

XIII. A NOTE ON CERTAIN OPHIUROIDS IN THE INDIAN MUSEUM.

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(Plate xiii.)

This note deals with four species obtained by the R.I.M.S. "Investigator." Three are members of the Gorgonocephalinae, while the fourth is a *Trichaster*. The generic names employed are in accordance with the definitions given by Professor Döderlein in his recent review of the Euryalae (5).

Astrodendrum laevigatum (Koehler), 1897.

This specimen (Regd. no. ZEV $\frac{1415}{7}$), from Station No. 284, is considerably larger than the type described and figured by

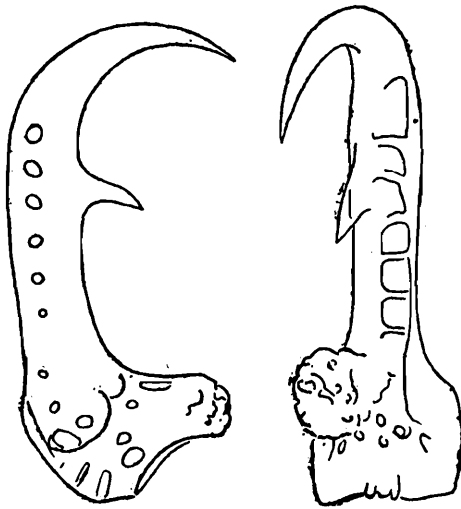


FIG. 1.—Girdle hooks of *Astrodendrum laevigatum*, $\times 200$.

Koehler (3) as *Gorgonocephalus laevigatus*. It was obtained off the east coast of Ceylon from a depth of 506 fathoms.

The radial shields on the dorsum of the disc are developed irregularly, and some are imperfect. In addition they are bent, forming a dorsal loop (resembling in outline a Geometrid caterpillar): this, being probably due to the shrinkage of the disc after immersion in spirit, indicates the weakness of the shields.

The madreporite plate is very evident, standing up as a prominent convexity from the general surface, and projecting so as partially to occupy the soft inter-brachial space.

This species is readily distinguished from the following by the complete absence of small granular ossicles on the dorsal surface of the disc and by the much greater relative size of the openings of the genital bursae, which, in this specimen which has a disc 60 mm. in diameter, measure from 16 to 18 mm.

The form of the girdle hooks is seen in text-fig. 1.

Astrodendrum sagaminum (Döderlein), 1902.

I include under this name two small specimens from Station 333 (Regd. no. ZEV $\frac{2135}{7}$).

The larger of these has a disc measuring 12.5 mm. in diameter, the smaller is clinging to the larger specimen and its disc measures 5.8 mm.

The skin of the disc is very nearly transparent, and contains numerous small granules, which are also present on the upper surface of the radial shields. The upper surfaces of the arms also are finely granular.

The apertures of the genital bursae, though relatively smaller than those of *A. laevigatum*, are comparatively larger than in the example of *A. sagaminum* which is figured by Döderlein (5). They measure 2 mm. in the larger and 0.9 mm. in the smaller specimen. But it may well be that the relative sizes of these apertures and the disc would be subject to alteration during growth up to the attainment of maturity. These are both young specimens and their discs are small, so that the basal end of each arm is quite free from the disc: in a dorsal view of the larger specimen two arm segments, and of the smaller four arm segments, are visible beyond the disc margin and before the occurrence of the first bifurcation of the arms.

Astrocladus dofleini, Döderlein, 1910.

(Pl. xiii, fig. 1.)

One specimen (Regd. no. ZEV $\frac{5533}{7}$) from Station 467, at a depth of between 42 and 75 fathoms, off the west coast of the south of India. This specimen, though the disc is complete, has all its arms fractured just beyond their first bifurcation.

The disc, measuring from the end of a radial shield to the opposite inter-brachial margin, has a diameter of 28 mm. The skin on the upper surface of the disc is opaque and finely granular, the shields being indicated by radiating ridges. Besides the fine granulations there are tuberosities which are very regular in their arrangement. In the centre of the disc they form a cluster of small round tubercles of various sizes. In each inter-radial and inter-brachial depression many of these tubercles are rather larger than

those in the centre, and distinctly conical. On the radial shields these conical tuberosities attain their greatest development: there are three or four on each shield and they are separated by intervals; at the outer end of each shield, except on one, are two large cones in contact at their bases. The outermost of these cones is the larger and measures 4 mm. in height.

Each inter-brachial space forms a semicircular bight in the disc margin. The thick, but unsupported skin of this space is bounded above by four or five tuberosities, not distinct from those on the dorsum of the disc, and there may be a feeble indication of a few small tubercles under the skin of this region. At the sides of this space are the openings of the genital bursae. The skin of the space forms a valve-like flap which closes the upper and outer ends of these openings, reducing the aperture to a curved slit, but leaves a wider piriform opening below. The length of the bursal slit is 4 mm.

The madreporite does not project into the soft inter-brachial

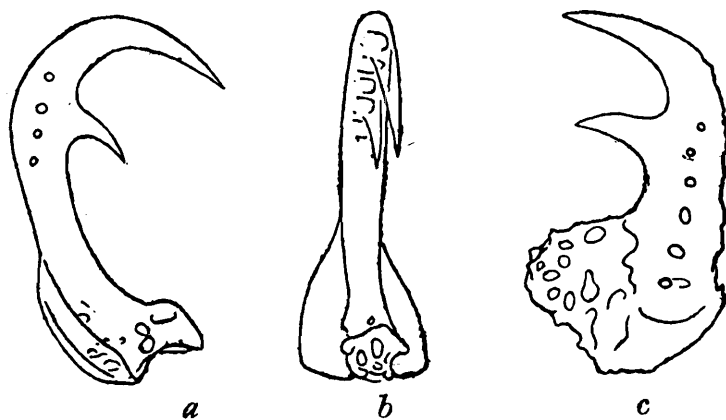


FIG. 2.—Girdle and tentacle hooks of *Astrocladus dofleini*, $\times 200$.

area, but is wholly situated on the firm skeleton of the under side of the disc. It forms an almost circular area, about 1.2 mm. in diameter, and is slightly concave.

The skin on the under side of the disc is also thick and finely granular.

The teeth and mouth papillae are spiniform but not so slender as in the genus *Astrodendrum*. The arms divide at the disc margin, the primary divisions being equally well developed. Each primary division begins to branch at a distance of 10 mm. from the disc, and the branching is unequal as in *Astrocladus exiguus* (Lamarck).

