home in the water, however, and apparently could not, owing to its wings, raise the tip of its abdomen above the surface." The wingless specimens are male larvæ, and exhibit the same modifications for an amphibious life as I have described them in very similar larvæ from Borneo²; that is to say, the terminal abdominal spiracles are situated at the base of two tubes projecting from below the seventh abdominal tergites. I have nothing further to add to that account beyond stating that the genus *Rhcnoda* can be distinguished from *Epilampra* by the forward production of the pronotum which completely covers the head, whereas in *Epilampra* the vertex of the head is exposed; adult males of *Rhcnoda* have not yet been recognised with certainty. It is quite evident that some species of *Epilampra* are amphibious in their early stages and probably all the species of *Rhcnoda* are amphibious throughout the whole of their life. At first I was inclined to believe that the larvæ sent me by Dr. Annandale were the young stages of the adult male, in spite of the different shape of the pronotum and the greater breadth of the abdomen in the larvæ, for we know that the larvæ of the species of *Gyna*, an African genus of cockroaches, differ from their adults just in these very characters. But after a careful examination I have come to the conclusion that Dr. Annandale's specimens constitute two distinct species. Mr. J. Mangan, in a paper "On the mouth-parts of some Blattidæ,"³ has described some peculiar processes that occur on the inner edge of the lacinia of the maxilla. These processes sometimes afford valuable characters for discriminating

¹ *J. Asiat. Soc. Bengal* (N. S.), ii, pp. 105-106 (1906).

² *Zoologist*, June 1907.

³ *Proc. R. Irish Acad.*, xxvii, Sect. B, No. 1 (1908).

species ; in closely allied species such as *Ectobius lapponicus*, L., and *E. perspicillaris*, Herbst, they appear to be identical, but though I have examined a considerable number of species, I have not yet found the processes to differ in structure in the same species at different stages in its life-history. Since these processes differ in the larvæ and in the adult submitted to me by Dr. Annandale (text-figs. 1 and 2), I am consequently of opinion

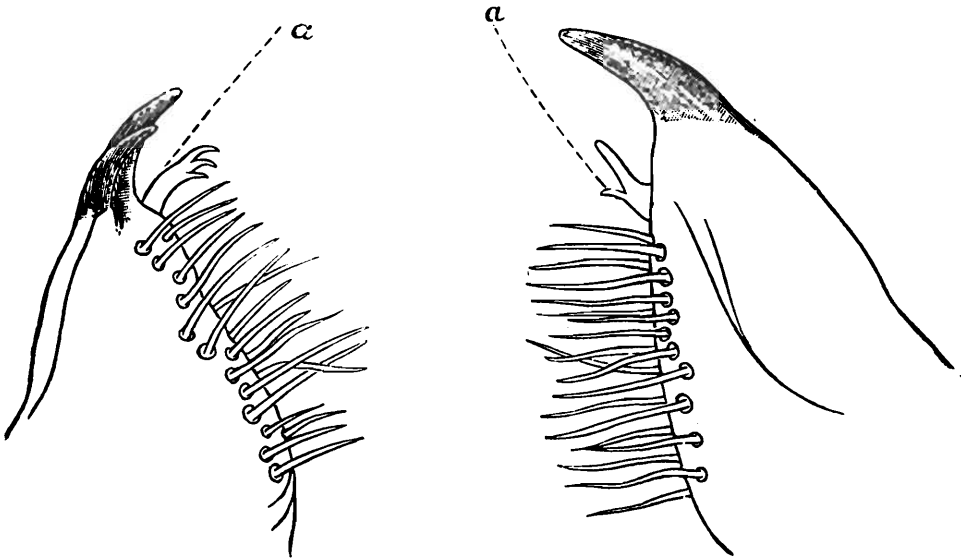


FIG. 1.

FIG. 2.

FIG. 1.—Right lacinia of *Epilampra annandalei*, ♂, inner aspect, × 100.

„ 2.—Right lacinia of *Epilampra* sp., larva, outer aspect, × 100.

a = process of lacinia.

NOTE.—The bifid tip of the lacinia shown in fig. 2 is hidden beneath the large outer tooth.

Drawn with the camera lucida.

that the larvæ and adult must be referred to two quite distinct species. The adult exhibits no modifications whatever for an aquatic or amphibious life, the legs are not adapted for swimming and there is no sign of spiracular tubes projecting from beneath the seventh abdominal tergites as in the larvæ. As the tegmina and wings project beyond and cover the tip of the abdomen, the cockroach would not be able to rest below the surface of the water and at the same time draw in its air-supply through the terminal spiracles as can the larvæ, and I very much doubt if it can even swim below the surface of the water. Dr. Annandale's remarks in another letter to me on the swimming habits of this cockroach are worth quoting here :—“ The cockroaches were collected on a very hurried trip and I had little opportunity to study them. I am sure, however, that the winged form could only swim on the surface. It took to the water as most, or at any rate very many, of the smaller Indian Orthoptera will, if hard pressed. This is true of most Acridiids and many smaller Locustids and I think of nearly all crickets and many cockroaches, though perhaps to a less extent in the cockroaches. Many Indian cockroaches, especially

Epilampridæ, live in damp places near the edge of jungle streams and do not mind getting wet. It is astonishing what a large proportion of insects can swim well if they are forced to do so, and I think that in India there is a very marked tendency for members of terrestrial groups of all kinds to become aquatic or amphibious.' From observations in Borneo I can confirm Dr. Annandale's remarks, for I have frequently seen species of *Tettix* (s. l.) and *Tryxalides* take to the water when disturbed.

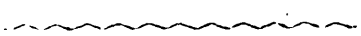
I have much pleasure in naming the new species after its discoverer.

Epilampra annandalei, sp. nov.

♂ Rufo-castaneous. Vertex of head freely exposed, finely dotted with fuscous; eyes wide apart. Pronotum trapezoidal, posteriorly produced obtusely, finely dotted with fuscous, smooth, litid. Tegmina exceeding the apex of the abdomen, unicolorous, impunctate. Wings with marginal area flavous, ulnar vein with fifteen rami, four being complete. Abdomen rufo-testaceous, supra-anal lamina produced, subquadrate, apex slightly emarginate, subgenital lamina rather large, produced, slightly asymmetrical, with two slender styles. Cerci long, acuminate. Femora strongly armed: front femora armed on anterior margin beneath with seven spines succeeded distally by filiform setæ; four spines on posterior margin. Formula of apical spines, $\frac{2}{1}$, $\frac{1}{1}$, $\frac{1}{1}$. Posterior metatarsi very long, exceeding the remaining joints in length, completely bi-serrulate beneath, second tarsal joint also armed beneath; all the pulvilli minute, apical.

Total length 20 mm.; length of body 12 mm.; length of tegmina 16 mm.; pronotum 41 mm. $\times$ 5 mm.

This species belongs to the group characterised by the small size, impunctate pronotum and elongate metatarsi; its nearest allies are *E. fervida*, Walk., *E. quadrinotata*, Walk., *E. geminata*, Br., and *E. flavomarginata*, Shelf. The larvæ cannot be referred with certainty to any known species, since we are almost entirely ignorant of the metamorphoses of any Blattidæ, but it would be unwise to describe a new species based only on immature forms, and for the present they must remain without a name.



V. DESCRIPTION DE QUELQUES NOUVELLES CÉCIDOMYIES DES INDES.

Par l'Abbé J. J. KIEFFER, Docteur phil. nat., professeur à Bitsch.

La famille des Cécidomyies, si riche en espèces et si intéressante dans le genre de vie et les premiers états de ses représentants, commence aussi dans les Indes à attirer sur elle, l'attention des amis de la nature. Grâce au Rév. P. Auguste Haas, professeur de chimie à Trichinopoly, il m'a été possible d'observer et d'étudier les espèces suivantes¹ : *Clinodiplosis nodifex*, K., *C. artemisiarum*, K., *C. cellularis*, K., *Daphnephila haasi*, K., *D. glandifex*, K., *D. linderæ*, K., *Lasioptera longispatha*, K., *L. trilobata*, K., *Oligotrophus indianus*, K., *O. mangiferæ*, K., *O. quadrilobatus*, K., *O. tenuispatha*, K., *Peromyia bengalensis*, K., *Rhopalomyia haasi*, K., *Schizomia incerta*, K., et *S. indica*, K. Le zèle avec lequel le chef de l'Indian Museum, Monsieur N. Annandale, cultive l'Entomologie aux Indes, donne lieu d'espérer que dans un avenir peu éloigné, la connaissance des Cécidomyies aura fait de grands progrès dans ce pays. Nous donnons ici la description de deux nouvelles espèces.

Lestremia indica, sp. nov.

Jaune; thorax brunâtre, pleures plus claires; antennes et pattes brunâtres. Yeux glabres et confluent. Les quatre articles des palpes graduellement plus minces et plus longs, le quatrième presque deux fois aussi long que le troisième. Antennes de 2+9 articles; les 9 articles du flagellum sessiles, de moitié plus longs que gros, sub-cylindriques, à peine amincis à leur extrémité, avec

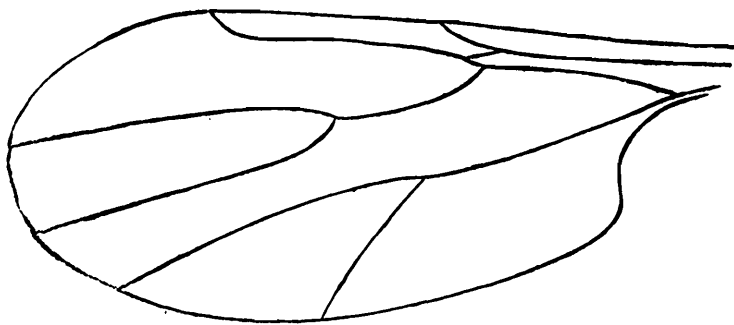


FIG. 1.—Aile.

¹ "Etude sur de nouveaux Insectes et Phytoptides gallicoles du Bengale," *Ann. Soc. Scientif. Bruxelles*, 1905, vol. 29, p. 143—200, avec 1 planche et 15 fig. dans le texte; "Description de Galles et d'Insectes gallicoles d'Asie," *Ibidem*, vol. 33.

un verticille de soies et sans autres appendices; article terminal plus de deux fois aussi long que gros, graduellement aminci à l'extrémité, sans prolongement. Ailes avec poils microscopiques qui leur donnent un aspect ponctué (fig. 1); partie distale de la 1^e nervure de moitié plus longue que la transversale qui est très oblique; extrémité du cubitus située vis-à-vis de la base du 2^e tiers de la fourche de la 3^e nervure; tige de cette fourche égale à la moitié de la longueur de la fourche, un peu arquée, ayant son origine un peu avant l'extrémité de la transversale; les deux rameaux de la fourche, presque droits et subparallèles; 4^e nervure bifurquée avant la fourche de la 3^e, son rameau inférieur droit et très oblique. Métatarse antérieur aussi long que les trois articles suivants réunis; 5^e article trois fois aussi long que gros; pulvilles nuls; empodium plus court que les crochets tarsaux, ceux-ci ayant leur milieu élargi et dentelé. Dernier article des lamelles de l'oviducte deux fois aussi long que large. Taille ♀, 2 mm; Calcutta (N. Annandale).

Contarinia (Stictodiplosis) pulcherrima, sp. nov.

Imago.—D'un blanc sâle; antennes noires sauf les deux premiers articles; les quatre tarses antérieurs, l'extrémité des quatre fémurs antérieurs, les deux bouts des quatre tibias antérieurs et le métatarse postérieur noirs; le reste des pattes jaunes; larges bandes transversales sur l'abdomen, trois bandes longitudinales sur le mesonotum et taches sur les mésopleures et sur les métapleures brunes; pince du mâle brunâtre; dessus et dessous de l'abdomen et une tache latérale sur chaque segment avec de longs poils noirs; poils des pattes jaunes, ceux des taches noirs; occiput avec de longues soies arquées en avant; scutellum avec 12 soies fort longues; des soies semblables sur le bord postérieur des segments dorsaux de l'abdomen. Occiput avec un prolongement conique. Palpes composés de 4 articles graduellement plus longs, le 4^e deux fois aussi long que le 3^e. Antennes de 2+12 articles; les deux premiers articles du flagellum soudés l'un à l'autre. Chez la femelle les articles du flagellum sont cylindriques, plus de deux fois aussi longs que gros, avec deux verticilles de soies et terminés par un col égal à la moitié de leur longueur, sauf le premier et le dernier; chez le premier, qui est cinq fois aussi long que gros, rétréci faiblement au milieu et parcouru transversalement par de fines lignes de poils, le col n'atteint que le cinquième de l'article; chez le dernier, le col est remplacé par un prolongement obtus qui est un peu plus long que gros. Chez le mâle, les articles du flagellum sont composés de deux nœuds, dont le basal est globuleux et le terminal est ellipsoïdal, sauf aux deux premiers articles qui ont les deux nœuds ellipsoïdaux; le rétrécissement qui sépare les deux nœuds est aussi long que le nœud supérieur, et un peu plus court que le col qui termine le nœud supérieur; chaque nœud porte un verticille de soies et un verticille de filets arqués, ce dernier à peine plus court que le premier et hyalin. Scutellum

avec 12 soies fort longues ; des soies semblables sur le bord postérieur des segments abdominaux. Ailes jaunes, traversées par deux bandes transversales d'un noir bleuâtre ; ces deux bandes

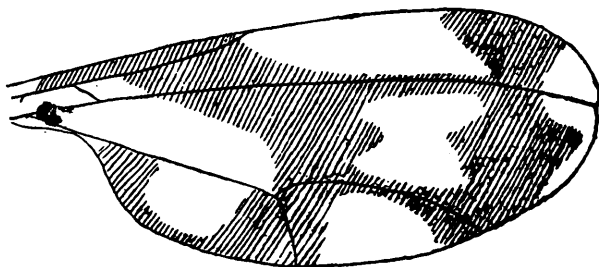


FIG. 2.—Aile.

sont reliées l'une à l'autre par deux traits dont le supérieur suit la 2^e nervure, et l'inférieur suit le rameau supérieur de la troisième nervure ; en outre, la première bande envoie un prolongement étroit le long du bord supérieur et du bord inférieur de l'aile jusque près de la base ; les nervures sont jaunes ou noires, selon l'espace qu'elles parcourent ; il en est de même des poils du bord costal. La nervure transversale est oblique et située au premier quart de la 1^{re} nervure longitudinale ; 2^e nervure longitudinale droite aboutissant à l'extrémité alaire, le bord costal interrompu à cet endroit ; rameau supérieur de la 3^e nervure fortement arqué, l'inférieur presque perpendiculaire à la tige de la fourche. Aux pattes antérieures, le tibia est égal au 2^e article tarsal, qui est aussi long que les trois articles suivants réunis ; le 3^e est d'un tiers plus long que le 4^e ; celui-ci quatre fois aussi long que gros, presque double du 5^e ; empodium aussi long que les crochets. Pince du mâle et oviducte de la femelle conformés comme d'ordinaire dans ce genre. Taille ♂ ♀, 2.8—3 mm.

Nymphe.—Armure frontale nulle. Soies cervicales très longues, plus longues que les stigmates thoraciques ; ceux-ci bruns, arqués, à peine plus minces à l'extrémité qu'à la base, très longs, quatorze fois aussi longs que gros. Spinules dorsales jaunes, chaque série composée de 2 ou 3 rangées. Corps couvert de verrues petites, pointues, disposées en rangées, et groupées par deux.

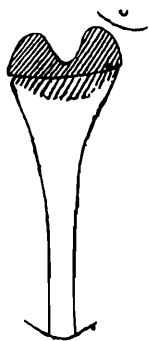


FIG. 3.—Spatule.

Larve.—Blanche ou vitelline, sans autre verrues que les spiniformes ; papilles dorsales et latérales sans soie. Spatule jaune

(fig. 3), partie évasée divisée par une incision arquée, en deux lobes transversaux et obtus. Métamorphose en terre, en décembre ; éclosion quinze jours plus tard.

Oeuf blanc, trois fois aussi long que gros, muni d'un pédicule effilé et à peine plus court que l'œuf.

Galle.—Renflement des rameaux de *Symplocos theæformis*, L., ? plante nommée *Kharani* par les indigènes. Sous l'écorce se trouvent de nombreuses cellules situées sans ordre dans la couche ligneuse. Kurseong (R. P. Auguste Haas).

VI DESCRIPTION OF NEW LAND AND MARINE SHELLS FROM CEYLON AND S INDIA

By H. B. PRESTON, F.Z.S.

Of the specimens described in the present paper, many were collected by the author in the years 1895—7 in the province of Uva, Central Ceylon, while others, including all the marine species, were obtained from the collection of the late Mr. Hugh Nevill, when that collection was dispersed at auction some few years ago in London.

1. *Euplecta foveolata*, sp. nov.

Shell broadly turbate, sharply carinate, rimate, light yellowish brown, glossy, sculptured above with very indistinct spiral striæ and fine closely set arcuate riblets, base of shell polished, smooth, marked only with lines of growth; whorls $5\frac{1}{2}$, rapidly increasing in size; sutures well-impressed; columella reflexed, thus partly concealing the narrow perforation; aperture obliquely sublunate; peristome thin.

Altitude	10.5 mm.
Diam., major	16 „
Aperture, alt.	6 „
„ diam.	7.25 „
Habitat—S. India.	

A very graceful and beautiful species which, unlike most of the members of this group, shows no trace of granulation in the sculpture.

2. *Euplecta lankaensis*, sp. nov.

Shell thin, slightly polished, pale yellowish white, conoidal, slightly carinate; whorls $6\frac{1}{2}$, very flat, sculptured with fine transverse lines of growth crossed by very indistinct spiral striæ, presenting a very fine decussate appearance; sutures not deeply impressed; base of shell somewhat convex; umbilicus very narrow and almost concealed by the reflexion of the columella; columella descending obliquely; peristome acute; aperture broadly lunate.

Altitude	7 mm.
Diam., major	8.25 „
Aperture, alt.	5.5 „
Habitat—Matale, Ceylon.	

Allied to *Euplecta convexiuscula*, Pfr., but not marked with such coarse lines of growth ; the present species is also finely decussate and more strongly carinate ; moreover, the spire is considerably higher and the whorls are much flatter.

3. *Euplecta neglecta*, sp. nov.

Shell conoidal, thin, pale brownish yellow ; whorls 6, sculptured with somewhat coarse, oblique, transverse striæ crossed by spiral striæ presenting in places a faintly decussate appearance, the last whorl acutely carinate at the periphery, the carina being of a paler colour than the rest of the shell ; sutures impressed ; base of shell very convex, smooth except for lines of growth ; umbilicus very narrow and partly covered by the reflexed columella ; columella descending vertically ; peristome acute ; aperture broadly lunate.

Altitude	10 mm.
Diam., major	14.5 „
Aperture, alt.	5.5 „
„ diam.	6.5 „
Habitat—Uda Pussellawa, Ceylon.	

The present species may be compared with *E. emilliana*, Pfr. ; it differs, however, from that species mainly in the following characters : its more conoidal shape and inflated base, its broader aperture and its much less markedly decussate sculpture.

It may be of interest to mention here that specimens of *Euplecta lævis*, Blanford,¹ occurred, though sparingly, with *E. neglecta*, and I take this opportunity of recording the fact, as in his description of *E. lævis* the late Dr. W. T. Blanford was unable to give an exact locality for his species.

4. *Microcystis edithæ*, sp. nov.

Shell depressedly turbinate, narrowly perforate, thin, semi-hyaline, polished, fulvous-brown ; whorls 4, minutely, spirally striate, the striæ being especially noticeable on the second whorl, the last two whorls marked with lines of growth ; base of shell sculptured with fine, wavy striæ presenting under the microscope an almost finely granular appearance ; sutures almost channelled ; columella reflexed over and partly concealing the umbilicus ; peristome acute ; aperture obliquely lunate.

Altitude	1.25 mm.
Diam., major	2.5 „
Habitat—Uda Pussellawa, Ceylon.	

A pretty little hyaline form whose nearest ally appears to be *M. thwaitesi*, Pfr. ; from this it is, however, easily distinguishable by its much smaller size and darker colour and by its having fewer whorls than that species.

¹ *Proc. Malac. Soc. London*, vol. iv, pp. 241—253.

5. *Microcystis thwaitesi*, Pfr., var. *depressa*, var. nov.

Much more depressed than the typical form, the spire being scarcely raised at all, in other respects it appears to be normal.

Habitat—Uda Pussellawa, Ceylon.

6. *Microcystis winifredæ*, sp. nov.

Shell depressed, narrowly perforate, thin, polished, shining, yellowish horn colour ; whorls 3, sculptured throughout with very minute, spiral striæ ; sutures impressed ; umbilicus deep, very narrow, partly concealed by the reflexed columella ; peristome simple ; aperture broadly lunate.

Altitude	4.75 mm.
Diam.; major	8.5 „
Aperture, alt.	4.25 „
„ diam.	3.5 „
Habitat—Uda Pussellawa, Ceylon.	

7. *Thysanota elegans*, sp. nov.

Shell trochiform, rimate, vitreous, yellowish white ; whorls 6, the first two rounded, spirally striate, the remainder sculptured with fine spiral lines crossed by coarser, transverse, arcuate striæ and bearing a strong, peripheral, hairy liration, the last whorl sharply carinate at the base ; base of shell spirally striate only ; sutures deeply impressed ; umbilicus very narrow ; peristome simple ; aperture narrow, sublunate.

Altitude	1.75 mm.
Diam., major	1.5 „
Habitat—Uda Pussellawa, Ceylon.	

Differing from *Thysanota hispida*, Sykes,¹ in its much smaller size and more graceful form ; both the spiral and arcuate transverse striæ appear to be a character which are also absent in *T hispida*.

8. *Glessula sinhila*, sp. nov.

Shell moderately thin, polished, dark yellowish horn colour, obtusely lanceolate ; whorls $7\frac{1}{4}$, marked with very faint lines of growth only ; sutures impressed ; columella descending in a very oblique curve ; peristome simple, bent slightly inwards above ; aperture inversely, elongately auriform.

Altitude	21.75 mm.
Diam., major	9 „
Aperture, alt.	7.75 „
„ diam.	4 „
Habitat—Ceylon.	

¹ *Proc. Malac. Soc. London*, vol. iii, p. 160.

Allied to *G. inornata*, Pfr., but easily distinguished from that species by its much more slender form.

9. *Mangilia (Daphnella) angusticincta*, sp. nov.

Shell fusiform, yellowish white, encircled by a suprasutural, thin, chocolate-coloured band which continues on the body-whorl below the periphery; whorls 6, strongly carinate above, sculptured with transverse costæ and fine spiral striæ, the last whorl bearing a somewhat coarse spiral liration towards the base; sutures scarcely impressed; peristome varicosely thickened; columella straight above, excavated below where it is stained reddish brown; aperture elongate.

Altitude	7.5 mm.
Diam., major	3 „
Aperture, alt.	2.5 „
„ diam.	.5 „
Habitat—Ceylon.	

Allied to *D. bella*, Pease¹ (= *Mangilia interrupta*, Rve.), from which it differs in its narrower form, much more angled whorls and single narrow, deep, chocolate band; the costæ in the present species are also much stronger and the aperture is narrower; moreover, in *D. bella* the columella is not stained and is not so much excavated at the base as in *M. angusticincta*.

10—11. *Phyllina purpureo-cincta*, sp. nov.

Shell ovate, rather broad in proportion to its height, solid, coarsely tuberculate, the tubercles arranged in spiral rows, and sculptured throughout with spiral grooves and ridges, white, encircled with an infrasutural band of purplish brown, the last whorl painted with two other bands of the same colour between the rows of tubercles; whorls 5; sutures irregular, lightly impressed; peristome varicosely thickened, bearing five small denticles on the lower portion; columella almost straight and tinged with pale mauve, bearing three small denticles near its base, of which the middle one is the largest; canal very short; aperture ovate; interior of shell painted with two spiral bands of purplish brown, the intervening spaces being discoloured with a very pale shade of the same colour; operculum horny, with a central nucleus, purplish brown edged with a pale horn-coloured rim.

Altitude	8.5 mm.
Diam., major	5.25 „
Aperture, alt.	3 „
„ diam.	1 „
Habitat—Ceylon.	

¹ *Proc. Zool. Soc. London*, 1860, p. 147.

12—13. *Nassa shawi*, sp. nov.

Shell solid, ovate, yellowish brown; spire acuminate; whorls $6\frac{1}{2}$, rapidly increasing in size, sculptured with transverse costæ and somewhat coarse, wavy, spiral grooves which become obsolete at the periphery of the last whorl; sutures crenulate; columella finely denticulate at base, curved and extending upwards into a callus which reaches the lip above; peristome varicosely thickened behind, thin and serrated at the edge; denticulate just within the aperture; aperture sub-ovate; canal short.

Altitude	8 mm.
Diam., major	4.75 „
Aperture, alt.	2 „
„ diam.	1.25 „
Habitat—Ceylon.	

14. *Pentadactylus ceylonicum*, sp. nov.

Shell fusiform, moderately solid, pale flesh colour; whorls $6\frac{1}{2}$, sharply angled below the sutures, scabrous, sculptured with coarse transverse varices and reddish brown tuberculous ridges, the interstices occupied by spiral ridges of a finer character; sutures scarcely impressed, irregular; columella straight, bearing three very indistinct plaits towards the base and diffused into a callus which joins the lip above; outer lip serrated, bearing six plait-like denticles which run some little distance into the mouth of the shell; aperture ovate; canal rather broad, short, very slightly curved.

Altitude	19.75 mm.
Diam., major	10 „
Aperture, alt.	7 „
„ diam.	2.75 „
Habitat—Ceylon.	

15. *Leptopoma taprobanensis*, sp. nov.

Shell pyramidal, white, painted with broad reddish brown flame markings; whorls $4\frac{1}{2}$, convex, the apical whorls uniformly reddish brown, smooth, the remainder sculptured throughout with spiral liræ; sutures deeply impressed; base of shell convex; umbilicus moderately broad; peristome continuous, single, reflexed, white; aperture circular.

Altitude	6.5 mm.
Diam., major	6.25 „
Aperture, alt.	2.5 „
„ diam.	2.5 „
Habitat—Ceylon.	

The spiral liræ of this species readily separate it from any other hitherto described form from Ceylon.

16. *Cyclophorus liratula*, sp. nov.

Shell subdiscoidal, moderately solid, covered with a brown periostracum; spire raised; whorls $3\frac{1}{2}$, somewhat rapidly increasing in size, painted with broad, regular, brownish purple flame markings, rather coarsely, spirally lirate and very finely transversely striate; umbilicus wide and deep; peristome continuous, double; aperture nearly circular; interior of shell bearing a bluish white callus for a distance of about four millimetres from the aperture.

Altitude	6 mm.
Diam., major	11 „
Aperture, alt.	4 „
„ diam.	3.5 „
Habitat—Ceylon.	

17—18. *Cyclophorus (Theobaldia) liliputiana*, sp. nov.

Shell small, suborbicular, depressed, white painted with a broad, reddish brown, subperipheral band, both above and below which occur zigzag flame markings of the same colour; whorls $4\frac{1}{4}$; spire scarcely raised; sutures deeply impressed; umbilicus wide and shallow; peristome white, continuous, double, slightly reflexed; aperture circular.

Altitude	4 mm.
Diam., major	10 „
„ minor	7.75 „
Aperture, alt.	3.25 „
„ diam.	3.25 „
Habitat—Ceylon.	

Distinguished from any other Sinhalese member of the group by its extremely small size, vivid and well-marked painting and generally compact appearance.

19. *Cyathopoma ogdeniana*, sp. nov.

Shell turbinate, bearing traces of having been covered with a brown periostracum, sculptured above with distant transverse and spiral ridges, the former being absent on the base of the shell, in which region the latter are more numerous and less distant; whorls $4\frac{1}{2}$, somewhat inflated; sutures deeply impressed; umbilicus wide and deep; peristome continuous, thickened, slightly reflexed and double throughout; aperture circular.

Altitude	2.5 mm.
Diam., major	2 „
Habitat—Uda Pussellawa, Ceylon.	

In general outline and sculpture this species may be compared with *C. serendibense*, Preston¹; the whorls of the present form are,

¹ *Proc. Malac. Soc. London*, vol. v, pt. 5, 1903, p. 340.

however, more tumid, the umbilicus is wider and the peristome is throughout thickened, reflexed and double, which is not the case with *C. serendibense*.

I have much pleasure in associating with this species the name of my friend Mr. J. Armitage Ogden, of Kirklees Estate, Uda Pussellawa, on which estate it was collected.

20. *Cyathopoma perconoideum*, sp. nov.

Shell elongately conic, white, bearing traces of having been covered with a light yellowish brown periostracum ; whorls 6, convex, sculptured with several spiral liræ ; sutures impressed ; umbilicus very narrow and partly concealed by the outward expansion of the peristome ; peristome continuous, reflexed in the umbilical region and at the base, simple at all other points ; aperture almost circular.

Altitude	2 mm.
Diam.	75 „
Habitat—	Bandarawella, Province of Uva, Ceylon.

Allied to *Cyathopoma conoideum*, Sykes,¹ but more elongately conoid in form ; the spiral liræ are also much more numerous than in that species. The umbilicus is narrower, being reduced in the present form to a mere chink ; the aperture, moreover, is more nearly circular than in *C. conoideum*.

21. *Cyathopoma uvaense*, sp. nov.

Shell conoidal, greyish white, covered with a smooth chocolate-coloured periostracum, sculptured with fine spiral somewhat distant liræ ; whorls $4\frac{1}{2}$, shouldered above, moderately convex ; sutures impressed ; umbilicus wide and deep ; peristome almost continuous, white, very slightly reflexed ; aperture subcircular.

Altitude	3 mm.
Diam., major	3.5 „
Aperture, alt.	1 „
„ diam.	1 „
Habitat—	Bandarawella, Province of Uva, Ceylon.

22. *Pecten helleri*, sp. nov.

Shell nearly equivalve, equilateral, subtrigonal very flat, creamy white, painted with broad, irregular, transverse, blood-red bands and ornamented on both valves with ten-grooved, rather broad and flattened, radiate ribs ; the surface of both valves is also sculptured with closely set, fine, silky, concentric striæ ; auriculæ nearly equal, radiately grooved, those of the left valve stained

¹ *Proc. Malac. Soc. London*, vol. iii, p. 159.

with rusty red while those of the right valve are almost white :
umboes small, acute.

Long.	20.25 mm.
Lat.	19 5 „
Habitat—Ceylon.	

[N.B.—*The plate illustrating this paper will be issued later.*]

VII DESCRIPTION OF TWO NEW SPECIES
OF *CARANX* FROM THE BAY OF BENGAL.

By B. L. CHAUDHURI, B.A., B.Sc. (Edin.), Assistant
Superintendent, Indian Museum.

Caranx guptæ, sp. nov.

D. v/28-30. P. 24 V 5. A. ii/17. Ll. 114 (keeled plates 33, spined 20).

Height of body 2, and length of head $4\frac{1}{4}$ in the total length. Eye large, its diameter being $2\frac{1}{2}$ in the length of head, with adipose lid all round, one diameter from end of snout and two apart.

Shape.—The anterior root of the soft dorsal is the highest point in the curved upper (dorsal) profile, the point being situated nearer to the posterior end. The posterior portion of the dorsal profile from this point is more curved than the anterior portion which is more sloping. In the lower (dorsal) profile the curvature from the posterior end suddenly stops at the anterior root of the

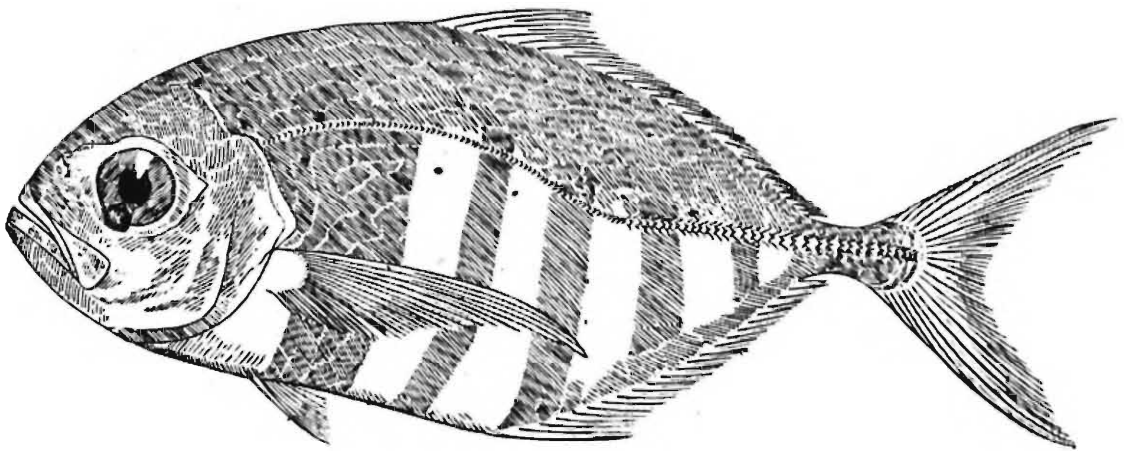


FIG. 1.—*Caranx guptæ*, sp. nov.

soft anal, from which point to a point directly below the lower jaw the profile is almost a straight line, which gives a characteristic shape to the species.

Mouth.—The cleft of the mouth is quite oblique, and is directed forward and upward. The lower jaw is longer than the upper.

Teeth.—Villiform and sharp in both jaws.

The pre-opercle is not serrated.

Fins.—The spinous portion of the dorsal fin is feeble and delicate, the anterior root of the soft anal is much behind the anterior root of the soft dorsal. There are two rudimentary detached anal

spines in front of the soft anal, which are concealed under a fold of skin. Pectorals long, slightly curved and tapering, contained $2\frac{3}{4}$ times in the total length. The ventrals are short and thick and arise vertically below the roots of the pectorals. The caudals are deeply forked.