The dorsum of the arms is beset with tuberosities, like those on the disc; there are generally two on each segment. At the proximal part of the arm they form blunt cones, on bases measuring 1 mm. or more. These tuberosities, diminishing in size, can be traced beyond the ninth division of each arm.

Tentacle papillae begin at the second bifurcation of the arms, and form three rough rounded knobs close together. In the more

distal parts of the arms there are two tentacle papillae close to each tentacle. Text-fig. 2c shows a tentacle hook from the thinner part of the arm. A girdle hook is shown in text-fig. 2a-b.

It is one of my misfortunes that I have only been able to compare this specimen with one other member of this genus, namely with *A. exiguus* (Lamarck)=*G. cornutus*, Koehler (3). From this it differs in having more than one conical tuberosity on each radial shield. From *A. euryale* (Retzius), it differs in having numerous tuberosities in the inter-brachial regions on the dorsum of the disc.¹

The specimen examined shows points of resemblance to *A. ludwigi* (Döderlein) (4). Both have well developed tuberosities on the radial shields. *A. ludwigi*, however, differs in having no tuberosities on the arms and having its madreporite projecting into the soft inter-brachial area. But for these differences (which might not obtain in an example of *A. ludwigi* which measured more than 7 mm. in the diameter of the disc) I feel inclined to include this specimen in that species. But it agrees sufficiently well with that variety of *A. dofleini*, Döderlein, which has conical tuberosities. It shows a general resemblance to the example Döderlein figures in his review of Japanese Ophiuroids (5, plate 4, fig. 4), but has the tuberosities on the disc much more prominent.

***Trichaster elegans*, Ludwig, 1878.**

(Pl. xiii, figs. 3—4.)

This species (Regd. no. ZEV $\frac{5480}{7}$), founded on a single specimen from the Bay of Bengal, has apparently not been met with since Ludwig (2) published his description. Döderlein (5) has concluded that Ludwig's specimen was but a young example of *T. palmiferus* (Lamarck). For these two reasons it may be well to give a short description of a specimen recently obtained by the R.I.M.S. "Investigator" in the neighbourhood of the Mergui Archipelago (Station No. 533. Lat. 12°55'50" N., Long. 96°51'50" E.).

This example is considerably larger than the one described by Ludwig, its linear measurements being nearly twice as great. It was living on a sandy bottom at 58 fathoms depth, and its general colour was a sandy grey on the upper and almost white on the lower surface. The centre of the disc, however, was of a very dark olive green, and this same colour extended as a band to each inter-brachial margin of the disc, and also in the same manner along the dorsum of each arm. On the arms the intensity of the colour gradually diminished through brown into the general grey colour, so that after the first bifurcation, the dark streak was hardly noticeable.

¹ The only figure of this species with which I have been able to compare the specimen is that given by L. Agassiz (1) under the name of *Gorgonocephalus verrucosus*.

The upper surface of the disc was even, and not elevated above the level of the upper surface of the arms: since its immersion in spirit the soft parts have somewhat collapsed in the centre (as can be seen in plate xiii, fig. 4), and the radial shields of the disc, and the lateral arm plates also, are now clearly distinguishable.

I have been able to compare this specimen with an example of *T. palmiferus* (Lam.) (Regd. no. ZEV $\frac{5481}{7}$) presented to the Museum many years ago by Dr. Hungerford, who obtained it in Hong Kong.

The following features serve to distinguish the two species:—

- (1) In comparison with the size of the disc, the inter-brachial spaces in *T. elegans* are much wider than in *T. palmiferus*; or, in other words, the arms at their bases are narrower.
- (2) The arms of *T. elegans* are much more slender: not only

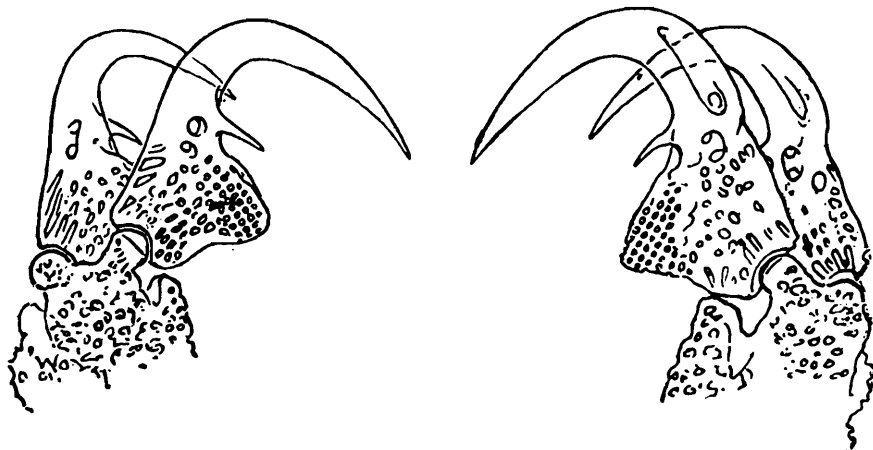


FIG. 3.

Trichaster elegans, × 107.

Trichaster palmiferus, × 107.

are they relatively narrow at their bases, but at the first bifurcation their breadth has diminished to less than one fourth part, while in *T. palmiferus* the breadth at this point is one third of the breadth at the base of the arms.

- (3) The apertures of the genital bursae are much more widely separated in *T. elegans*. In the specimen of *T. palmiferus* from Hong Kong, the two apertures in each inter-brachial space practically unite to form one and the surface that should intervene is drawn in, and forms an almost linear septum. This difference, which is illustrated in plate xiii, figs. 2 and 3, is the consequence of the reduced size of the inter-brachial space.
- (4) The radial shields on the disc, at their outer end, and the lateral arm plates, at their upper ends, are only slightly expanded: the latter nowhere form conical elevations.

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|----------------|-----------------------------------|
| 1. Agassiz, L. | Mém. Soc. des Sci. Nat. de Neu- |
| | chatel, vol. ii, 1839. |
| 2. Ludwig, H. | Zeit. Wiss. Zool., vol. 31, 1878. |

3. Koehler, R. Deep Sea Ophiuroidea collected by
 R.I.M.S. "Investigator." Cal-
 cutta, 1899.
4. Döderlein, L. . Jenaische Denkschriften, vol. 8,
 1896.
5. ,, . Abh. Ak. Wiss. Munchen, II (5),
 1912.



EXPLANATION OF PLATE XIII.

FIG. 1.—*Astrocladus dofleini*, Döderlein.