Scales.—The scales are minute, the breast and head being perfectly naked.

Lateral line.—114 scales in all, of which the posterior 33 are covered with keeled plates; 20 of these keeled plates are armed with prominent spines. The lateral line runs straight forward from the root of the caudal fin until it passes all the keeled plates, when it curves forward, following almost accurately as a parallel curve of the anterior dorsal profile, ending in the upper corner of the operculum.

Colour.—Steel-grey with five broad vertical silvery bands which are more pronounced in the lower half. There is a small reddish area in the middle of the root of the caudal fin. The margins of the caudal and dorsal are tinged with black. There is a small horse-shoe-shaped mark in front of the snout coloured whitish grey on a black background.

Trawled by the "Golden Crown" off Elephant Point in July, 1908.

Length of two specimens.—16 cm.

Caranx auricoronæ, sp. nov.

D. vi/23. P. 22. V 5. A. ii/21. C. 19. Ll. 80 (30 plates).

Height of body $1\frac{3}{4}$, and length of head $3\frac{1}{2}$ in the total length. Diameter of eye $2\frac{2}{5}$ in the length of head, one diameter from end of snout and two apart.

Shape.—Highly compressed, both the dorsal and ventral profiles convex except in the anterior third of the ventral profile. No concavity in the anterior profile in front of the eye, but a small depression just anterior to the first dorsal.

Mouth.—Oblique, upper jaw not protrusible, lower jaw longer, slightly curved and not horizontal.

Teeth.—Villiform in both jaws.

Fins.—Spinous dorsal not rudimentary but well-developed, quite separated from second dorsal by a smooth open space; the spines of the first dorsal are joined together by thin white membrane. In the second dorsal a secondary sexual character is well-developed in the male but entirely wanting in the female. In the male specimen the 7th to 15th soft dorsal rays, inclusive, are prolonged to a considerable length in soft black filiform prolongations. Some of the rays anterior to these appear to have been damaged. These filiform appendages are wanting in the anal fin of the male fish and in both soft dorsal and anal fins of the female which was found to be full of matured ova. The ventral fin, which is a little longer than the head, is anterior to the origin of the pectorals, and

appears perpendicularly below the depression in front of the spinous dorsal. The ventral fin is comparatively large and fan-like, the rays being long enough to reach the anterior root of the anal fin. All the rays are joined together by parachute-like thin black membrane of considerable width. The ventral fin appears to cover completely a trenchant space with a groove which extends from the root of the ventral to the anterior root of the anal. Within this trenchant groove, at about its middle, the cloacal opening is situated, posterior to which are two rather long detached anal spines. The position and character of the parachute-like covering of the ventral fin suggests some accessory function subserving breeding or development. Pectoral nearly $1\frac{1}{2}$ times as long as the head. No filiform prolongation of rays in the anal fin either in the male or female, but the anterior rays slightly longer than the more posterior ones. The caudal fin is deeply forked.

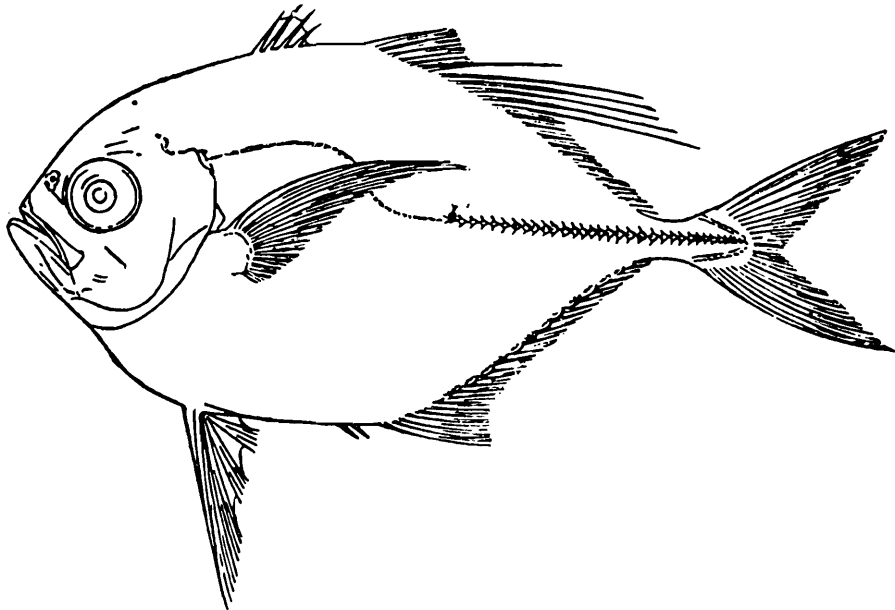


FIG. 2.—*Caranx auricoronæ*, sp. nov.

Colour.—Upper half steel-grey ; eyes, body of fins and lower posterior half golden, and lower anterior half silvery ; the edge of the caudal fin and soft dorsal black. The fold of thin membrane between the rays of the ventral fin quite black. There are, however, neither opercular spots nor any vertical bands or stripes of any kind in the adult.

Scales.—Present, small and deciduous, mostly in the caudal region.

Lateral line.—Covered with 30 plates which are not armed with spines nor keeled.

Two specimens, one male and one female with matured ova, caught by the steam trawler "Golden Crown" in the month of September, 1908, off the coast of Chittagong.

Length of specimens.—14 cm.

VIII REMARKS ON SOME LITTLE KNOWN INDIAN OPHIDIA.

By F. WALL, Major, I.M.S., C.M.Z.S.

Through the courtesy of Dr. Annandale I have recently had access to the large collection of snakes in the Indian Museum, an examination of which has strengthened my convictions in many cases, and enables me to describe several new species and remark upon some rarities.

Tropidonotus xenura, Wall.

In the Bombay Natural History Society's Journal (vol. xvii, p. 616) I described and figured a new species under the above title, from a very sodden specimen submitted to me by the Bombay Society. The habitat of this was not known, and until recently it appeared to be unique.

In the Indian Museum I discovered, mixed up with several specimens of *Tropidonotus modestus*, Günther, four more examples of this species, all of which are from Cherrapunji, Khasi Hills, Assam. One of these is the No 4278 of Sclater's list.

All these specimens agree with the type except that the anal is divided in all. I think I was very probably in error in reporting this shield entire in the type, for I remember that in the sodden state of the specimen I found it difficult to decide the point to my satisfaction. In the type, again, the tail was extensively docked, but all the subcaudals present entire. In the four Indian Museum examples the subcaudals are also all entire. The ventrals and subcaudals are 161 + 107, 165 + ?, 158 + ?, 158 + 81. The tail is imperfect in two.

The divided state of the anal is remarkable. I cannot recall another snake with entire subcaudals and a divided anal.

The species bears a strong superficial resemblance to *modestus*, but is very well differentiated and distinct. The differences are as follows: (1) in *modestus* the subcaudals are all divided; (2) in *modestus* there are two præoculars, in *xenura* only one; (3) in *modestus* there is one temporal, in *xenura* two; (4) in *modestus* keels are absent in the last two or three rows in midbody, in *xenura* all the rows are keeled.

Tropidonotus chrysargus, Schlegel.

Specimen No. 12680 in the Indian Museum from Tavoy, referred by Sclater to the Japanese species *vibakari*, is an abnormal

specimen of this species. I have compared it carefully with other examples of *chrysargus*, and find it agrees perfectly in every way except as regards the temporals, which are single on both sides. The ventrals and subcaudals are $140 + 76$. Anal divided.

Helicops schistosus, var. *andersonii*, var. nov.

I have examined three specimens collected by Anderson in Yunnan, which he, and subsequently Sclater, referred to *Helicops schistosus*.

In most respects extremely like *H. schistosus*, I cannot see how they can be considered as belonging to the typical form of this species in face of the fact that in all three the internasals are divided. A single internasal is stated to be one of the generic characters of *Helicops* to which all the eleven known species conform, and though I am very familiar with *schistosus* from Southern India, the United Provinces and Orissa, I have never met with one in which this shield was divided. The Yunnan form should, I think, rank as a variety of *H. schistosus*, under the title *andersonii*. I notice that, besides the condition of the internasals, all three specimens agree in having both the 1st and the 2nd supralabials touching the nasals, whereas in the typical *H. schistosus* the 1st only does so. The ventrals and subcaudals are $151 + 61$?, $154 + 83$, $143 + 79$?. In two the tail is imperfect.

Dinodon septentrionalis, Günther.

Until recently the Indian Museum contained no specimen of this rare snake identified as such. I found, however, a very fine specimen in a bottle with specimens of *Bungarus bungaroides*. This is the No. 7741 of Sclater's list. Locality Darjiling. The scales are in 17 rows, vertebrals not enlarged, loreal present, pupil vertical, and ventrals and subcaudals $212 + 58$? (tail imperfect). This specimen removes any doubt of the Eastern Himalayas as a habitat.¹ The type specimen collected by Jerdon was recorded dubiously from the Himalayas or Khasi Hills. Within our Indian dominions Boulenger has recorded a specimen from the Karen Hills (*Catalogue*, 1896, vol. iii, p. 619), and another from Mogok, Ruby Mines District, Burma (*Journ. Bom. Nat. Hist. Soc.*, vol. xvi, p. 235). I have also had a very fine specimen from the Ruby Mines measuring 3 feet $4\frac{1}{8}$ inches, ventrals 217, subcaudals 82, and another from Jeypore, Assam (♀), ventrals 214, subcaudals 81. The snake is remarkably like the many-banded krait *Bungarus multicinctus* in life or when recently preserved, the rich black on the dorsum crossed with milky-white bands giving it a strikingly handsome appearance.

¹ I have recently had another specimen sent me from Phoobsering, below Darjiling (circa 5,000 feet).

Dryocalamus gracilis, Günther.

The specimen, No. 8690 from False Island, Arakan coast (?), referred by Sclater to *Hydrophobus davisoni* is, I think there can be no doubt, *Dryocalamus gracilis*. The scale rows are 15, the ventrals 236, subcaudals 85, anal divided. The loreal touches the eye and has a small præocular above. There are twenty-three whitish bands on the body, and fourteen on the tail. I think there is a good reason to doubt the locality for this specimen, as the snake is known otherwise only from Peninsular India. I have seen two specimens in life, both in Berhampore (Orissa). The ventrals and subcaudals were 243+79, and 235+87. In the former there were twenty-six bands on the body, and in the latter twenty-eight.

Ablabes gilgiticus, Annandale.

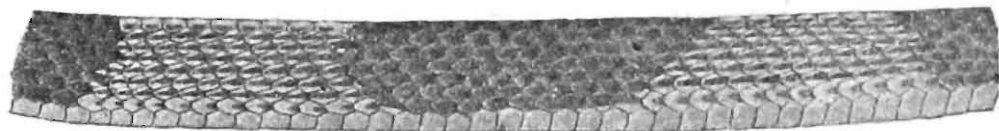
I have lately seen the type specimen of this species (described by Dr. Annandale, *J. A. S. Bengal*, 1905, p. 210) which proves to be *Trachischium fuscum* (Blyth). Dr. Annandale had already discovered the true identity of the specimen. The appearance of this species so far to the west of what had previously been known as its habitat is most interesting, and should serve to impress one with the limited knowledge we still possess of the snakes inhabiting the Himalayas although so many collectors have contributed to our knowledge of the fauna of that extensive Range. Previously the species had not been known to the west of Nepal.

Bungarus magnimaculatus, Wall and Evans.

In the *Journ. Bom. Nat. Hist. Soc.*, vol. xiii, p. 611, Captain (now Colonel) Evans and I made reference to a krait which we thought a species up to that time not described, but contented ourselves with making the type of a new variety of *B. cæruleus* under the title *magnimaculatus*. I have now seen five examples of this form, and have critically examined at the lowest computation over 200 specimens of *cæruleus*, and I am decidedly of opinion that *magnimaculatus* deserves recognition as a distinct species. Two of the five specimens I have examined are in the Indian Museum, and are the very ones remarked upon by Sclater (*J. A. S. Bengal*, lx, p. 245). As the form has never been properly described, I propose to do so now.

Description.—Rostral touches 6 shields, the rostro-nasal sutures are longer than the rostro-internasal. Internasals 2, the suture between the fellows about half that between the præfrontal fellows, half to three-fifths the internaso-præfrontal sutures. Præfrontals 2, the suture between them nearly twice the præfronto-frontal sutures; in contact with internasal, postnasal, præocular and supraocular. Frontal touches 6 shields, the fronto-parietal sutures longest. Supraoculars: length three-fourths to four-fifths frontal, breadth half or rather more than half frontal. Nasals touch the 1st and 2nd supralabials. Præocular 1. Post-

oculars 2. Temporal 1, touching the 5th and 6th supralabials. Supralabials 7, the 2nd much narrower than the 1st and 3rd; the 3rd and 4th touching the eye. Infralabials 4, the 4th largest, and in contact with two scales behind. Sublinguals 2 subequal pairs, the posterior touching the 4th only of the infralabial series. Costals two headlengths after head 15, midbody 15, two headlengths before vent 15; vertebrals as broad as long or broader in



Part of body of *Bungarus magnimaculatus*, $\frac{3}{4}$ size, showing two of the light bands.

midbody. Supracaudals in odd rows, the vertebrals enlarged. Ventrals 218 to 228. Anal entire. Subcaudals 43 to 48, all entire. Colour black with from eleven to fourteen light bands on the body and two to three on the tail. These light bands are formed of black and white streaks in the length of the snake, the vertebral white streak being specially broad. The intervening black does not extend to the belly, which is uniformly white. Some blackish mottling is present beneath the tail. A white præocular spot is more or less evident.

Habitat.—Known only from a very localised area in the Irrawaddy basin. Details of the specimens follow in tabular form.

Length.—The longest measurement is 4 feet. Nos. 4 and 5 are the specimens referred to by Slæter (*J. A. S. Bengal*, 1x, p. 245).

No. of specimens.	Ventrals.	Subcaudals.	Light bands on body.	Light bands on tail.	Locality.	Remarks.
1	226	42 ¹ ?	14	2	Monywa	} Types. No. 13244, Indian Museum. No. 13245, " "
2	218	43	11	2	"	
3	228	47	11	3	Meiktila	
4	225	48	11	3	"	
5	219	48	11	3	"	

Bungarus walli, Wall.

In the *Journ. Bom. Nat. Hist. Soc.*, vol. xvii, p. 608, I described a new krait founded on a series of eight specimens

¹ Tail very slightly imperfect.

all from Fyzabad in the United Provinces. I have lately had opportunities of examining six more examples. In the museum of St. Joseph's College, Darjiling, I found two specimens labelled *cæruleus* which had formed part of the collection of the late Dr. Vincent Richards. Here I would recall the fact that this investigator succumbed to the wounds inflicted by a krait which may have been one of these specimens. This is by no means certain, as there are also in his original collection, now at St. Joseph's College, two specimens of *cæruleus*. The Principal of the College told me that his death is attributed to one of these snakes, but could not be sure which, and I can get no further information of the fatality. One of the *walli* could not, I think, have inflicted the injury, as its mouth is full, with the caudal extremities of two slow-worms (?) (*O. gracilis* ?) protruding.

Unless the coloration of one of these specimens is due to the quality of the preservative, it must be considered a melano, as the under parts and the upper lip are black. The usual beaded, white, equidistant dorsal arches are, however, quite distinct. The localities of these two specimens are not recorded, but it is probable they were obtained from Bengal. The other four specimens alluded to are in the Indian Museum. Three of these are old, and were referred to *cæruleus*. The last is the large specimen referred to by Dr. Annandale as *sindanus* (*J. A. S. Bengal*, 1905, p. 213). I give the details of these specimens in tabular form:—

No. of specimens.	Scales two heads-lengths behind head.	Scales midbody.	Scales two heads-lengths before anus.	Ventrals.	Subcaudals.	Locality.	Remarks.
1	19	19	17	203	54	?	St. Joseph's College.
2	17	17	17	192	48	?	"
3	19	17	17	199	54	Purneah	No. 13760, Ind. Museum.
4	19	19	17	197	52	"	No. 13762, "
5	19	17	17	202	55	"	No. 13764, "
6	19	19	17	200	51	Midnapore	No. 15299, "

The largest measurement now recorded is that of the Midnapore example (5 feet $4\frac{1}{2}$ inches).

Amblycephalus modestus, Theobald.

I have examined the type and only known specimen of this snake, which has only been imperfectly described, and propose to give a full description here.

Description.—Rostral in contact with 6 shields, the anterior nasal sutures greater than the internasals. Internasals: suture between the fellows two-thirds that between the præfrontal fellows, one-third the internaso-præfrontal sutures. Præfrontals:

suture between the fellows two-thirds the præfronto-frontal sutures, in contact with internasal, loreal, præocular, eye and supraocular. Frontal in contact with 6 shields, the supraocular sutures are smallest, about two-thirds the parietals, and three-fifths the præfrontals. Supraoculars half as long as and one-third as broad as the frontal. Nasals touch the 1st and 2nd supralabials, undivided. Loreal in contact with the internasals. Præoculars 2, small. Postoculars 2 on the right side, 1 on the left entirely cutting off the labials from the eye. Temporals: a single anterior shield which, however, especially on the right side, appears to be a confluence of 2—an upper and a lower. Supralabials 7, the seventh longest, none touching the eye. Sublinguals: three large pairs of broad shields with no mental groove between, followed by a very large first ventral. Costals two headlengths after head 15, midbody 15, two headlengths before vent 15. Vertebrae not enlarged. Ventrals 156. Anal entire. Subcaudals 37, divided. Body compressed. Eye large, pupil vertical. Colour uniform dark olive-black.

I can see no difference in the lepidosis between this and *macularius* except in the temporal, which is possibly aberrant. The 2nd and 3rd supralabials touch the loreal (instead of the 2nd only), but the same anomaly is seen in specimen No. 8026 in the Indian Museum from Maïtaban, which is one of the types of *macularius*. The only real difference appears to me to be in the colours, but the specimen may be a melanotic form of *macularius*.

Here I may say that I count the ventrals and subcaudals of the three type specimens of *macularius* 169+40, 168+48, and 170+51.



IX REMARKS ON SOME FORMS OF *DIPSADOMORPHUS*

By F. WALL, Major, I.M.S., C.M.Z.S.

Many of the forms now recognised as species in the genus *Dipsadomorphus* exhibit extremely close affinities. A close study of the head shields of many of the species (I have examined no less than thirteen of the twenty-three known) shows a number and disposition so similar, that, with the single exception of the rostral shield in some few species, I can find no means of differentiating between them. The only points made special use of by Mr. Boulenger, viz., the height of the præocular and the size of the posterior sublinguals, with the separation of the fellows of this pair, I find too inconstant to place any reliance upon.

The close similarity of these shields in the different species probably accounts for the frequent confusion among them by various observers. Thus *trigonata* has been mistaken for *gokool* by Ferguson (*Reptil. Fauna Ceylon*, 1877, p. 21), Phipson (*Journ. Bom. Nat. Hist. Soc.*, vol. ii, p. 247) and Traill (*Journ. Bom. Nat. Hist. Soc.*, vol. ix, p. 499). *Gokool* was considered the young of *cynodon* by Cantor (*Cat. Mal. Rept.*, 1847, p. 77).

The *multifasciata* of Günther was confused for a long time with *ceylonensis*. Stoliczka (*Journ. Asiat. Soc. Bengal*, vol. xxxix, p. 199) could not see the justification for considering it a species apart, though Blyth and most herpetologists since his time wholly support Günther's views. Boulenger (*Faun. Bri. Ind.*, Rept. and Batrach., 1890, p. 359) did not separate it from *ceylonensis*, though later (*Cat.*, iii, 1896, p. 69) he too has accepted Günther's opinion.

I have for a long time thought that the species *ceylonensis* and *hexagonotus*, as regarded by Mr. Boulenger in his *Catalogue* (1896), comprise more than one form fit to rank as a species, and I have been accumulating observations for some years which now enable me to speak with conviction.

The separation of the species in this genus is mainly, if not wholly, dependent upon the difference in the number of the scale rows, the degree of enlargement of the vertebrae, and the differences in the ranges of the ventrals and subcaudals. I think more use may be derived from the scale rows by counting them in two situations instead of in midbody alone. I find that at a point two heads-lengths before the anus the rows are fewer than in midbody, and at least in one instance the counts are useful, for in the two species *trigonata* and *gokool*, which are extremely alike, the rows come to 15 in the former and only to 17 in the latter.

Dipsadomorphus ceylonensis.

I have arranged all the specimens identified as *ceylonensis* of which I have any knowledge in tabular form. The British Museum examples and the four I quote from Dr. Willey (*ex epistola*) I have not examined.

(1) *D. ceylonensis*; Günther.

Characterised by scales in 19 rows, ventrals 214 to 235, subcaudals 98 to 109. Habitat—Ceylon and Western Hills of Peninsular India.

No. of specimens.	Scales in midbody.	Ventrals.	Subcaudals.	Habitat.	Authority.
1	19	229	105	Mysore ..	Indian Museum.
2	19	227	109	Madras Presdy.	"
3	19	223	106	"	"
4	19	219	100 ?	Anamallay	"
5	19	227	..	"	"
6	19	234	105	"	British Museum.
7	19	229	100	Nilgiris	"
8	19	214	98	Malabar	"
9	19	235	111	Matheran	"
10	19	235	107	Ceylon	"
11	19	229	..	" ..	"
12	19	231	..	"	"
13	19	232	104	"	"
14	19	219	101	"	"
15	19	222	99	"	"
16	19	226	103	"	"
17	19	220	101	"	"
18	19	234	110	"	Dr. Willey (<i>ex epistola</i>).
19	19	234	106 ?	"	"
20	19	233	107	" ..	"
21	19	224	103	"	"

(2) *D. beddomei*, sp. nov.

Characterised by 19 scale rows, ventrals 248 to 266, subcaudals 113 to 127. Habitat—Ceylon and Western Ghats.

No. of specimens.	Scale rows in mid-body.	Ventrals.	Subcaudals.	Habitat.	Authority.
1	19	257	126	Ceylon	British Museum.
2	19	262	125	"	"
3	19	253	113	" ..	"
4	19	266	120	" ..	"
5	19	253	122	"	"
6	19	263	127	Kandy	F. Wall.
7	19	248	117	Matheran ..	British Museum.

(3) *D. nuchalis*, Beddome.

Characterised by 21 scale rows (rarely 23), ventrals 234 to 251, subcaudals 90 to 108. Habitat—Hills of Western Peninsular India and Nepal.

No. of specimens.	Scale rows in mid-body.	Ventrals.	Subcaudals.	Habitat.	Authority.
1	21	235	101	Chitlong, Nepal	Indian Museum.
2	21	234?	104	"	"
3	21	246	100 ?	Travancore ..	"
4	21	251	106	" ..	"
5	21	242	102	" ..	"
6	21	246	107	" ..	"
7	23	238	103	"	"
8	23	241	106	" ..	"
9	21	249	108	"	"
10	21	242	107	"	"
11	21	248	90	Wynaad ..	British Museum.
12	21	242	100	W. India ..	"
13	21	243	104	"	"
14	21	234	94	" ..	"
15	21	234	102	" ..	"
16	21	249	101	"	"

(4) *D. andamanensis*, sp. nov.

Characterised by 21 scale rows, ventrals 259 to 267, subcaudals 118 to 133. Habitat—Andamans.

No. of specimens.	Scales in midbody.	Ventrals.	Subcaudals.	Habitat.	Authority.
1	21	267	121	Andamans	No. 7928, Indian Museum.
2	21	266	118	"	No. 7929, Indian Museum.
3	21	265	122	"	No. 7930, Indian Museum.
4	21	264	133	"	No. 8641, Indian Museum.
5	21	259	121	"	No. 15189, Indian Museum.
6	21	264 ?	130	"	No. 15192, Indian Museum.

From the above tabulated specimens it appears to me that under the title *ceylonensis* at least four distinct forms have been confused, all of which I consider should rank as species rather than varieties of a single species. For the first of these I would reserve the title *ceylonensis*, for Günther's type specimen with scales 19, ventrals 220, subcaudals 108, habitat Ceylon, clearly is one of this form.

For the second *beddomei* seems to me appropriate, since most of the known specimens are of Colonel Beddome's collecting.

For the third Beddome's name *nuchalis* should be retained.

For the fourth I propose *andamanensis* since all the six known specimens come from this insular group.

The last-named form, *andamanensis*, has perplexed more than one authority. Stoliczka (*J. A. S. Bengal*, xxxix, p. 198) referred to four specimens in the Indian Museum from the Andamans which he identified as *hexagonotus* (Blyth). These are the first four specimens in the table above and the identical ones referred later by Sclater to *fusca*.¹ I have examined these, and two others in the Indian Museum acquired since from Mr. C. G. Rogers from the Andamans. The last two were sent by Dr. Annandale to the British Museum, where they were pronounced by Mr. Boulenger to be *ceylonensis*. These I examined two years ago on their return from London, and disagreed with Mr. Boulenger's opinion. I have recently re-examined them beside the other four specimens, with which they completely agree. The recognition of this form as a distinct species removes the Andamans from the sphere of distribution of *ceylonensis* (Annandale, *J. A. S. Bengal*, 1905, p. 176).

All of these forms seem to me to agree in the lepidosis of the head, and have the vertebral row of scales about as broad as long at midbody. They are all coloured much alike, and seem to attain a similar growth.

Dipsadomorphus hexagonotus, Stoliczka (*non* Blyth).

I have examined the type specimen of Blyth's *hexagonotus* (*Journ. Asiat. Soc. Bengal*, vol. xxiv, p. 360). This is No. 8048 of Sclater's list from Cherrapunji, Khasi Hills, Assam, referred by him to *fusca* (an Australian species!). The scales are in twenty-one rows, the ventrals 247, and the subcaudals 134 (not 126 as given by Blyth²). It is now uniform brown in colour. I think there can be no doubt that this is a young *cyaneus* (Dum. & Bibron). The young of this species are known to be brown in colour (Boulenger, *Catalogue*, vol. iii, 1896, p. 72). Further, Blyth says of this specimen that the head is green, and remarks that it probably grows to a large size and may become wholly green.

The next authority to refer to *hexagonotus* was Stoliczka (*Journ. Asiat. Soc. Bengal*, vol. xxxix, p. 198) who refers to five specimens from the Andamans. Four of these I have already alluded to under *ceylonensis* and shown to constitute a definite

¹ The fifth specimen referred by Sclater to *fusca* is in my opinion a young *cyaneus*: see further remarks on *hexagonotus* which follow.

² I frequently find that my counts of the ventrals and subcaudals, especially the latter, do not agree with that of other authors, and I often wonder whether they made use of a lens at this time, and if so, whether the lens permitted freedom of both hands. The subcaudals especially are very hard to count in small snakes. I invariably use a watchmaker's lens, and begin counting from the tail-tip. In this way the smallest shields are counted when the eye is fresh to the work, and as it grows tired with the strain, the larger shields come into view. I also pass the fingers of one hand along the shields as I count them, thus assisting the eye and relieving strain.

species, *andamanensis*. The fifth with the scale rows 19 is described too imperfectly to recognise with certainty, but appears to me probably the same form found in Burma in which the scale rows are 19. If my surmise is correct, this specimen, which appears to have been lost, is the true type specimen of *hexagonotus*, and Stoliczka's name should replace Blyth's as the godfather of the species, *hexagonotus* having precedence over Theobald's *ochracea*.

Under the title *hexagonotus* Mr. Boulenger appears to me to include two forms which I consider deserve specific recognition. I have records of fourteen specimens of a form from Burma which agree in having 19 scale rows, the ventrals ranging between 221 and 245, and the subcaudals 89 to 107. Five of these are in the British Museum, the rest are of my own collecting. Two other specimens in the British Museum from Burma collected by Beddome do not conform to this type, but to that known from the Himalayas. In recent papers to the Bombay Natural History Society I have shown that many of Beddome's records of habitat are open to question, but even supposing that these two specimens have been correctly labelled, they do not vitiate the inferences to be drawn from the series under discussion, as they may have come from hills in the west or north of Burma, the fauna of which closely agrees with that of the Eastern Himalayas. I am of opinion that the form represented by these fourteen specimens all from Burma is a distinct species for which the name *hexagonotus* should be retained, as it appears probable that the type specimen is that already referred to from the Andamans by Stoliczka with the scales in 19 rows.

In addition to these I have examined no less than thirty-nine specimens of a form which inhabits the neighbourhood of Darjiling, and which is characterised by having 21 scale rows, ventrals ranging from 218 to 252, and subcaudals from 100 to 119. There are three more examples in the British Museum from the same locality which completely agree. Two others in the same Institution from Burma (?) (the query is mine) also agree. This form appears to me a distinct species for which I propose the name *stoliczkæ*, the first references to it having been made by Stoliczka

X. A PELAGIC SEA-ANEMONE WITHOUT TENTACLES

By N. ANNANDALE, D.Sc., Superintendent, Indian Museum.

During a visit to Puri, on the Orissa coast of the Bay of Bengal, my assistant brought me (on February 1st, 1909) a number of small, more or less globular bodies which he had found on the beach at the edge of the waves. A careful search revealed many more. On examination these bodies proved to be Actiniaria in a state of contraction. On being placed in clean sea-water they immediately changed their shape, becoming narrowly conical instead of globular; but no tentacles appeared. The oral extremity became nearly flat, the peristome being distinguished from the column by its greater translucency as well as its position. The mouth was conspicuous, forming a relatively long, narrow slit expanded at one end. The whole animal had a milky appearance, which concealed its internal organs; the exterior had a pale vinous colour, which deepened into brown at the aboral pole. A circular pore was easily seen at this pole.

As these Actinians evidently represent a form very different from any previously described, I propose to call them *Anactinia pelagica*, gen. et sp. nov., in allusion to their lack of tentacles and their pelagic habit. Although none of my specimens have gonads in a recognizable condition, I do not think that they represent a larval stage, for on the one hand the large number of mesenteries they possess, and on the other the fact that many Actinians only exhibit sexual activity at certain times of year, is evidence to the contrary. Several forms have, however, been described by van Beneden as larvæ which possess a considerable number of mesenteries. The following description is based on the dissection and sectioning of a number of specimens as well as on the superficial examination of living and preserved material.

STRUCTURE.

Column.—The column may be any shape between globular and conical, the aboral end being pointed in the latter case and the peristome nearly flat. These differences in form are due solely to the state of contraction or expansion of the muscles. My largest specimens measured, when fully expanded, about 12 mm. in length and 4 mm. in transverse diameter across the peristome, which met the walls of the column practically at a right angle. In such specimens the aboral extremity measured only 1 mm. in diameter, the

basal pore, which was circular, measuring about 0.75 mm. The external surface was smooth on the upper half of the column, longitudinally plicated to a slight extent on the basal half. Most or all of the mesenterial spaces appeared on the external surface as slightly elevated ridges separated from one another by narrow grooves, which represented the mesenteries. There were no apertures of any kind on the sides of the upper parts of the column; but near the base I have been able to detect a number of minutely microscopic circular pores. These have no swollen lips and do not appear to function as cinclides. The external cilia are short and feeble. There is no protective sheath, and the secretion of the ectodermal gland-cells is by no means profuse.

Peristome.—The most remarkable feature of the peristome is the almost entire absence of tentacles. An examination of living material failed to reveal any trace of these organs; but in specimens preserved in spirit they can be seen to exist as minute rudiments, which to the naked eye or under a hand lens appear as a single circle of white dots, one at the upper extremity of each mesenterial space, that is to say, 24 or 26 in all. These dots are situated round the periphery of the peristome. They are imperforate and so minute that it is barely possible to see them in profile with the aid of the most powerful hand lens. They are only visible owing to their greater opacity, which is due to the fact that each represents a reduplication of the body-wall, or rather a microscopic hollow outgrowth. Their structure appears to be in no way differentiated from that of the surrounding parts.

The peristome itself is nearly flat in fully expanded specimens, but when the muscles of the column are contracted it is usually concave; sometimes, owing to a partial evagination of the stomodæum, it becomes highly convex or even conical.

The lips of the mouth are by no means tumid and do not appear to be capable of very close juxtaposition. The upper extremity of the ciliated groove of the stomodæum is represented at one end by an expansion, which in some cases is nearly circular. The mouth occupies the greater part of the diameter of the peristome in one direction and is rather narrow in the other; its two ends are about equidistant from the edge of the peristome.

Body-wall.—In a transverse section through the body-wall the ectoderm is seen to consist of the elements commonly found in the ectoderm of the Actiniaria. The epithelial cells bear very short cilia. Gland-cells are, as usual, of two kinds, one more elongated than the other; but both are somewhat scarce. Sense-cells, each bearing a rather stout style, are numerous. Nematocysts are extremely abundant all over the surface of the column. They vary greatly in size but are fairly constant in shape and proportions. All are rounded at either end somewhat abruptly and most are curved; the length is about $\frac{1}{2}$ the breadth, and varies from 0.0162 mm. to 0.042 mm.

Immediately inside the ectoderm there is a ring of clear mesogloea, in which minute star-shaped cells and extremely slender

transverse nerve-fibres can be detected with some difficulty. This is clearly the so-called nervous layer.

Inside the nervous layer is a considerably broader one, which also consists fundamentally of mesogloea but is noteworthy for the fact that it contains numerous bundles of longitudinal muscle-fibres, which in cross-section appear as slightly oblique transverse bars or narrowly oval masses. Often they are arranged in such a way that two succeeding bars form an angle with one another. At the inner end of these longitudinal muscles is a narrow but very distinct ring of circular muscle-fibres. An examination of the body-wall from the inner surface shows that these circular muscle-fibres form a series of parallel rings extending from the upper end to the base of the column, at the two ends of which they are rather stouter than they are in the middle. There is not, however, a regular sphincter at either end.