Upper surface of disc.

„ 2.—*Trichaster palmiferus* (Lamarck).

Lateral view of an inter-brachial space, $\times 1\frac{1}{2}$.

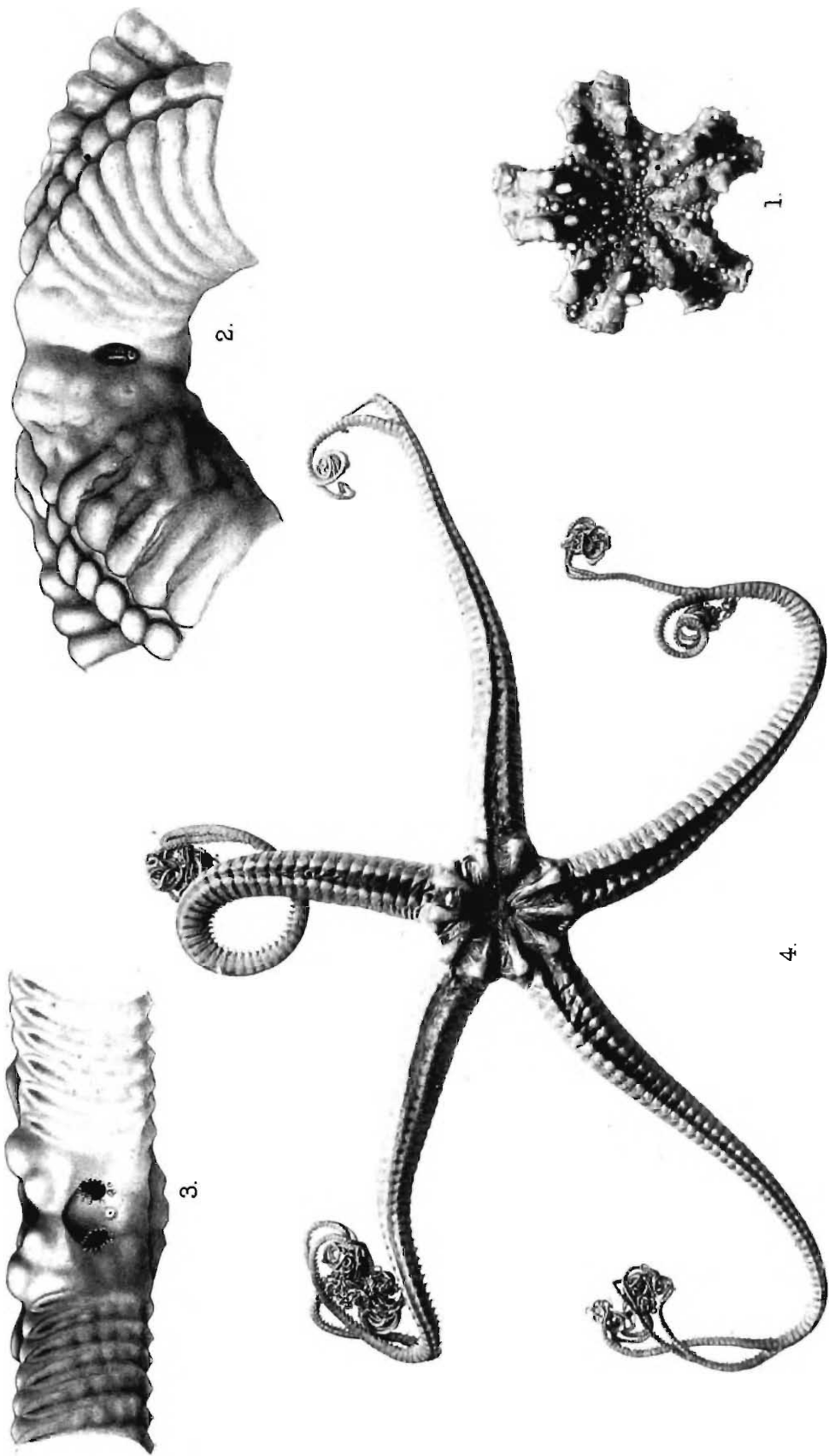
„ 3.—*Trichaster elegans*, Ludwig.

Lateral view of an inter-brachial space, $\times 2$.

„ 4.—*Trichaster elegans*, Ludwig.

Entire animal: dorsal view, $\times \frac{3}{4}$.

Bemrose, Coll. Darby.



INDIAN OPHIUROIDEA.

S. C. Mondul, del. & photo.

XIV THE INDIAN BARNACLES OF THE SUBGENUS *SCALPELLUM*.

By N. ANNANDALE, D.Sc., F.A.S.B., *Superintendent of the Indian Museum.*

In a former paper ¹ I have discussed the subdivision of the genus *Scalpellum* and reviewed the indigenous species assigned to the subgenus *Smilium*. At present I propose to consider the remaining Indian species of the genus, that is to say those which fall into Hoek's ² divisions *Arcoscalpellum* and *Mesoscalpellum* or into the subgenera recognized by Pilsbry ³ under the names *Arcoscalpellum* and *Scalpellum*. It seems to me unnecessary to assign to these species more than subgeneric rank and I therefore include all under the common designation *Scalpellum* (s.s.) or subgenus *Scalpellum*.

To this subgenus 12 Indian species are here attributed, one of them not having as yet been described. This and three others are only known from the seas of British India ; four are known from the Malay Archipelago (one of them also from the western part of the Indian Ocean) and one from the Mid-Pacific ; one is found in the deeper parts of the western Pacific and the southern Atlantic as well as those of the Indian Ocean ; one is identical with a species described from the northern Atlantic off the American coast, and one has an extended distribution in both the Atlantic and the Indian Oceans. All are deep-sea forms only found, at any rate in tropical waters, at depths greater than one hundred fathoms. It is possible that the *Scalpellum*-fauna of the seas of British India will ultimately be proved capable of division into three geographical groups, of which one has a very restricted range, one is distributed in the deeper parts of the Indian and the western Pacific Oceans, while the third is scattered in the Indian and Atlantic Oceans at great or considerable depths. Most of the species are, however, as yet known from but few specimens and it is therefore not surprising that the distribution often seems to be extraordinarily discontinuous. This fact also makes it impossible to be dogmatic as regards specific limits, for variation is great in some species that are well known.

The following list gives the names of the species as yet recorded from the Bay of Bengal and the Arabian Sea, and also a general statement as to the known range of each :—

¹ *Rec. Ind. Mus.* V, p. 145, 1910.