The endoderm of the body-wall consists of rather long, highly vacuolated cells. The cilia with which they are provided are barely visible in my sections. At the base of many of these cells peculiar sausage-shaped bodies are present, each containing two or more round structures which take up eosin very strongly. Probably these bodies are micro-organisms of some kind.

In a transverse section of the body-wall, opposite the middle of the stomodæum of a fully expanded specimen, the ectoderm is the broadest of the apparent layers, occupying more than a third of the total thickness (*i.e.*, about 0.4 mm. out of a total of 1.06 mm.). The whole of the mesogloea is considerably narrower, occupying about 0.3 mm.; of this one-third is occupied by the nervous layer and two-thirds by the muscular layer. The endoderm is rather thicker than the mesogloea at some points, thinner at others.

Stomodæum.—The stomodæum extends in fully expanded specimens about a third of the way to the base of the column. It is much compressed but relatively broad, its two ends being nearly equidistant from the body-wall. A ciliated groove is present at one end only; in the middle part of the stomodæum it is of considerable size as compared with the remainder of the internal periphery. Its cilia are long and stout compared with those of the ectoderm on the external surface of the column. The musculature of the stomodæum resembles that of the body-wall in arrangement, but the longitudinal muscles are not so well developed and the circular muscle is very feeble.

Mesenteries.—In the smaller specimens I have examined there are 24 mesenteries, in the larger specimens 26. The mesenteries are not arranged in pairs, and have no muscle-banners (retractor muscles); all are entire. In transverse section each is seen to be considerably swollen in the middle and narrow at either end, *i.e.*, at the inner end, which is joined to the mesentery, and at the outer end, which is joined to the body-wall.

A band of mesogloea makes its way into each mesentery from either end, appearing in transverse section as a slender filament; at its outer extremity each band of mesogloea supports a few

transverse muscle-fibres. I have not been able to detect longitudinal muscles in the mesenteries at any point. The swollen appearance of the central part is due solely to enlargement and vacuolation of the endoderm cells which form the bulk of the mesentery. These cells have very minute nuclei, which are situated at their free edge.

The outlines of the mesenteries in transverse section are important in relation to the position of the mesenterial mesogloea. In few mesenteries does this occupy the middle line exactly, but in nearly all cases it is slightly nearer one surface than the other (plate ix, figs. 5, 6). Moreover, the surface from which it is most remote can in most cases be seen to be more broadly convex than that to which it is nearest. All the mesenteries, therefore, may be said to point in one direction. This direction is that most remote from the apex of the ciliated groove.

The mesenteries decrease in transverse length at either end of the stomodæum, those at the apex of the ciliated groove being not quite so short as those opposite them.

The mesenterial filaments are less strongly contorted than is the case in many Actinians. On some mesenteries they run almost straight from the lower end of the stomodæum to the base of the mesentery, while in others they are contorted only in the middle part of their length. The longitudinal groove running down the upper part of each filament is deep, and the corresponding ridge on the middle part high; otherwise the minute structure of the filament offers no particular feature of interest.

Some of the mesenterial filaments are continued at the lower extremity of the mesentery so as to form acontia, which can be thrust out of the basal pore or even of the mouth; but the acontia are much shorter than is usually the case in the Sagartiidæ, and, moreover, do not seem to be particularly well supplied with nematocysts, although those structures occur in them in considerable numbers. So far as I can find, neither the number of the acontia nor the exact mesentery to which each is attached is in any way a constant character. There are no acontia-like filaments on the upper part of the mesenteries.

There are no mesenterial foramina.

*Gonads*¹ are absent from all the specimens I have examined, but, as I have already pointed out, this may be due to the fact that my specimens were not collected during the breeding season.

BIOLOGY

Anactinia does not appear to have any means of independent progression, and my specimens exhibited no movements except

¹ In a specimen taken by Dr. J. Travis Jenkins on the surface of the sea about 10 miles off the Orissa coast on February 20th, 1909, immature testes are present. They occur on some of the mesenteries, not on all; there appears to be a tendency for fertile and infertile mesenteries to alternate, but this rule is not without exceptions.—*March 3rd*, 1909.

those implied in their change of shape. They were, however, practically of the same specific gravity as that of sea-water on the surface of the Bay of Bengal. There can be little doubt that they had been carried by the currents and the winds, so far as the latter affected the water on the surface. The individuals cast up on the beach at Puri had evidently been driven through the surf-line, probably by a stiff breeze acting on the surface of the water. It is noteworthy that though they were numerous on February 1st, not a single specimen was found on January 29th, 30th, 31st, or on February 2nd.

It is well known that surface animals without independent means of progression often occur in vast shoals of the same species. This fact was well illustrated at Puri on the occasion on which *Anactinia* was found. On January 29th and 30th large numbers of a species of *Porpita* were washed ashore. Among them were a few specimens of a species of *Veilella*. On January 31st, however, the relative proportions of the two genera were reversed, *Veilella* becoming abundant and *Porpita* scarce. On February 1st both were scarce, but *Anactinia* was abundant, while on February 2nd, after a sharp shower of rain during the night, very few surface organisms of any kind were found on the beach.

I can find no trace of food in any of the specimens of *Anactinia* I have dissected.

SYSTEMATIC POSITION.

The arrangement of the mesenteries, the position of the longitudinal muscles of the column and the presence of a single ciliated groove running down the stomodæum are all facts which link *Anactinia* with *Cerianthus*, and there can be no doubt that it should be placed in the same order as that aberrant form. The absence of tentacles, however, as well as other less important differences, point to a very distinct separation between the two genera. *Anactinia* in all probability is a member of the order Cerianthidea which has become modified in accordance with a pelagic life.

It is worthy of remark in this connection that the larvæ of *Cerianthus* are pelagic in habit but settle down at the bottom before they have developed many tentacles. The young of Actiniaria, however, as also those of some other Cœlenterates, appear to provide for their own distribution mainly in two different ways. Those of *Sagartia troglodytes*, *Actinia mesembryanthemum* and some other common viviparous species, for example, retract the tentacles with which they are provided at birth, close their mouths and, being of almost the same specific gravity as the water in which they live and not having any projecting structures on their surface, are rolled over and over by the slightest movement in the water and are so carried for considerable distances. The young of *Metridium schillerianum*, of *Cerianthus* and of some species of *Hydra*, on the other hand, expand their tentacles to the utmost (so as to cover as large a superficial area as possible) and float on

or near the surface, that is to say in a position in which external agencies act most readily on the water and therefore on the organisms which it contains. *Anactinia* appears to have adopted the former means of progression and to have become modified accordingly, probably in the course of evolution from a Cerianthid ancestor.

As regards described forms to which *Anactinia* may be allied, it bears a somewhat close external resemblance to the minute larva described by van Beneden (*Les Anthozaires de la "Plankton-Expedition,"* p. 107, pl. ix, 1898) as *Apiactis denticulata*, but, apart from other differences, exhibits no trace of the thickening of the mesogloea characteristic of that form. Possibly it is related to the same author's *Ovactis* (*op. cit.*, p. 56), but there are several important features wherein it differs from that genus. Both these forms are regarded by van Beneden as larval.

Considering the doubt which exists as to the maturity of my specimens and the resemblance they bear to some of van Beneden's genera, I think it best not to define the form they represent as the type of a new family, but the genus and species may be described as follows :—

Genus ANACTINIA, nov.

Pelagic Cerianthidea without tentacles or a protective sheath. The musculature of the column as in the Cerianthidæ. Mesenteries twenty-four or more ; the membranous part of each mesentery strongly developed and forming in cross-section a protrusion directed away from the ciliated groove. Acontia but no (?) cinclides present. Column conical when fully expanded, the aboral pole being pointed. The external surface smooth, feebly ciliated. Ectoderm richly armed with large nematocysts at every point. The ciliated groove of great extent relative to the stomodæum. The mesenteries at both ends of the stomodæum very short. No foramina in the mesenteries.

Anactinia pelagica, sp. nov.

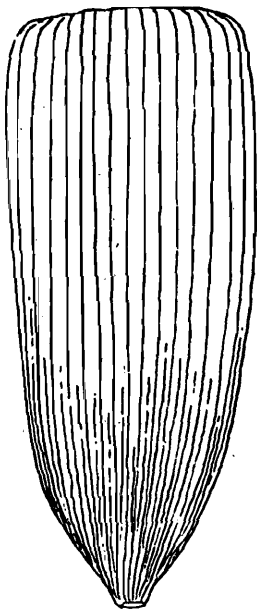
Peristome at right angles to the column when fully expanded. Mouth slit-shaped, with the ciliated groove always more or less patent at one end. A microscopic, imperforate tubercle (representing a tentacle) on the external surface above the upper end of each mesenterial interval. Mesenteries 24 or 26. External surface minutely plicated longitudinally at the aboral end. Colour pale, with a slight vinous tint, which deepens to light brown at the aboral pole ; the external tissues somewhat feebly translucent, having a milky appearance in life. The basal pore relatively large, not provided with a sphincter.

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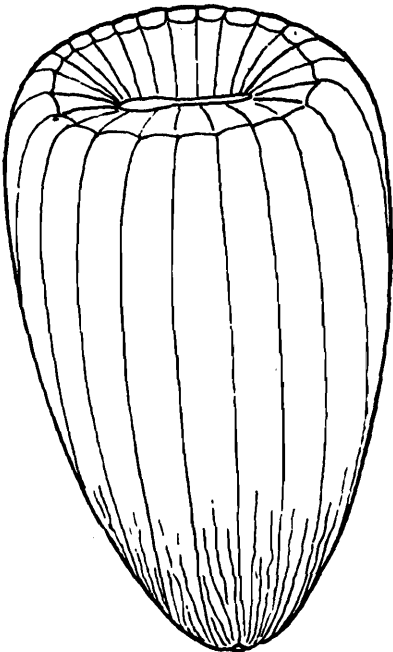
### EXPLANATION OF PLATE IX.

- FIG. 1.—*Anactinia pelagica* in a fully expanded condition viewed from the side,  $\times 5$ .
- „ 2.—A slightly oblique lateral view of an individual partially contracted,  $\times 8$ .
- „ 3.—The peristome of the same specimen viewed from above,  $\times 8$ .
- „ 4.—Transverse section through the column on a level with the middle of the stomodæum,  $\times 8$ : *c.* = ciliated groove.
- „ 5.—A portion of the same,  $\times 16$ .
- „ 6.—Transverse section through the body-wall in the same region, highly magnified: *ect.* = ectoderm; *n.l.* = nervous layer; *l.m.* = longitudinal muscles; *c.m.* = circular muscles; *en.* = endoderm.



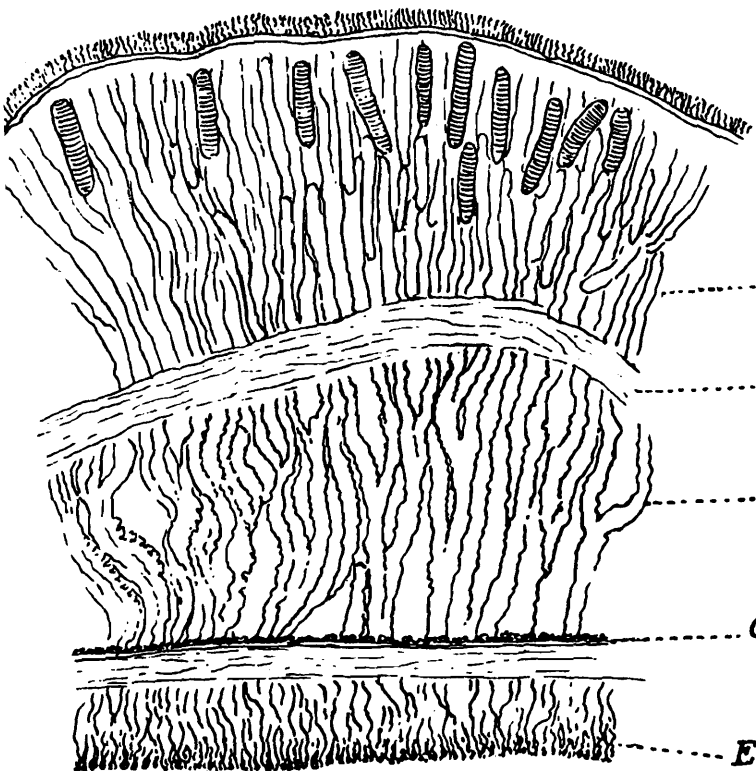
× 5.

Fig. 1



× 8.

Fig. 2.



Ect

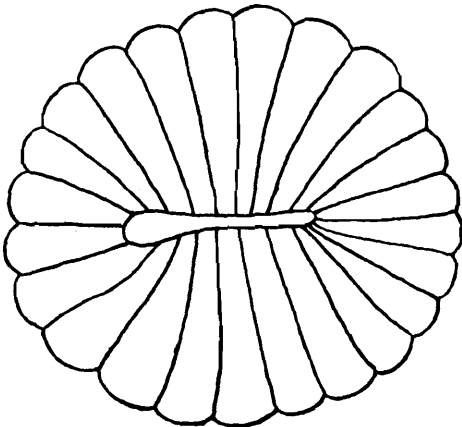
NL

LM

CM

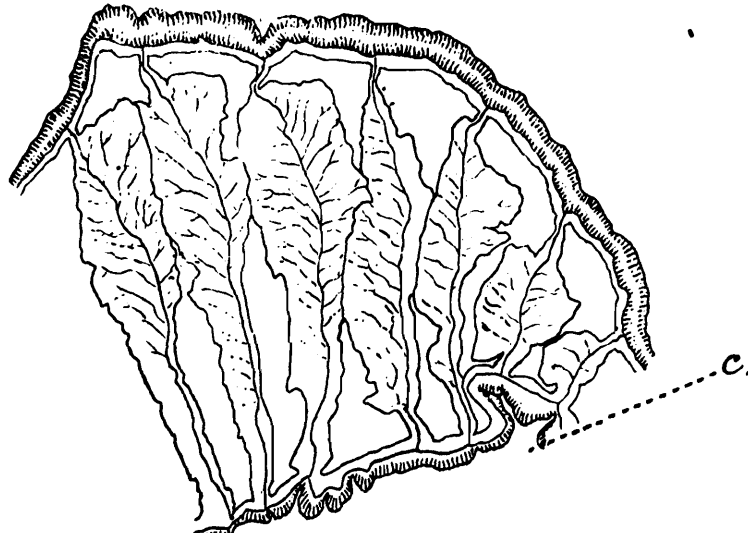
En

Fig. 6.



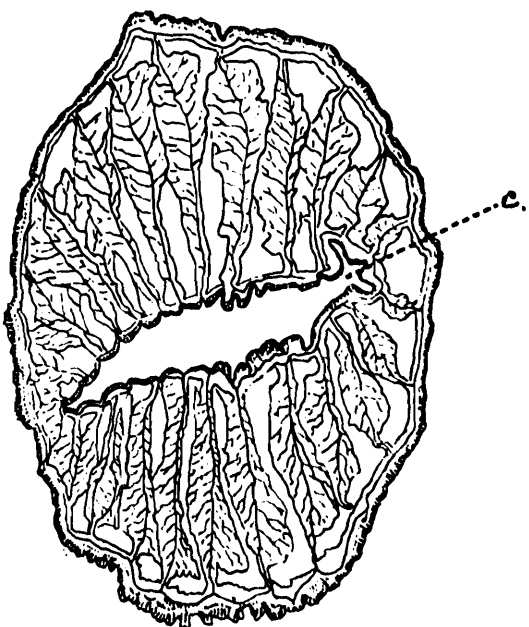
× 8.

Fig. 3.



× 16.

Fig. 5.



× 8.

Fig. 4

## XI RHYNCHOTA MALAYANA.

### PART II.

By W. L. DISTANT.

The present contribution again largely refers to the Rhynchota of Borneo. The collections made by Wallace in his memorable Malayan expedition contained much Bornean homopterous material which was worked out by Walker, but this was evidently only a sample of the rich Rhynchotal fauna of that island. The Homoptera of the Dutch islands are still practically unknown. Bierman commenced the study of the Javan insects and might have adequately undertaken those of Celebes, but we have, unfortunately, to deplore his early decease. The Malay Peninsula is still somewhat unworked ground as regards the Homoptera. Annandale and Robinson have lifted the veil from the Siamese Malay States, but we cannot expect the same enthusiasm to be displayed by residents in the collection of Rhynchota as I still gratefully remember was the case with butterflies when I prepared my "Rhopalocera Malayana." As regards the Philippines, of course, Stål's "Hemiptera insularum Philippinarum" is an object-lesson to other workers.

### Sub-order HETEROPTERA.

#### Fam. PENTATOMIDÆ.

#### Sub-fam. Tessaratominae.

#### Genus TESSARATOMA.

*Tessaratoma*, Lep. and Serv., Encycl. Meth., x; p. 590 (1825).  
Type *T papillosa*, Drury.

*Tessaratoma kinta*, sp. nov. (Pl. x, figs. 8, 8a, 8b.)