² *Siboga-Exped.*, Mon. XXXIa, p. 58, 1907.

³ *Proc. Acad. Nat. Sci. Philadelphia*, p. 104, 1908.

1. *Scalpellum alcockianum*, Annandale.
Off Ceylon : 859—880 fathoms.
2. *S. velutinum*, Hoek.
Indian and Atlantic Oceans : 35 to over 1200 fathoms.
3. *S. trapezoideum*, Hoek.
Off Ceylon and in the Malay Archipelago : 590 to 1508 fathoms.
4. *S. pacificum*, Pilsbry.
Arabian Sea and seas of Hawaii : 222 to 1299 fathoms.
5. *S. novae-zelandiae*, Hoek.
Pacific, Indian and Atlantic Oceans : 490 to 1520 fathoms.
6. *S. woodmasoni*, Annandale.
Arabian Sea : 890 fathoms.
7. *S. albatrossianum*, Pilsbry.
N. Atlantic and B. of Bengal : 1997 and 2045 fathoms.
8. *S. gruvelii*, Annandale.
Indian Ocean : 434 to 1200 fathoms.
9. *S. curiosum*, Hoek.
Off C. Comorin and in the Malay Archipelago : 269 to 595 fathoms.
10. *S. lambda*, Annandale.
B. of Bengal : 643 fathoms.
11. *S. longius*, sp. nov.
Off Andaman Is. : 130—250 fathoms.
12. *S. laccadivicum*, Annandale.
Arabian and Laccadive Seas and in the Malay Archipelago : 434 to 1154 fathoms.

KEY TO THE INDIAN SPECIES OF *SCALPELLUM* (S.S.).

- I. Umbo of carina apical; the whole valve simply arched.
 - A. Capitulum with paired valves relatively small (though almost complete), widely separated and almost entirely concealed by an opaque membrane; margins of tergum not excavated *S. alcockianum*, p. 229.
 - B. Paired valves relatively large, always in contact or almost so at certain points; membrane never opaque
 1. Carinal latera meeting behind *below* the base of the carina.
 - a. Carinal latera very prominent, projecting outwards as well as backwards; valves of lower whorl imbricate *S. velutinum*, p. 229.
 - b. Carinal latera moderately prominent, projecting backwards but not outwards; all valves adjacent *S. trapezoideum*, p. 230.
 2. Carinal latera meeting behind *over* the base of the carina.
 - a. Posterior basal part of carinal latera with strong radiating ridges *S. pacificum*, p. 230.
 - b. Posterior basal part of carinal latera smooth *S. novae-zelandiae*, p. 231.
- II. Umbo of carina forming a distinct projection on the dorsum of the valve, never apical.
 - A. Valves stout, complete, conspicuously striated.
 1. Inframedian latus pointed above, moniliform *S. woodmasoni*, p. 232

2. Inframedian latus truncated above, not moniliform *S. albatrossianum*, p. 232.
- B. Valves delicate, almost smooth, often incomplete.
1. Umbo of carina widely separated from apex of valve.
- a. Carinal latera projecting far beyond dorsum of carina *S. gruvellii*, p. 232.
- b. Carinal latera barely projecting beyond dorsum of carina *S. curiosum*, p. 233.
2. Umbo of carina subapical.
- a. Occludent latus much wider than high at its inner end *S. laccadivicum*, p. 235.
- b. Occludent latus as high as wide in lateral view.
- a. Posterior basal part of carinal latera smooth, meeting *over* base of carina *S. lambda*, p. 234.
- b. Posterior basal part of carinal latera irregularly corrugated, meeting *below* base of carina *S. longius*, p. 234.

1. *Scalpellum alcockianum*, Annandale.

Ann. Mag. Nat. Hist. (7) XVII, p. 392 (1906); *Ill. Zool. 'Investigator'*, Crust. Ent., pl. I, fig. 2; pl. II, figs. 2, 2a, 2b (1907).

In my original description of this species I failed to notice the rostrum, which is concealed by the membrane and by the band-like rostral latera. It is a small transverse hexagonal plate pointed at either end and with the upper and lower margins elongate and parallel. The labrum is prominent and bullate.

The types are from 'Investigator' station 277 to the S. of Ceylon: 5°48'15" N., 80°56' E.; 859 to 880 fathoms.

S. alcockianum is related to the N. Atlantic *S. giganteum*, Gruvel, several of the peculiar features of which it possesses in an exaggerated degree. Varieties may be expected to occur in which the valves occupy a much greater part of the capitular area than in the typical form, if we may judge from the analogy of *S. stearnsi* Pilsbry, a somewhat similar Malaysian species. The great length of the anal appendages is a noteworthy character, but the exact length and the number of segments of these structures is variable within wide limits.

Type No. $2\frac{9}{10}^3$ Crust. Ind. Mus.

2. *Scalpellum velutinum*, Hoek.

Scalpellum velutinum, Hoek. 'Challenger' Zool. Rep. VIII (Cirripedia), p. 96, pls. IV, figs. 10, 11, and IX, figs. 7, 8, 9 (1883); Pilsbry, *U. S. Nat. Mus. Bull.* 60, p. 26, pl. III, figs. 2, 3 (1907); Annandale, *Ill. Zool. 'Investigator'*, Crust. Ent., pl. IV, fig. 7 (1908); *Ann. Mag. Nat. Hist.* (8) VII, p. 588 (1911).

Scalpellum eximium, Hoek, *op. cit.*, p. 100, pls. IV, figs. 6, 7, and IX, figs. 10, 10* (1883).

Scalpellum sordidum, Aurivillius, *Bull. Soc. Zool. France* XXIII, p. 190 (1898).

Scalpellum alatum, Gruvel, *Rep. 'Travailleur' et 'Talisman'*, Cirrhipèdes, p. 57 (1902).

Specimens from 'Investigator' station 232: $7^{\circ}17'30''$ N., $76^{\circ}54'30''$ E. (430 fathoms) and others from Indian seas labelled 'simply "deep sea"' agree in every respect with examples from off the south-west of Ireland that I have recently examined.

The spines on the degenerate male (see Hoek's fig. 10* on plate IX in the first part of his 'Challenger' report) have a very characteristic form, but the whole specimen of that sex figured under the name *S. eximium* on the same plate was certainly distorted.

S. velutinum is one of the most widely distributed of the deep-sea Cirripedia. It occurs on both sides of the N. Atlantic and off Tristan d'Acunha; there are specimens in the British Museum taken from a cable lying in 1200 fathoms in Lat. $12^{\circ}20'$ N., Long. $52^{\circ}30'$ E.

The bathymetric range is from 35 to over 1200 fathoms. As Pilsbry points out, the species is closely related to *S. formae*, Alessandri, of the Italian Miocene.

Type in the British Museum.

3. *Scalpellum trapezoideum*, Hoek.

Scalpellum trapezoideum, Hoek, *Siboga-Expeditie*, Mon. XXXIa (Cirripedia Pedunculata), p. 102, pl. VIII, fig. 6 (1907); Annandale, *Ill. Zool. 'Investigator'*, Crust. Ent., pl. IV, fig. 9 (1908).

? *Scalpellum truncatum*, Annandale in Herdman's *Pearl Oyster Fisheries* (Roy. Soc. Lond.), part V Suppl. XXXI, p. 142 (1906).

A specimen, dredged by the 'Investigator' at station 317 from 590 fathoms in the Gulf of Manaar ($7^{\circ}4'$ N., $79^{\circ}32'$ E.) agrees with Hoek's description and figures. It was identified by me as (?) *Scalpellum truncatum*, Hoek, in Professor Herdman's report on the Ceylon Pearl Fisheries, but clearly belongs to the species to which it is assigned in the 'Investigator' Illustrations. It is attached to a piece of coal.

The species was originally described from Lat. $6^{\circ}30'$ S., Long. $12^{\circ}55'$ E. and from a depth of 2796 m. (=1508 fathoms).

Type in the Amsterdam Museum.

4. *Scalpellum pacificum*, Pilsbry.

Scalpellum pacificum, Pilsbry, *Bull. Bur. Fish. U.S.A.* No. 617, p. 182, pl. IV, figs. 3, 4 (1907).

Scalpellum tenue, Annandale (*nec* Hoek), *Herdman's Pearl Oyster Fisheries*, V, p. 142 (1906).

Cirri colourless, moderate. The anterior ramus of the first cirrus flattened and expanded, especially in the 4th, 5th, and 6th segments; the last (9th) segment much narrower than the others,

bearing numerous stout bristles; posterior ramus slender, slightly longer than anterior ramus.

Mouth-parts moderate. Mandible wide, with four subequal teeth of moderate size; the first widely separated from the others; the fourth (inner angle) pointed. The second maxilla moderately wide; its cutting edge nearly straight but bearing a very narrow incisure separated from the outer edge by three large and one small bristle; the stoutest of these bristles not much larger than those on the edge within the incisure.

Anal cirri short, cylindrical, slender, with 5 segments, of which the basal (1st) is much the longest; 2nd and 5th segments subequal, shorter than 3rd and 4th; four long subequal bristles at apex; one long and one moderate bristle at apex of 4th segment posteriorly; at least two shorter bristles in same position on the 3rd segment.

Penis absent.

Type in the U.S. Nat. Mus.

Distribution. 'Investigator' stations 299 and 268: Arabian Sea, 23°43' N., 58°51'30" E.; 1299 fathoms, and south of Cape Comorin, 7°36' N., 78°5' E.; 556—589 fathoms; Hawaiian seas; 315 and 222 to 498 fathoms ('Albatross').

S. pacificum is allied to *S. novae-zelandiae*, Hoek, from which it may be distinguished by its stouter and more closely set valves, by the greater breadth of the rostral latus and especially by the formation of the posterior basal part of the carinal latera. Its closest ally, however, is probably *S. albatrossianum*, Pilsbry, although the two species fall technically into different subdivisions of the subgenus in the system here provisionally adopted.

5. *Scalpellum novae-zelandiae*, Hoek.

Hoek, 'Challenger' Zool. Rep. VIII (Cirripedia), p. 124, pl. V, figs. 7, 8 (1883); Gruvel, Rep. 'Travailleur' et 'Talisman,' Cirrhipèdes, p. 54, pl. II, figs. 12, 13, 15 (1902); Annandale, Ill. Zool. 'Investigator,' Crust. Ent., pl. V, fig. 7 (1908).

Two Indian specimens are in our collection obtained by the 'Investigator', one from the Andaman Sea (490 fathoms) and one from Lat. 6°18' N., Long. 90°40' E. (1520 fathoms). They agree fairly well with Hoek's original figure, but vary in certain characters, notably in the exact form of the valves of the lower whorl. In one the inframedian latus is shaped like an hourglass; and in the other it is barely constricted at all.

Scalpellum novae-zelandiae was originally obtained off New Zealand by the 'Challenger' in 700 fathoms. The 'Travailleur' took three specimens in Lat. 38°8' N., Long. 12°3' E. in between 1314 and 1370 fathoms. The species, everywhere scarce, has thus an even wider known range than *S. velutinum*, occurring in the Pacific, Indian and Atlantic Oceans.

Type in the British Museum.

6. *Scalpellum woodmasoni*, Annandale.

Ann. Mag. Nat. Hist. (7) XVII, p. 39 (1906); *Ill. Zool. 'Investigator,'* Crust. Ent., pl. I, fig. 7 (1907).

Only the type-specimen is known. It is from 'Investigator' station 183 in the Arabian Sea: Lat. $23^{\circ}8'22''$ N., Long. $65^{\circ}49'45''$ E.; 890 fathoms.

Type No. $\frac{124}{10}$ Crust. Ind. Mus.

7. *Scalpellum albatrossianum*, Pilsbry.

Pilsbry, *U. S. Nat. Mus. Bull.* 60, p. 54, fig. 19 (1907); Annandale, *Ill. Zool. 'Investigator,'* Crust. Ent., pl. III, fig. 10 (1908).

Only two specimens of this species are known; the type, which was taken in the N. Atlantic off Cape Hatteras in 2045 fathoms by the 'Albatross', and one taken by the 'Investigator' in 1997 fathoms at station 110 in the Bay of Bengal: Lat. $9^{\circ}34'$ N., Long. $85^{\circ}43'15''$ E.

So far as I can judge from Pilsbry's figure, there is hardly any difference between the specimens, but he says that the carinal umbo is apical, while I class it as subapical. In the Indian specimen this umbo, as Pilsbry says was the case with the American one, is in contact with the terga and, therefore, appears to be terminal. There is, however, a short continuation of the valve hidden between the terga. The species is closely related to *S. woodmasoni*, from which it may be distinguished by its broader scutum and hourglass-shaped inframedian latus.