Head, pronotum and scutellum stramineous; lateral margins of head and apex of scutellum black; abdomen above black; body beneath stramineous; head beneath, rostrum, disk of prosternum, margins (more or less contentious) of meso- and metasterna, legs, and three longitudinal series of transverse segmental spots (one largest and central and one on each lateral margin) black; corium stramineous; membrane very pale stramineous; wings piceous-black, the costal and basal areas pale ochraceous; antennæ black, second and third joints subequal in length (remainder mutilated in all the specimens now before me); rostrum passing the anterior

coxæ; pronotum with the anterior angle subquadrately ampliate and moderately reflexed, these amplified areas coarsely wrinkled, remaining surface finely punctate, the anterior marginal area wrinkled and punctate; scutellum finely and sparingly punctate, the black apex foveately depressed and somewhat obscurely centrally ridged; connexivum with the posterior angles of the segments acutely produced; metasternal process compressed, elevated, its apex rounded and reaching the anterior coxæ; posterior femora with two long apical spines beneath; corium densely, finely, obscurely punctate; membrane moderately passing the abdominal apex.

Long. excl. hemelytra, ♂ and ♀, 29 to 30 mm. Breadth between pronot. angl. 16 mm. Exp. hemelytra 65 mm.

Hab.—Malay Peninsula; Perak (Doherty).

I possess four specimens (3 ♂♂, 1 ♀) of this exceedingly well-marked species which in the structure of the pronotum is allied to *T. quadrata*, Dist., from which it differs by its smaller size, different shape of the metasternal process, and the peculiar markings and coloration of the body beneath; from *T. malaya*, Stål, it is separated by the different structure of the pronotum, the different colour of the abdomen above, smaller size and the distinct markings of the body beneath. In the specimen figured the antennæ were completely mutilated.

*Tessaratomy kina*, sp. nov. (Pl. x, figs. II, IIa, IIb.)

Head, pronotum and scutellum bright shining ochraceous; lateral margins of head, antennæ and apex of scutellum black; abdomen above black, the connexivum castaneous; body beneath, rostrum and legs piceous; prosternum ochraceous with discal piceous shadings; corium bright ochraceous, membrane pale ochraceous; wings pale bronzy, subhyaline, the basal area stramineous; antennæ with the second and fourth joints subequal in length, each a little longer than the third; rostrum reaching the anterior coxæ; pronotum with the anterior angles subquadrately ampliate, these amplified areas coarsely wrinkled, remaining surface finely, sparingly punctate, the anterior marginal area somewhat transversely wrinkled; scutellum finely, obscurely punctate, the black apex broadly, longitudinally foveate; connexivum with the posterior segmental angles acute; metasternal process compressed, moderately directed upwardly, its apex rounded and reaching the anterior coxæ; rostrum reaching the intermediate coxæ; posterior femora with two long apical spines beneath; corium densely, finely punctate.

Long. excl. hemelytra, ♀, 28 mm. Breadth between pronot. angl. 14½ mm. Exp. hemelytra 62 mm.

Hab.—Borneo; Kina Balu (Whitehead; Coll. Dist.).

Allied to *T. kinta* but differing by the more upturned metasternal process, second joint of antennæ longer than third, the

castaneous connexivum, narrower pronotum, and different colour and markings of the body beneath.

In the figure the abdomen is a little too elongate.

### Fam. LYGÆIDÆ.

#### Genus MACROPES.

*Macropes*, Motsch., Et. Ent., viii, p 108 (1859).

Type *M. spinimanus*, Motsch.

*Macropes philippinensis*, sp. nov. (Pl. xi, figs. 7, 7a.)

Head, pronotum, scutellum, abdomen above, body beneath and legs black; first and second joints of antennæ and the tarsi sordid ochraceous; abdomen beneath ochraceously pilose; hemelytra pale creamy yellow, base, central vein and outer margin of clavus, apical angular area of corium, base of membrane and a large discal spot, black; antennæ with the second and fourth joints subequal in length, each longer than third; rostrum passing the anterior coxæ; pronotum with the anterior lobe smooth, broad, convexly narrowed to head, centrally, finely, longitudinally sulcate, behind the sulcation broadly, transversely, opaquely granulate; membrane not quite reaching the apex of the fourth abdominal segment; scutellum apically, centrally, longitudinally carinate; anterior femora very strongly incrassated and strongly spinous beneath.

Long. 9 mm.

Hab.—Philippine Islands (C. S. Banks; Brit. Mus.).

### Fam. TINGIDIDÆ.

#### Genus ELASMOGNATHUS.

*Elasmognathus*, Fieb., Ent. Monogr., pp. 30 and 90 (1844).

Type *E. helferi*, Fieb.

*Elasmognathus picturatus*, sp. nov. (Pl. x, figs. 4, 4a.)

Head piceous, greyishly pilose; antennæ pale ochraceous, the apical joint (excluding base) piceous, first and second joints brownish; pronotum castaneous, the anterior vesicle or hood and the produced lateral areas dull greyish white, the margins of the areolets darker; hemelytra with the discoidal and subcostal areas pale tawny, an oblique central line to the first and the margins of the latter castaneous-brown; costal area very pale stramineous with a dark castaneous spot beyond middle and a larger spot of the same colour at apex; sutural area greyish-brown; body beneath castaneous, thickly, greyishly pilose; legs pale ochraceous; first and second joints of antennæ strongly incrassate, fourth longer than first and second together; pronotum with the anterior hood

scarcely covering base of head, globosely erect and anteriorly convexly rounded and a little bent forwardly; the lateral areas globosely erect and a little obliquely directed outwardly, very distinctly areolate and the margins of the areolets raised and prominent; the disk reticulately granulose, tricarinate, the central carination straight and procurrent, the lateral carinations largely concealed by the produced lateral areas; hemelytra, with the areolets of the discoidal and sutural areas, small and dense, those of the latter more obscure; costal area with most of the areolets moderately large and subquadrate.

Long.  $4\frac{1}{2}$  mm.

Hab.—Borneo; Kuching (Hewitt).

#### Genus TELEONEMIA:

*Teleonemia*, Costa, Ann. Mus. Zool. Napoli, ii, p. 144 (1864).

Type *T. funerea*, Costa.

*Teleonemia bimaculata*, sp. nov. (Pl. x, figs. 6, 6a.)

Head and pronotum fuscous-brown; the first with a paler mark behind each eye, the latter with a transverse black spot palely margined on each side near anterior margin which is narrowly ochraceous; hemelytra with the discoidal and subcostal areas pale brownish ochraceous, the margin of the areolets a little darker, the discoidal area with two large piceous spots, one at base, the other at apex, the latter more palely and broadly continued across the subcostal and costal areas; costal area greyish with the margins of the areolets fuscous and with a piceous spot at apex; sutural area greyish brown near base, pale greyish near apex, margins of the areolets piceous; body beneath piceous, greyishly pilose, abdominal apex greyish white; legs piceous-brown; antennæ fuscous-brown, first and second joints incrassate, first a little longer than second, fourth longer than first and second together; pronotum coarsely punctate, tricarinate, the central carination straight and procurrent, the lateral carinations very short and oblique, an obscure transverse impression at their anterior termination, the apex, posterior lateral margins and the lateral carinations paler in hue; hemelytra with the discoidal area coarsely punctate, subcostal area with small areolets arrayed in longitudinal series, costal area with irregular subquadrate areolets, sutural area with the apical areolets considerably larger than those near base.

Long.  $4\frac{1}{2}$  mm.

Hab.—Borneo; Kuching (Hewitt).

*Teleonemia borneensis*, sp. nov. (Pl. x, figs. 1, 1a.)

Piceous-black; tibiæ brownish testaceous; antennæ with the first and second joints moderately incrassate, first joint longer than

second, fourth longer than first and second together; pronotum strongly; transversely compressed near anterior margin, coarsely punctate, its apex very coarsely punctate, the central longitudinal carination strongly and acutely raised, the lateral carinations more obscure but also procurent and sinuate, the anterior marginal area robustly granulate; hemelytra densely areolate, the areolets of the sutural area larger than those found on the remaining areas.

Long. 4 mm.

Hab.—Borneo; Kuching (Hewitt).

*Teleonemia* (?) *elegantula*, sp. nov. (Pl. x, figs. 3; 3a.)

Head pale bluish grey, eyes dark indigo-blue; antennæ brownish, first, second and fourth joints darker; pronotum indigo-blue, the lateral margins and anterior area greyish white, the hood ochraceous; hemelytra with the discoidal and subcostal areas pale bluish, a large dark indigo-blue spot occupying the central disks of both; costal and sutural areas greyish, hyaline, the margins of the areolets brownish, the basal portion of the sutural area pale bluish; body beneath greyish blue; legs pale castaneous-brown; antennæ with the first and second joints incrassate, first longer than second, fourth longer than first and second together; pronotum with the anterior vesicle or hood somewhat compressed and pointed in front, areolate, scarcely covering base of head, globose and strongly depressed near middle, tricarinate, the lateral carinations a little sinuate and not reaching the pale anterior area, thickly punctate, more coarsely so posteriorly; hemelytra with the discoidal and subcostal areas coarsely punctate, the costal and sutural areas areolate, the costal distinctly widened beyond middle.

Long.  $3\frac{1}{2}$  to 4 mm.

Hab.—Borneo; Kuching (Hewitt).

## Sub-order HOMOPTERA.

### Fam. FULGORIDÆ.

#### Sub-fam. Lophopinæ.

Genus MAKOTA, gen. nov.

Head a little longer than space between eyes, the lateral margins strongly ridged, the apex angulate; face with its base produced above eyes, dilated on each side before clypeus near which it is obliquely directed inwardly, centrally tricarinate, the central carination straight, the lateral carinations more roundly oblique; clypeus centrally carinate; pronotum broad, short, tricarinate, anteriorly a little produced between the eyes; mesonotum large, tricarinate, the carinations continuous with those of the pronotum, the lateral ones oblique; rostrum almost reaching the

posterior coxæ; tegmina not quite three times as broad as long, the costal and posterior margins almost straight and parallel, the apex truncate, the veins longitudinal, those on the apical area dense and numerous, the costal area with numerous slightly oblique transverse veins beyond middle; wings with a subapical series of small, fine, transverse veins; anterior and intermediate tibiæ strongly dilated, posterior tibiæ not dilated, sulcate beneath, with two strong spines beyond middle; basal joint of posterior tarsi long and thickened.

Type *M. illustris*, Dist.

*Makota illustris*, sp. nov. (Pl. xi, figs. 6, 6a.)

Vertex of head, pronotum and scutellum ferruginous-brown; apex of vertex, lateral margins of pronotum and apex of mesonotum, ochraceous; abdomen above dull brownish ochraceous; face, sternum and legs dull ochraceous; legs spotted and mottled with fuscous, apices of the posterior tibiæ and tarsi piceous; abdomen beneath ferruginous-brown, more or less mottled with piceous; tegmina hyaline, the basal third, apical, fourth, and claval area brownish ochraceous with piceous spots and mottlings, the opaque apical area with a hyaline spot near apex on the costal and posterior margins containing small piceous spots, and an apical hyaline margin without spots, the veins on the central hyaline area spotted with piceous, posterior margin of claval area thickly spotted with piceous; wings hyaline, apical and posterior margins broadly fuscous; structural characters as in generic diagnosis.

Long. excl. tegm. 10 mm. Exp. tegm. 26 mm.

Hab.—Bornéo; Kuching (Hewitt).

*Makota notabilis*, sp. nov. (Pl. xi, figs. 1, 1a.)

Vertex of head ochraceous, with the lateral margins at the region of the eyes black; pronotum black, the carinæ and broad lateral margins ochraceous, some fine linear ochraceous spots near basal margin; mesonotum piceous; clypeus, sternum and abdomen beneath more or less piceous; face, legs and lateral spots to abdomen ochraceous; legs spotted with piceous, margins of femora and apices of tibiæ and tarsi black; tegmina pale ochraceous subhyaline, basal fourth, apical third, and claval area black, a pale ochraceous subhyaline spot near apex on the costal and posterior margins containing small piceous spots and an apical subhyaline margin without spots, the veins on the central, pale area spotted with black.

Long. incl. tegm. 13 mm.

Hab.—Borneo; Kuching (Hewitt).

Allied to *M. illustris* but differing in the less developed anterior tibiæ, the more acutely posteriorly widened face, the piceous clypeus, darker coloration, etc.



Genus *ALUMA*, gen. nov.

Vertex about as long as breadth between eyes, the lateral margins strongly ridged and a little angulate on each side at their apices; face long, much longer than clypeus, the base produced beyond eyes, gradually widened towards clypeus before which it is again bent inwardly, tricarinate, the lateral carinations very robust; clypeus centrally carinate; rostrum passing the intermediate coxæ; anterior and intermediate tibiæ dilated, posterior tibiæ not dilated and armed with two strong spines beyond middle, the apical spines well developed; basal joint of posterior tarsi long and strongly thickened; tegmina about three times as long as broad, the costal area with oblique transverse veins, veins on remaining surface longitudinal, on apical area dense and numerous, with numerous short transverse veins, and a distinct subapical transverse series defining a short subapical area, costal margin moderately sinuate, apex slightly rounded, inner margin a little dilated beyond claval apex; pronotum short and broad, centrally tricarinate, its apex moderately produced between eyes, its lateral angles subacute; mesonotum broader than long, tricarinate, the carinations continuous with those on pronotum.

Type *A. ocellata*, Dist.

The shape and venation of the tegmina as well as the structure of the face will distinguish this genus from *Makota*, to which it is allied.

*Aluma ocellata*, sp. nov. (Pl. xi, figs. 3, 3a.)

Body above and tegmina black; body beneath and legs piceous, the anterior and intermediate tibiæ above obscurely banded with black; tegmina with a large subapical ocellate spot, black, margined with reddish brown and with a small white pupillate spot situate nearer its hinder extremity, a few scattered obscure greyish spots near middle of costal area; tarsi and disk of sternum brownish ochraceous; structural characters as in generic diagnosis.

Long. incl. tegm. 14 mm.

Hab.—Borneo; Kuching (Hewitt).

Genus *SAREBASA*, gen. nov.

Head a little longer than breadth between eyes, a bent transverse impression between the eyes, in front of which are two prominent ridges gradually directed outwardly, the lateral margins in front of eyes raised and acute, their apices, with those of the two central ridges, having the appearance of four short spines in transverse series; posteriorly the head is a little narrowed between the eyes, widened anteriorly and apically subtruncate; face with its base projecting above the eyes where it is narrowest, and then gradually widened to a little before clypeus to which it is again inwardly directed, tricarinate, the central carination straight, the

lateral carinations parallel to the lateral margins; clypeus about as long as face, centrally carinate; rostrum reaching the posterior coxæ; pronotum short and broad, strongly narrowed from basal angles (which are subprominent) to between eyes, the apical margin rounded, basal margin truncate, tricarinate on disk, the central carination straight, the two lateral carinations rounded and meeting in front; mesonotum broad, tricarinate; femora moderately broad and flattened, beneath strongly, longitudinally ridged; anterior tibiæ moderately dilated, posterior tibiæ widened from base to apex which is broad and subtruncate; two prominent spines, one near base, the other near apex; basal joint of the posterior tarsi broadly thickened, longer than remaining joints together; tegmina more than twice as long as broad, costal margin rounded, apex broad, truncately rounded, posterior margin widened and rounded beyond claval apex, costal area obliquely veined, remaining veins longitudinal, dense and numerous on apical half.

Type *S. celebris*, Dist.

*Sarebasa celebris*, sp. nov. (Pl. xi, figs. II, IIA.)

Vertex pale luteous, the lateral margins in front of eyes with black ringlets; pronotum fuscous-brown, the anterior and lateral margins and a series of small spots at basal margin pale luteous; mesonotum and abdomen above fuscous-brown, the latter with the segmental margins pale; face pale luteous, its lateral areas with transverse black spots, its central area with two transverse black spots; clypeus black; body beneath and legs fuscous-brown or piceous; sides of face, spots to anterior and intermediate tibiæ, the posterior tibiæ excluding apices and margins of the abdominal segments beneath, pale luteous; tegmina pale greyish ochraceous, transversely shaded with piceous as shown in figure; wings hyaline, the veins and broad apical and outer margins fuscous; structural characters as in generic diagnosis.

Long. excl. tegm. 9 mm. Exp. tegm. 23 mm.

Hab.—Malay Peninsula; Selangor (H. E. Durham; Brit. Mus.).

Genus *APIA*, gen. nov.

Vertex about as long as breadth between eyes, the apical margin rounded and slightly angulated on each side; face long, truncate at base, gradually and slightly widened towards clypeus before which it is narrowed on each side; rostrum mutilated in typical specimen; pronotum short and broad, tricarinate, the central carination straight, the lateral carinations meeting in front of it, anteriorly conically produced between the eyes; mesonotum large, broad, tricarinate, the central carination straight, the lateral carinations oblique; abdomen above centrally ridged, the ridge appearing dentate by the compression of the abdominal segments; legs of moderate length and size, anterior tibiæ slightly but not prominently dilated, posterior tibiæ with two spines somewhat

close together, a little beyond middle; tegmina nearly three times as long as broad, the costal area obliquely veined, remaining venation longitudinal, becoming dense and close towards apical area.