The cirri and mouth-parts closely resemble those of *S. pacificum*, but the anterior ramus of the first cirrus is relatively broader, the outer tooth of the mandible is relatively larger and the two inner teeth of the appendage lie closer together. The anal appendages of the two species are also closely similar, but those of *S. albatrossianum* bear a larger bunch of bristles at the apex. In spite of the fact that *S. pacificum* falls into a different section of the sub-genus technically, I see no difficulty in believing it to be closely allied to *S. albatrossianum*.

The figure in the 'Investigator' Illustrations was prepared from the Indian specimen, before it was realised that the species was identical with the American one.

Type in the U. S. Nat. Mus.

8. *Scalpellum gruvelii*, Annandale.

Scalpellum gruvelii and var. *quadratum*, Annandale, *Ann. Mag. Nat. Hist.* (7) XVII, p. 390 (1906); *Ill. Zool. 'Investigator,'* Crust. Ent., pl. I, fig. 1; pl. II, figs. 1, 1a and 3 (1907); Herdman's *Rep. Pearl Oyster Fisheries*, V,

p. 141, fig 4 (1906); Stewart, *Mem. Ind. Mus.* III, p. 33, pl. VII, fig. 5 (male); 1911.

Scalpellum chitinosum, Hoek, *Sib.-Exp.*, Mon. XXXIa, p. 73, pl. VII, fig. 4 (1907).

This is a variable species, like all those in which the valves are sometimes incomplete; the "complete" form, if it exists, is unknown. Pilsbry's *S. imperfectum*¹ and *S. sanctaebarbarae*¹ are very closely allied and may be only varieties or local races. I have seen a specimen of the former. *S. chitinosum*, Hoek, is certainly identical. The exact position of the carinal umbo is one of the variable characters.

Stewart (*op. cit. supra*) has given a detailed and excellent account of the male and of the later development of both sexes.

Scalpellum gruvelii has been taken by the 'Investigator' at the following stations:—

Sta. 249: Laccadive Sea, 7° N., 76°36'15" E.; 1022 fathoms (Types).

„ 276: Laccadive Sea, 7°11' N., 76°35'30" E.; 1006 fathoms.

„ 277: S. of Ceylon, 5°48'15" N., 80°56' E.; 859—880 fathoms.

“ 306: Laccadive Sea, 9°20' N., 75°24' E.; 930 fathoms.

There are specimens in the British Museum from a cable laid at 1200 fathoms in the Indian Ocean in Lat. 14°20' N., Long. 52°30' E. They were accompanied by *Scalpellum velutinum* and *S. (Smilium) acutum*, Hoek. *S. chitinosum* was taken off Sumbawa and the Kei Is. in the Malay Archipelago in 794 and 1788 m. (=434 and 977 fathoms). *S. imperfectum* is from the N. Atlantic and *S. sanctaebarbarae* from off the coast of California. The type of the former was attached to a specimen of *S. velutinum*. It was taken in 781 fathoms and others of the same form were taken in 852 and 1230 fathoms. *S. sanctaebarbarae* was dredged from 414 and 603 fathoms.

Type No. $\frac{3\cdot33}{10}$ Crust. Ind. Mus.

9. *Scalpellum curiosum*, Hoek.

Scalpellum curiosum, Hoek, *Sib.-Exp.*, Mon. XXXIa, p. 79, pl. VII, figs 8, 8a, 8b (1907); Annandale, *Ill. Zool. 'Investigator'*, Crust. Ent., pl. IV, fig. 8 (1908);

Scalpellum japonicum, *id. (nec Hoek)*, Herdman's *Pearl Oyster Fisheries*, V, p. 141 (1906).

A specimen dredged by the 'Investigator' at station 268 (S. of Cape Comorin, Lat. 7°36' N., Long. 78°5' E.) in between 556

¹ U. S. Nat. Mus. Bull. 60, pp. 75 and 77, figs. 30 and 31 (1907).

and 595 fathoms, only differs from Hoek's figure in having the capitulum a little broader, the carina more strongly arched, the valves of the lower whorl more incomplete and the peduncular plates broader. In these "incomplete" species great variation must be expected, and without further material I hesitate to regard the Indian form as distinct.

Type in the Amsterdam Museum.

10. *Scalpellum lambda*, Annandale.

Rec. Ind. Mus. V, p. 115 (1910).

Type No. $\frac{5633}{10}$ Crust. Ind. Mus., from 'Investigator' station 372: 13°54'15" N., 94°2'15" E.; 643 fathoms.

11. *Scalpellum longius*, sp. nov.

Capitulum narrowly ovoid, more than twice as high as broad, bearing 13 (or 14) thin, smooth, translucent white valves, which cover its surface almost completely; external membrane thin, colourless, transparent, smooth.

Carina regularly and moderately curved; umbo subapical; sides moderately broad, distinctly concave; dorsum concave, with well-defined lateral borders; apex of valve far removed from apex of capitulum.

Tergum very large, triangular, extending for about $\frac{1}{3}$ of its length above the apex of the carina, sharply pointed and somewhat retroverted at the upper end; occludent margin convex; lower margin straight, sloping upwards and outwards from the carina; carinal margin straight, much the longest of the three, sloping upwards and outwards along the carina, with a distinct tooth just above the carinal apex and distinctly sinuous beyond it.

Scutum smaller than tergum, irregularly triangular; apex retroverted from occludent edge of capitulum, sharply pointed; occludent margin as a whole convex, vertical; tergal margin short, markedly concave, with a prominent tooth at either extremity; inner margin almost as long as occludent margin, very strongly sinuous.

Median (upper) latus having the form of an oblique isosceles triangle with each basal angle broadly, obliquely, equally truncated, in such a way that the whole outline is pentagonal; tergal and scutal margins equal, the latter slightly concave, the former slightly convex; carinal and lower margins equal, straight; suture with carinal latus longer than either, straight, slanting.

Carinal latus quadrilateral, high but narrow, by no means prominent behind; inner and outer margins straight, vertical subparallel; upper margin much shorter, straight, sloping downwards from carina; lower margin straight, sloping downwards from inframedian latus; posterior basal part meeting its fellow below the base of the carina and forming a short vertical suture with it, irregularly triangular, corrugated.

Inframedian latus high, moderately narrow, pointed below, angular above, where it is nearly as wide as the carinal latus.

Rostral latus triangular, pointed below at the aperture, by no means prominent.

Rostrum minute, almost entirely concealed; possibly sometimes absent.

Peduncle cylindrical, much shorter than capitulum, covered with prominent, transverse, alternating scales closely compacted.

I have dissected out the appendages of a specimen but can find no difference in them likely to be constant from those of *S. lambda*, except in the following points:—the two rami of the first cirrus are equal (possibly a variable character) and the anal appendages consist of only 6 segments instead of about 8.

The mandibles are perhaps abnormal; the three outer teeth are subequal and equidistant, but the inner angle is produced and forms a projecting portion of relatively large size and with nearly parallel but somewhat irregular edges; at its extremity it bears two teeth, of which the inner tooth is bent towards the outer one.

Type No. $\frac{5043}{10}$ Crust. Ind. Mus.

Locality. Andamans; 130—250 fathoms.

Males not observed.

Measurements:—

	Capitulum.	Peduncle.
Height	8.5 mm.	1.5 mm.
Breadth	4.0 ,,	1.5 ,,

Possibly *Scalpellum longius* as here described is merely a complete form of *S. lambda*, but the structure and position of the posterior basal parts of the carinal latera of the two forms are very different; in *S. lambda* these meet over the base of the carina and have the shape of regular isosceles triangles in contact for the whole of their bases, and their surface is smooth. Unless or until intermediate specimens are obtained, the two must, therefore, be regarded as specifically distinct. The greater relative height of the capitulum is quite probably an inconstant feature.

S. longius will be figured, with *S. lambda*, in an account of the Indian species of the families Scalpellidae (=Pollicipedidae, mihi, 1909¹) and Iblidae which is now in the course of preparation but will not be ready for publication for some little time.

12. *Scalpellum laccadivicum*, Annandale.

Scalpellum laccadivicum and var. *investigatoris*, Annandale, *Ann. Mag. Nat. Hist.* (7) XVII, p. 393 (1906); *Ill. Zool.* 'Investigator,' Crust. Ent., pl. I, figs. 3, 4 (1907).

Scalpellum subflavum, *id.*, *ibid.*, p. 397 (1906) and pl. I, fig. 6 (1907).

¹ "An account of the Indian Cirripedia Pedunculata, Part 1.—Family Lepadidae (*sensu stricto*)," *Mem. Ind. Mus.* II, p. 63 (1907).

Scalpellum polymorphum, Hoek, *Sib.-Exp.*, Mon. XXXIa, p. 80, pl. VII, figs. 9-11 (1907).

I have now no doubt that all the forms mentioned in the above synonymy represent a single very variable species, the valves of which may be practically complete, or very incomplete indeed, or exhibit various intermediate stages. Some specimens of my *S. subflavum* are identical with Hoek's figure of his *S. polymorphum* form C, while the types of *S. laccadivicum* and its variety *investigatoris* are somewhat less complete as regards the valves of the upper whorl than any of the specimens obtained by the 'Siboga.' Their capitulum is also broader, but there is considerable variation in this respect, as there is also in the length of the peduncle. My description of the appendages, drawn up at a time at which I had little experience, was incorrect in several particulars. They agree well with those described by Hoek, allowance being made for the very considerable individual variation that certainly exists. The rostrum is rudimentary or absent.

Scalpellum laccadivicum has been taken by the 'Investigator' at the following stations:—

- Sat. 297: Gulf of Oman, 25°11' 30 N., 57°15' E.; 689-700 fathoms.
- „ 298: Arabian Sea, 23°48' 30" N., 58°33' 45" E.; 337-398 fathoms.
- „ 317: W of Ceylon, 7°4' N., 79°32' E.; 590 fathoms (Types).
- „ 319: Laccadive Sea, 12°2' N., 73°46' E.; 1154 fathoms.
- „ 358: Arabian Sea, 15°55' 30" N., 52°38' 30" E.; 585 fathoms.

At station 319 only the typical form and the form *investigatoris* were obtained; at all the others, and also at an unrecorded point in the Andaman Sea (173 fathoms), only the form *subflavum*. The 'Siboga' specimens were taken off the Kei Is. and off Sumbawa in 397 m. (=220 fathoms).

Type No. $\frac{5040}{10}$ Crust. Ind. Mus.



XV NOTES ON FRESHWATER SPONGES

By N. ANNANDALE, D.Sc., F.A.S.B., Superintendent, Indian Museum.

NO. XV.—SPONGES FROM SHELLS OF THE GENUS *Aetheria*.

The curious shells of the genus *Aetheria* ("Freshwater Oysters," as Reeve has aptly called them) offer on their roughened and often corrugated surface a favourable nidus for the growth of sponges, while the fact that, like the true oysters (*Ostrea*), they are firmly fixed by the lower valve to solid bodies, renders them still more suitable in this respect. The genus is confined to tropical Africa and is represented in the collection of the Indian Museum by only two lots of shells, one of which is labelled as being from the Nile, while the other is of uncertain *provenance*. The former represents a form of *A. caillaudi*, Fér., the species to which the latter, which has been examined by Mr. H. B. Preston, also in all probability belongs. This species is found only in the basin of the Nile, from which the first of the two sponges here described certainly and the second probably, therefore, comes.

At least one freshwater sponge (*Corvospongilla loricata*, Weltner) has already been described from a shell of *Aetheria*, and I have little doubt that others would be discovered in the same position if a careful examination were to be made of the shells of this genus already preserved in museums.

The only Indian species of the family Aetheriidae (*Mulleria dalyi*, Smith) is found in the tributaries of the R. Kistna. It was originally described from Mysore and has recently been collected in the Western Ghats by Mr. F. H. Gravely. I have examined specimens from both localities, but, although the shells closely resemble those of *Aetheria* in external characters, I can find on them no trace of either sponges or polyzoa.

Spongilla (*Eunapius*) *aetheriae*, sp. nov.

Sponge.—Only the basal part of the sponge remains and even from it all but the gemmules and their dense cage of spicules has disappeared. It was, however, evidently an encrusting form.

Skeleton.—All that remains of the skeleton is a dense but quite irregular network of macroscleres enclosing the gemmules. No trace of spicule fibres can be detected in it.

Spicules.—The skeleton-spicules are smooth, slender, sharply pointed amphioxi, on an average about 0.296 mm. long by 0.0136 mm. in greatest transverse diameter. The gemmule-spicules

resemble them in every respect except that they are smaller and relatively more slender, their corresponding average measurements being 0.136 mm. by 0.004 mm., and that they show a greater tendency to irregularity, a considerable proportion of them being either somewhat sinuous as a whole or else bearing a globular swelling in the middle, or exhibiting both peculiarities.