Type *A. lineolata*, Dist.

*Apia lineolata*, sp. nov. (Pl. xi, figs. 10, 10a.)

Head, pronotum and scutellum ochraceous, with longitudinal piceous lines, five on vertex of which three are discal and two marginal, ten on pronotum and about the same number on mesonotum; abdomen dark brownish, the segmental margins piceous; body beneath and legs ochraceous, face, with the margins and seven longitudinal lines, piceous; legs with piceous longitudinal lines; tegmina ochraceous mottled with greyish, costal area beyond basal third greyish with oblique fuscous lines, the longest crossing apical area, two transverse and bent almost parallel with apical margin, a piceous subapical spot near posterior margin; wings pale fuliginous, posterior and apical margins broadly fuscous; structural characters as detailed in generic diagnosis.

Long. excl. tegm. 8 mm. Exp. tegm. 24 mm.

Hab.—Malay Peninsula; Singapore (H. N. Ridley; Brit. Mus.).

#### Genus VARMA.

*Varma*, Dist., Faun. Brit. Ind. Rhynch., iii, p. 330 (1906).

Type *V. fervens*, Walk.

*Varma obliqua*, sp. nov. (Pl. xi, figs. 8, 8a.)

Vertex, pro- and mesonota, face, sternum and legs pale ochraceous; abdomen brownish ochraceous, above marginally and centrally castaneous; tegmina subhyaline, the costal and apical areas, claval margins, and an oblique fascia before the apical area dull ochraceous, above the fascia on costal margin is a small piceous spot; wings hyaline, the veins and apical area dull ochraceous; face with the central and lateral carinations robust and much darker in hue, as is also the central carination to the clypeus, posterior tibiae with two strong spines beyond middle, preceded by a shorter and almost obsolete spine.

Long. excl. tegm. 6 mm. Exp. tegm. 18 mm.

Hab.—Malay Peninsula; Perak (Doherty).

#### Genus SERIDA.

*Serida*, Walk., Journ. Linn. Soc. Lond. Zool., 1, p. 158 (1857).

Type *S. latens*, Walk.

*Serida balteata*, sp. nov.

Vertex, pronotum and mesonotum piceous; basal margin, central and marginal ridges to vertex, lateral margins, central

carinations and longitudinal lines and spots on each lateral area of pronotum, central carinations, lateral margins, apex, irregular fasciæ on lateral areas and the margins of two small, dark, sub-apical spots to mesonotum, ochraceous; face, sternum and legs ochraceous; a central longitudinal fascia to face and clypeus, lateral margins of prosternum, a small apical and subapical spot to femora beneath and a spot behind eyes, black; abdomen mutilated in the two typical specimens now before me; tegmina hyaline, the veins, basal third of costal area attached to a transverse fascia which extends through corium and clavus, large suffusions on apical area which principally take the form of two transverse fasciæ fused internally and forming a large x-shaped spot, apical margin and posterior claval margin piceous-brown; wings hyaline, apical margins broadly piceous-brown; vertex longer than broad, the ridges prominent; face sub-angulately broadened beyond middle.

Long. incl. tegm. 11 mm.

Hab.—Cambodia (Mouhot; Brit. Mus.).

#### Genus CATARA.

*Catara*, Walk., Journ. Linn. Soc. Lond. Zool., x, p. 115 (1868).  
Type *C. subdivisa*, Walk.

#### *Catara subdivisa*.

*Catara subdivisa*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 115 (1868).

*Serida proxima*, Walk., loc. cit., p. 183 (1868).

Hab.—Morty Islds; Batchian (Doherty).

#### *Catara philippinensis*, sp. nov. (Pl. xi, figs. 12, 12a.) .

Body above and abdomen beneath more or less ferruginous-brown; face, sternum and legs brownish ochraceous; tegmina brownish ochraceous, the base of costal area piceous, remainder of costal area, the apical area, and two transverse fasciæ somewhat at right angles to each other fuscous-brown; wings hyaline, slightly fuliginous, the veins fuscous; vertex broader than long, centrally and marginally ridged; pronotum narrow, strongly anteriorly produced in front of eyes; posteriorly deeply angularly sinuate, all the margins ridged and with a prominent central longitudinal carination; mesonotum long, tricarinate; face elongate, the margins ridged, centrally longitudinally carinate, its base considerably above eyes and truncate, gradually widened towards clypeus before which it is obliquely turned inwardly; clypeus short and centrally carinate; rostrum reaching the posterior coxæ; posterior tarsi with two spines somewhat close together beyond middle; tegmina with the costal area obliquely veined, a curved transverse vein defining a closely longitudinally veined apical area, before which is another series of irregular transverse veins.

Long. excl. tegm. 7 mm. Exp. tegm. 18 mm.

Hab.—Philippine Islds. (C. S. Banks; Brit. Mus.).

Allied to *C. subdivisa*, Walk., but differing by the shorter pronotum, different markings to the tegmina, etc.

Genus JIVATMA.

*Jivatma*, Dist., Faun. Brit. Ind. Rhynch., iii, p. 328 (1906).

Type *J. metallica*, Dist.

*Jivatma insignis*, sp. nov. (Pl. xi, figs. 9, 9a.)

Vertex stramineous, the margins and those of the central carination brownish; pro- and mesonota ferruginous-brown, the latter between the carinations piceous; abdomen ferruginous-brown, sternum and legs brownish ochraceous; face and clypeus stramineous; tegmina umber-brown, the costal area with whitish transverse linear spots or stripes, a greyish white patch extending round costal and apical margins containing five brown streaks, of which three are outwardly oblique, one inwardly oblique and the fifth longitudinal, a small black spot near posterior angle; wings pale fuliginous, the veins darker; vertex centrally and marginally carinate; face tricarinate; clypeus with the central carination fine but distinct; rostrum about reaching the posterior coxæ; pro- and mesonota tricarinate; posterior tibiæ with three spines, two beyond middle and one at apex.

Long. excl. tegm. 6 mm. Exp. tegm. 19 mm.

Hab.—Borneo; Kuching (Hewitt).

*Jivatma whiteheadi*, sp. nov.

Vertex, pronotum and mesonotum brownish ochraceous, pronotum and mesonotum with two broad longitudinal piceous fasciæ only separated by the pale central longitudinal carination and outwardly defined by the lateral carination on each side, on mesonotum these fasciæ do not extend to the posterior apex; abdomen above and beneath more or less piceous; face, sternum and legs ochraceous; tegmina pale ochraceous, the costal area from base to beyond middle more or less greyish subhyaline with very obscure obliquely transverse ochraceous lines, beyond this pale area are five greyish subhyaline lines, commencing on costa and scarcely reaching middle of tegmen, the first three oblique, the fourth and fifth straightly transverse, the fifth subapical; proceeding from the outer angle of the posterior margin are two or three similar but shorter lines, the apical margin is more obscure greyish, and near the posterior angle is a black faintly ocellate spot outwardly margined with reddish ochraceous; wings pale fuliginous, a little darker at apex; vertex slightly longer than breadth between eyes, centrally and laterally strongly ridged; face with the angles before clypeus rather strongly produced, making the breadth there almost equal to the length.

Long. excl. tegm.  $5\frac{1}{2}$  mm. Exp. tegm. 20 mm.  
 Hab.—Philippine Islds. (Whitehead; Brit. Mus.).

Genus *LOPHOPS*.

*Lophops*, Spin., Ann. Soc. Ent. Fr., viii, p. 387 (1839).  
*Cystinocephala*, Stål, Öfv. Vet.-Ak. Förh., 1853, p. 266.  
*Gozarta*, Walk., Journ. Linn. Soc. Lond. Zool., x, p. 116  
 (1868).  
 Type *L. servillei*, Spin.  
*Lophops zebra*.  
*Gozarta zebra*, Walk., Journ. Linn. Soc. Lond. Zool., x, p. 116  
 (1868).  
 Hab.—Malay Archipelago; Tidor<sup>1</sup> (Wallace); Malay Peninsula;  
 Selangor (Durham; Brit. Mus.).

Fam. *CERCOPIDÆ*.

Sub-fam. *Aphrophorinæ*.

Genus *PTYELUS*.

*Ptyelus*, St. Farg. and Serv., Enc. Meth., x, p. 608 (1825).  
*Philænus*, Stål, Stett. Ent. Zeit., xxv, p. 66 (1864).  
*Amarusa*, Walk., Journ. Linn. Soc. Lond. Zool., i, p. 166  
 (1857).  
 Type *P. flavescens*, Fabr.  
*Ptyelus piceus*.  
*Amarusa picea*, Walk., Journ. Linn. Soc. Lond. Zool., i, p. 166  
 (1857).  
*Ptyelus tenebrifer*, Walk., List Hom. Suppl., p. 189 (1858).  
 Hab.—Borneo.

Genus *PLINIA*.

*Plinia*, Stål, Hem. Afr., iv, p. 66 (1866); *Id.*, Berl. Ent.  
 Zeitschr., x, p. 384 (1866).  
 Type *P. ampla*, Walk.

*Plinia pilosa*, sp. nov. (Pl. x, figs. 12, 12a.)

Black, thickly brownly pilose, tegmina more thickly and longly pilose, the hairs being arranged in tufts; vertex distinctly shorter than pronotum, somewhat conically rounded in front of eyes; face somewhat long and prominent, centrally a little flattened where there is a central longitudinal raised line, the lateral areas strongly, transversely striate; clypeus with a central longitudinal raised line which is widened posteriorly but does not reach apex; rostrum reaching the intermediate coxæ; posterior femora with two strong spines; tegmina very strongly and broadly wrinkled on the claval area.

<sup>1</sup> By a misprint in Walker's paper this locality reads "Tidon."

Long. 15 mm.

Hab.—S.-E. Borneo (Doherty; Coll. Dist.).

Allied to *P. ampla*, Walk., but differing by the shorter vertex, which in *ampla* is as long as the pronotum, very much more strongly pilose, claval area strongly wrinkled, and by the absence of the red margin to vertex as in *P. ampla*.

#### Genus CLOVIA.

*Clovio*, Stål, Hem. Afr., iv, p. 75 (1866).

Type *C. bigoti*, Sign.

*Clovio humboldtiana*, sp. nov. (Pl. x, figs. 7, 7a.)

Black or piceous; a central longitudinal stramineous fascia traversing the vertex, pronotum and scutellum; tegmina with six stramineous spots situate two in clavus—one at base elongate, the other near middle transversely oblique—and four on coriaceous area—two near costal margin and two on apical area; face and legs brownish, the posterior legs sometimes piceous; lateral and basal margins of face and a longitudinal fascia on each side of sternum, stramineous; vertex subequal in length to pronotum, anteriorly somewhat obtusely, roundly, angularly produced, and with an obscure, fine, transverse impression on disk; vertex, pronotum and scutellum finely punctate, the pronotum also very finely wrinkled; face flattened though very slightly convex; posterior tibiæ with two spines; tegmina densely, finely punctate.

Long. 8 to 9 mm.

Hab.—New Guinea; Humboldt Bay (Doherty; Brit. Mus.).

Allied to *C. ornata*, Walk.

*Clovio moresbyensis*, sp. nov. (Pl. x, figs. 9, 9a.)

Vertex, pronotum and scutellum piceous-brown; vertex with a narrow, black, marginal line in front of eyes, this line inwardly broadly margined with dull ochraceous; pronotum with a narrow transverse pale yellow line before middle; face, abdomen beneath and legs pale castaneous-brown; sternum piceous; basal and lateral margins of face, a submarginal fascia on each side of sternum, apex of clypeus, under surfaces and apices of femora and abdominal segmental margins, ochraceous; tegmina piceous-brown, an oblique spot before middle of clavus not reaching claval suture and extending over its inner margin a short way into the corium, and two small spots in oblique series on apical area pale ochraceous; vertex about as long as pronotum, obtusely, angularly produced anteriorly; rostrum reaching the intermediate coxæ; vertex, pronotum and scutellum very finely, transversely wrinkled; tegmina obscurely, densely, finely punctate; posterior tibiæ with two spines.

Long. 11 mm.

Hab.—New Guinea ; near Port Moresby.

Allied to *C. varipes*, Walk.

*Clovia pilosula*, sp. nov. (Pl. x, figs. 10, 10a.)

Vertex, pronotum and scutellum obscure ochraceous, sometimes brownish ; vertex very narrowly margined with black in front of eyes, and with a short, central, transverse, dark line on disk ; pronotum with six darkly impressed spots near anterior margin, face and scutellum black ; sternum, legs and abdomen beneath more or less brownish ochraceous ; basal and lateral margins of face, and a broad sublateral fascia on each side of sternum, golden yellow ; apices of posterior tibiæ and the posterior tarsi piceous ; tegmina piceous-brown, pilose ; clavus (excluding apex) obscure ochraceous ; a short oblique fascia crossing clavus beyond middle but not extending to middle of corium, extreme apex of clavus, and an oblique curved fascia extending from costal margin at commencement of apical area and extending to apex, pale dull ochraceous ; vertex almost as long as pronotum, obtusely, angularly rounded anteriorly ; rostrum reaching the intermediate coxæ ; vertex, pronotum and scutellum very finely wrinkled ; tegmina densely, finely pilose ; posterior tibiæ with two spines.

Long. 10½ to 12 mm.

Hab.—S.-E. Borneo (Doherty).

*Clovia batchianensis*, sp. nov.

Vertex, pronotum and scutellum pale ochraceous, vertex and pronotum with darker longitudinal lines of which two are central and procurrent, and on each side of these are one on vertex and two on pronotum, some linear spots on scutellum (imperfectly seen in type owing to the specimen being pinned in that locality), body beneath and legs pale brownish ochraceous ; a narrow basal line to face, apices of tarsi and apices of the posterior tibiæ black ; tegmina brownish, pilose, an oblique macular fascia crossing base of clavus to costal margin before middle, and an obscure discal oblique suffusion, and two oblique linear spots on apical area—the uppermost at about one-third from apex and the other on apical costal margin—pale ochraceous ; vertex a little shorter than pronotum, obtusely angularly rounded in front ; rostrum reaching the intermediate coxæ ; upper surface more or less shortly, finely pilose, the tegmina more densely and longly pilose ; posterior tibiæ with two spines.

Long. 9 mm.

Hab.—Batchian Island (Doherty).

*Clovia signifera*.

*Perinoia signifera*, Walk., Journ. Linn. Soc. Lond. Zool., i, p. 166 (1857).

Hab.—Borneo.



*Clovia expressa*.

*Perinoia expressa*, Walk., Journ. Linn. Soc. Lond. Zool., i,  
p. 167 (1857).

Hab.—Borneo.

*Clovia exclamans*.

*Perinoia exclamans*, Walk., Journ. Linn. Soc. Lond. Zool., i,  
p. 166 (1857).

Hab.—Borneo.

*Clovia ornata*.

*Perinoia ornata*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 294 (1869).

Hab.—Dorey, New Guinea.

*Clovia deflexa*.

*Perinoia deflexa*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 295 (1869).<sup>1</sup>

Hab.—Mysol (Wallace); New Guinea, Humboldt Bay  
(Doherty).

*Clovia disjuncta*.

*Perinoia disjuncta*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 295 (1869).

Hab.—Dorey, New Guinea.

*Clovia subjuncta*.

*Perinoia subjuncta*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 295 (1869).

*Perinoia placens*, Walk., *loc. cit.*, p. 296.

Var. *Perinoia semijuncta*, Walk., MS.

Hab.—Philippines; N. Luzon (Brit. Mus.), Amboina, Aru,  
Mysol, Batchian, Morty, New Guinea (Wallace; Brit. Mus.).

Two specimens labelled *semijuncta*, Walk., are contained in the British Museum, but I can find no trace of a description. It appears to be a variety of *C. subjuncta*, Walk., from which it differs by the following characters in coloration: The face is ochraceous, not black, but with the same stramineous margination; the transverse black band to the pronotum is broader; and the apical pale margin to the tegmina is not continuous to the claval apex, but terminates at the inner apical angle.

*Clovia furcata*.

*Perinoia furcata*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 297 (1869).

*Perinoia furcifera*, Walk., *loc. cit.*

Hab.—Sula, Ceram.

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<sup>1</sup> *Perinoia separata*, Walk. (*loc. cit.*, p. 294), seems, from the description, to be closely allied to this species, but the type is no longer to be found, and under these circumstances I regard it as a non-existent species. Kirkaldy (Trans. Ent. Soc. Lond., 1905, p. 330) comparatively refers to *separata*, Walk. This may, perhaps, be a slip of the pen.

*Clovia subfurcata.*

*Perinoia subfurcata*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 298 (1869).

Hab.—Gilolo, Ternate (Wallace); Batchian (Doherty).

*Clovia plena.*

*Perinoia plena*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 298 (1869).

Hab.—Sula.

*Clovia lituriplena.*

*Perinoia lituriplena*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 296 (1869).

Hab.—Mysol.

*Clovia varipes.*

*Perinoia varipes*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 300 (1869).

Hab.—Batchian.

*Clovia comma.*

*Ptyelus comma*, Walk., List. Hom. Suppl., p. 190 (1858).

Hab.—Sumatra.

*Clovia transversa.*

*Perinoia transversa*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 299 (1869).

*Perinoia pustuliceps*, Walk., *loc. cit.*

Var. *Perinoia badia*, Walk., *loc. cit.*

Differs from the typical form by the absence of the luteous transverse line to the pronotum.

Hab.—Mysol, New Guinea, Aru.

*Clovia plenipennis.*

*Ptyelus plenipennis*, Walk., Journ. Linn. Soc. Lond. Zool., x,  
p. 293 (1869).

*Ptyelus frontalis*, Walk., *loc. cit.*

Hab.—New Guinea, Aru.

## Genus PHILAGRA.

*Chalepus*, Walk., List. Hom., iii, p. 731 (1851), *nom. præocc.*

*Philagra*, Stål, Trans. Ent. Soc. Lond. (iii), i, p. 593 (1862).

Type *P. hastata*, Walk.

*Philagra cephalica*, sp. nov. (Pl. x, figs. 5, 5a, 5b.)

Head, pronotum, scutellum, sternum and legs fuscous-brown, very finely, greyishly pilose; abdomen above and beneath shining black; lateral margins of meso- and metasterna broadly ochraceous; bases of the posterior tibiæ brownish ochraceous; tegmina pale castaneous-brown, thickly mottled with obscure, irregular reddish spots; wings pale fuliginous, the veins black, the costal area hyaline; head longly produced, the vertex more than twice as long as pronotum, centrally longitudinally ridged, the lateral

margins also ridged ; pronotum with a central, longitudinal, incised line on disk, on each side of which, a little before middle, is a distinct foveate impression ; face with a central longitudinal ridge ; rostrum reaching the intermediate coxæ ; posterior tibiæ with two spines, the basal spine shortest.

Long. excl. tegm. 16 mm. Exp. tegm. 29 mm.

Hab.—Cambodia (Mouhot ; Brit. Mus.).

*Philagra provecta*, sp. nov. (Pl. xi, figs. 5, 5a, 5b.)

Head above, pronotum and scutellum black, thickly, finely, shortly, greyishly pilose ; abdomen above and body beneath black and less pilose ; apex of produced vertex, apex of scutellum, base of face, lateral margins of sternum, and the legs, brownish ochraceous ; tegmina brownish ochraceous with piceous suffusions ; wings hyaline with an ochraceous tint, the veins brownish ochraceous ; head about as long as pronotum and scutellum together, somewhat evenly and parallelly produced from about one-third in front of eyes, curved upwardly ; three short longitudinal impressions on anterior area of pronotum ; abdomen above shining black, the apical area more piceous-brown ; face finely, transversely wrinkled ; posterior tibiæ with two prominent spines.

Long. excl. tegm. 12 mm. Exp. tegm. 22 mm.

Hab.—Sangir (Doherty).

### Sub-fam. Cercopinæ.

Genus EOSCARTA.

*Eoscarta*, Bredd., Soc. Ent., xvii, p. 58 (1902).

Type *E. borealis*, Dist.

*Eoscarta rana*, sp. nov. (Pl. x, figs. 2, 2a.)

Body and legs piceous-black, the upper surface of the abdomen shining ; almost the posterior half of the pronotum, but not extending to the lateral angles, flavescent ; tegmina flavescent, the basal third piceous-black ; wings hyaline, the basal area infusate ; face longitudinally and somewhat broadly sulcate ; vertex about as long as breadth between eyes, rather angularly rounded in front ; pronotum densely, finely punctate and faintly transversely wrinkled ; scutellum distinctly centrally, roundly foveate ; tegmina somewhat granulosely wrinkled ; posterior tibiæ with a somewhat long spine.

Long. excl. tegm. 6½ mm. Exp. tegm. 18 mm.

Hab.—Borneo ; Kuching (Hewitt).

*Eoscarta monostigma*.

*Ptyelus monostigma*, Walk., Journ. Linn. Soc. Lond. Zool., x, p. 293 (1869).

*Ptyelus impressus*, Walk., loc. cit., p. 294.

*Ptyelus concolor*, Walk., MS.

Hab.—Morty Island, New Guinea.

The *P. concolor*, Walk., MS., is not the species described by Walker under the same name in List Hom., iii, p. 715 (1851), the latter being a synonym of *Poophilus costalis*, Walk.

In this small species the longitudinal furrow is frequently indiscernible or almost so in certain specimens.

### Fam. JASSIDÆ.

#### Sub-fam. Ledrinæ.

#### Genus LEDRA.

*Ledra*, Fabr., Syst. Rhyng., p. 24 (1803).

Type *L. aurita*, Linn.

*Ledra muda*, sp. nov. (Pl. xi, figs. 4, 4a.)

Ferruginous-brown; apical area of head, posterior two-thirds of pronotum and basal area of face obscure plumbeous; tegmina subhyaline, talc-like, the veins reddish brown, the basal area reddish brown followed by an obliquely transverse darker fascia; wings subhyaline and talc-like, the veins reddish brown; vertex little more in length than half the breadth between eyes, the disk finely granulate, coarsely granulate on apical area and somewhat coarsely so on lateral marginal areas, centrally longitudinally ridged, the ocelli a little nearer to each other than to eyes, and from each ocellus there is obliquely directed a short but distinct sharp impression; between ocelli and eyes is a small but distinct tubercle; pronotum with a subangulate transverse impression separating the narrow anterior paler area, the whole surface sparsely granulose, the granules larger and coarser towards base, on the posterior and darker area are four longitudinal ridges of which the two central are more distinct and granulose; scutellum finely, sparsely granulose, two prominent discal granules nearer to lateral margins than to each other; face broadly concave; rostrum reaching intermediate coxæ; anterior tibiæ moderately dilated, the margins longly, thickly pilose and sparsely granulose beneath, posterior tibiæ outwardly dilated, shortly, finely, obscurely serrate internally, externally widened beyond middle, shortly hirsute and with scattered short spines; tegmina with the basal opaque area punctate, with a few scattered granules and a few obscure pale spots.

Long. excl. tegm. 13 mm. Exp. tegm. 26 mm.

Hab.—Borneo; Kuching (Hewitt).

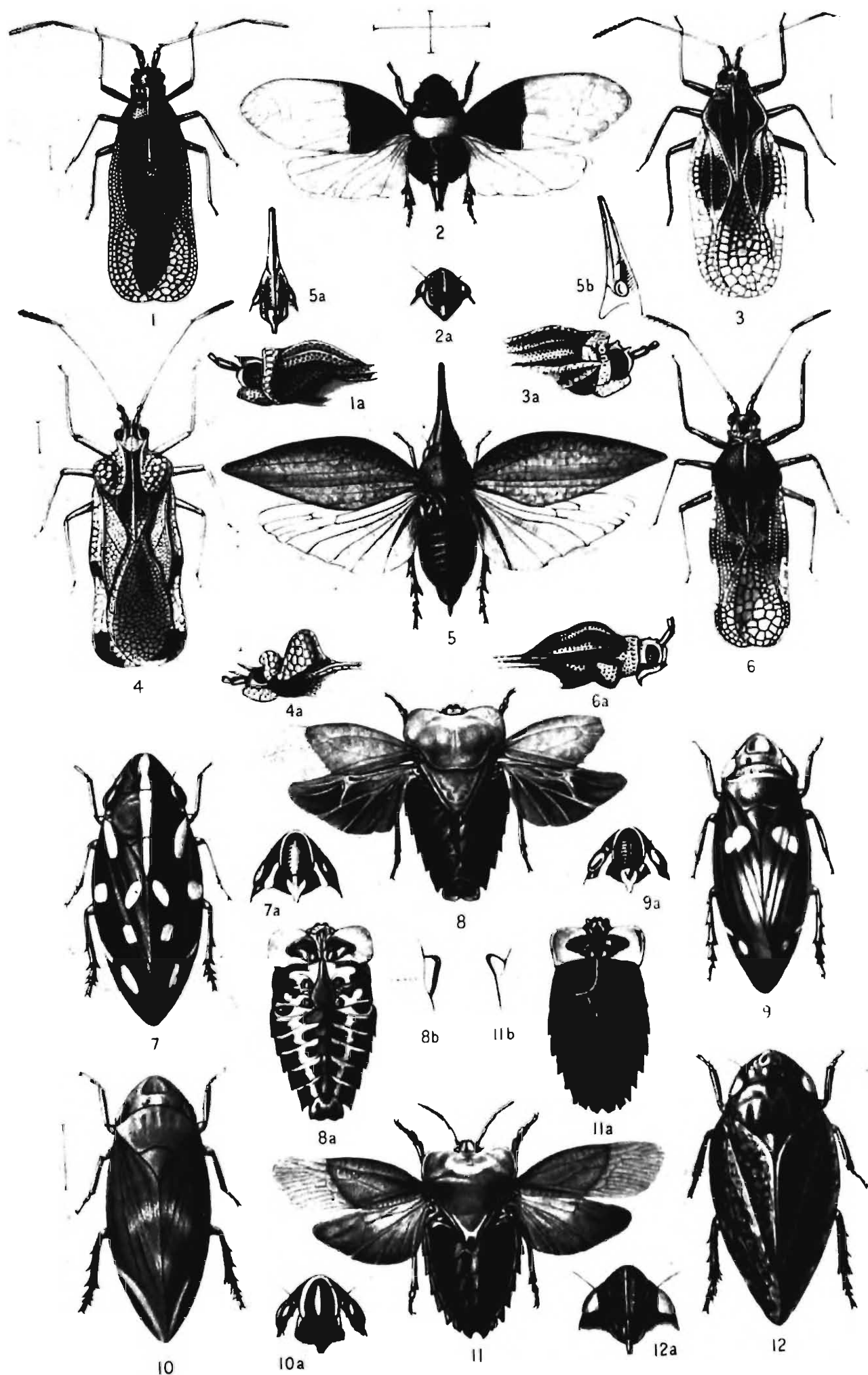
*Ledra gigantea*, sp. nov. (Pl. xi, figs. 2, 2a.)

Ferruginous-brown; tegmina with a piceous spot at inner margin near apex; wings subhyaline, talc-like, the veins ferruginous-brown; vertex about as long as space between eyes, coarsely

granulose except on basal area, ocelli a little nearer to each other than to eyes; pronotum not centrally longitudinally ridged, sparingly coarsely granulate, moderately raised before scutellum, the lateral margins moderately convex and finely dentate; scutellum finely punctate, a slight elongate elevation at apex; face broadly concave; rostrum mutilated in typical specimen; anterior tibiæ dilated, their outer margins longly pilose; posterior tibiæ broadly dilated, their outer margins hirsute, undulatory, dentate, narrowing towards base and apex, sparingly coarsely granulate; tegmina with the basal area punctate, with a few scattered granules, more abundant on basal third.

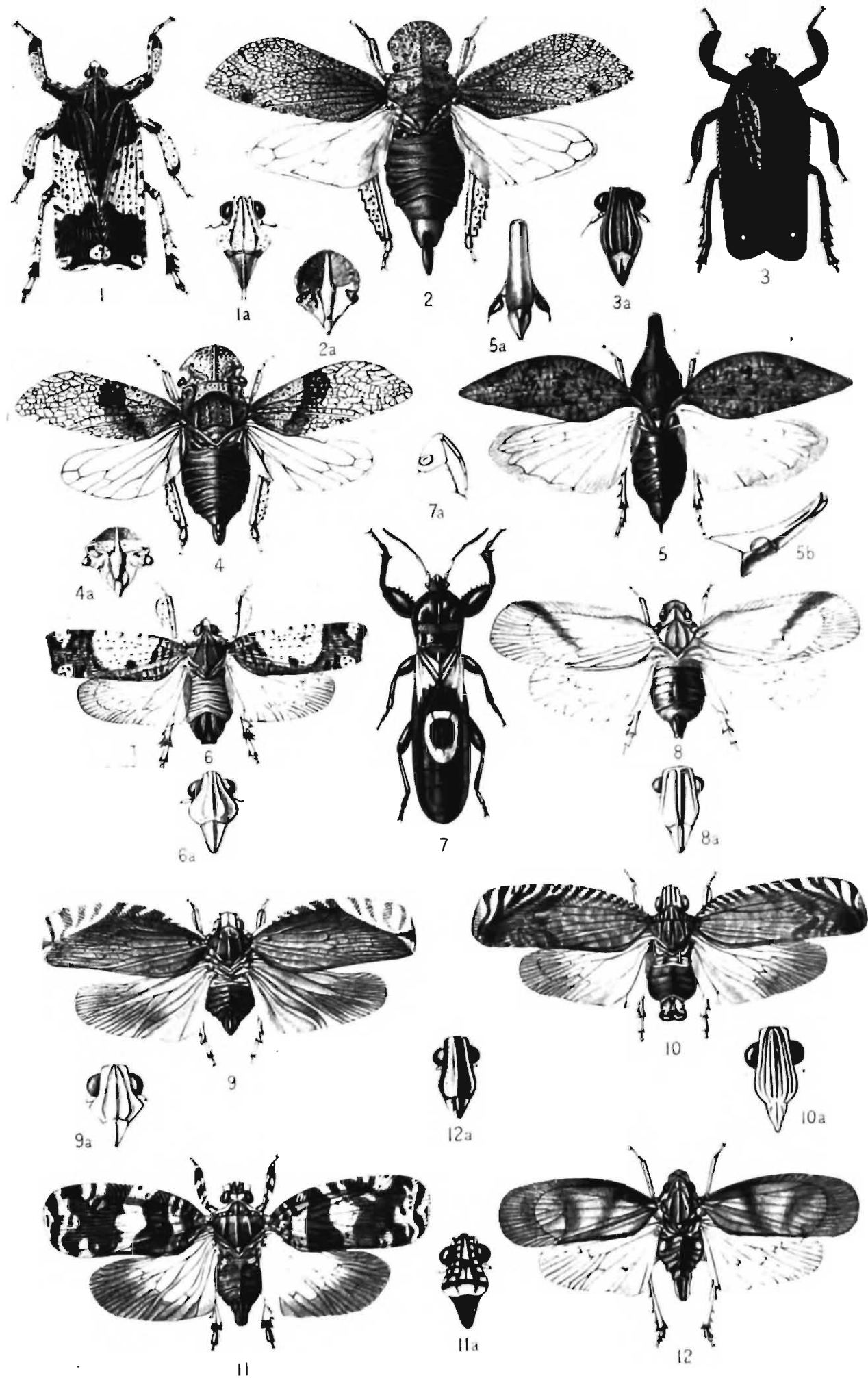
Long. excl. tegm., ♀, 28 mm. Exp. tegm. 46 mm.

Hab.—Borneo; Matang (Hewitt).



Horace Knight, del. West, Newman proo.

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|---------------------------|---------------------------|-------------------------|
| TELEONEMIA BORNEENSIS.    | 8. PHILAGRA CEPHALICA.    | 9. CLOVIA MORESBYENSIS. |
| EOSCARTA RANA.            | 6. TELEONEMIA BIMACULATA. | 10. " PILOSULA.         |
| TELEONEMIA PLECOANTULA.   | 7. CLOVIA HUMBERTIANA.    | 11. TESSARATOMA KINA.   |
| ELASMOGNATHUS PICTURATUS. | 8. TESSARATOMA KINTA.     | 12. PLINIA PILOSA.      |



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|----------------------|-----------------------------|------------------------|
| 1. MAKOTA NOTABILIS. | 5. PHILAGRA PROVECTA.       | 9. JIVATMA INSIGNIS.   |
| 2. LEDRA GIGANTEA.   | 6. MAKOTA ILLUSTRIS.        | 10. APIA LINEOLATA.    |
| 3. ALUMA OCELLATA.   | 7. MACROPES PHILIPPINENSIS. | 11. SAREBASA CELEBRIS. |
| 4. LEDRA MUDA        |                             |                        |

THE GENERIC NAME "INVESTIGATOR":  
A CORRECTION

Since the publication of my memoir "*Investigator sicarius*, a Gephyrean worm hitherto undescribed, the type of a new order" (*Memoirs of the Indian Museum*, vol. i, No. 4, 1909), the fact has been brought to my notice that the name "*Investigator*" has already been appropriated. Goode and Bean in 1895 separated the species *Nemichthys acanthonotus*, Alcock, from the genus *Nemichthys*, and bestowed the name *Investigator* upon the new genus thus formed (Goode and Bean, *Oceanic Ichthyology*, p. 518). It may be noted that Alcock has not accepted this alteration (Alcock, *Descriptive Catalogue of the Indian Deep-Sea Fishes*, Calcutta, 1899). It is, however, necessary to find another name for the Gephyrean genus *Investigator*, and I therefore propose the Greek form of the same word, namely, *Ereunetes*.

Thus for Order Investigatoroidea read Order Ereunetoidea;  
for Genus *Investigator* read Genus *Ereunetes*; type *Ereunetes sicarius*.

CALCUTTA:

F. H. STEWART.

June 7th, 1909.

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