Gemmules.—The gemmules form a pavement-layer which adheres to the shell by means of a basal membrane and of the cage of macroscleres in which they are included. Each has a single straight bottle-shaped vertical tubule in the middle of the upper surface, which is usually free to some extent from the investing macroscleres. The cellular pneumatic layer is thick and well developed and its polygonal compartments are large and distinct. The gemmule-spicules form a single somewhat irregular layer which lies on and near the surface of the pneumatic layer; some spicules being entirely, others partially embedded in it, and some lying on the surface.

Type.—No. Z. E. V 6034/7 *Ind. Mus.* (microscope-slide).

Habitat.—On shell of *Aetheria caillaudi* from the Nile.

This sponge is an interesting one as it is intermediate between the widely distributed *Spongilla carteri* of Asia, E. Europe, Mauritius and possibly tropical Africa and my own *S. ambigua* from S. Africa, resembling the former in the shape of its gemmule-spicules and the latter in the structure of its gemmules. It is one of the very few Spongillidae that have smooth amphioxious microscleres.

Together with the gemmules of *S. aetheriae* were others belonging to a species of *Stratospongilla* or *Corvospongilla* (more probably the latter) which the new species had evidently overwhelmed by its growth. These gemmules and their spicules resemble those of *C. burmanica* (Kirk.), but I cannot find a single macrosclere or free microsclere other than those of *S. aetheriae* associated with them. It is evident that they represent neither *C. loricatea*, Weltner, which was originally found on a shell of the same genus, nor *C. scabrispiculis*, which is described below.

Statoblasts of *Plumatella* occur in considerable numbers on the shell on which the type of *S. aetheriae* were found, and also the remains of a Ctenostomatous polyzoon probably belonging to the genus *Hislopia*, which has not hitherto been recorded from Africa although it is widely distributed in Asia.

Corvospongilla scabrispiculis, sp. nov.

Sponge.—The external form, etc., of the sponge is unknown. It encrusted shells of a mollusc of the genus *Aetheria* and was apparently hard but friable and of a dark colour. A stout basal chitinous membrane is present.

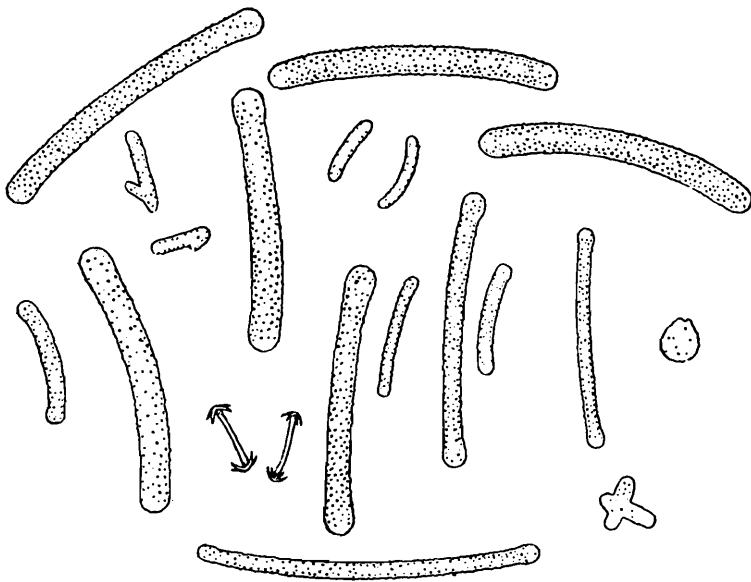
Skeleton.—The only part of the skeleton that can be described is the basal part. The structure of this is that of a stout network formed of spicules enclosed in a chitinous membrane continuous

with the basal membrane, which also contains spicules in considerable numbers.

Spicules.—The macroscleres are small and moderately slender, varying greatly in size but not exceeding 0.147 mm. $\times$ 0.0168 mm. Their ends are blunt and often more or less inflated. Their surface is covered uniformly with minute rounded prominences, but they do not bear sharp outstanding spines. As a rule the main axis is curved, but never very strongly.

The gemmule-spicules are very like those of the skeleton but smaller, and as a rule relatively less slender. They are never more than 0.0842 mm. long by 0.0126 mm. broad but vary greatly in size and proportions. Deformed spicules and irregular spheres are not uncommon among them.

The only free spicules are the minute amphidiscs characteristic



Spicules of *Corvospongilla scabrispiculis*, $\times$ 240.

of the genus. Their shafts are very slender, either straight or curved and as a rule about 0.025 mm. long. The terminal spines are fairly short and less retroverted than in some species.

Gemmules.—The gemmules, which are very numerous, form, together with the cages in which they are held, a regular pavement-layer and adhere firmly. Each is enclosed in a separate loculus which has a roof of spicules and membrane and a floor formed of the basal membrane of the sponge. The walls and roof are composed of two layers of macroscleres lying parallel to the surface of the sponge and crossing one another without protruding from the membrane. There is a circular aperture in the roof through which the foraminal tubule of the gemmule protrudes. Each gemmule has a thick chitinous outer coat in which its proper spicules are embedded horizontally and somewhat sparsely; it bears a single

straight, vertical tubule and is itself spherical or subspherical and from 0.23 to 0.35 mm. in diameter. It is of a bright-golden colour when clean but with its cage appears of a dirty brown. The diameter of the cavity of each cage is about 0.5 mm. and there is no pneumatic substance between the walls and the gemmule.

Type.—No. Z.E.V 5504/7 *Ind. Mus.*

Habitat.—Tropical Africa, probably the Nile basin.

The new species differs from most of its congeners in having rough instead of smooth skeleton-spicules, and also in their small size. In these characters it agrees with *C. micramphidiscoides*, Weltner,¹ from Central Africa; but the spicules of that species are of different shape and proportions and the macroscleres sometimes bear long spines, while amphioxi as well as amphidiscs occur free in the parenchyma. A noteworthy feature of *C. scabrispiculis* is the tendency displayed by both skeleton- and gemmule-spicules to be inflated at the extremities. A similar tendency occurs in some of the gemmule-spicules of the type-species of the genus, *C. loricata* (Weltner);² but I have not observed it displayed to anything like the same extent in the macroscleres of any species in which the macroscleres are smooth, although it occasionally occurs in a slighter degree.

¹ "Süßwasserschwämme (Spongillidae)." in *Wiss. Ergebn. Deutsch. Zentral-Afrika-Exp.* 1907-1908, vol. IV (Zool. ii), pp. 477-481, figs. 1-11 (1913).

² Kirkpatrick, *Rec. Ind. Mus.*, vol. II, pp. 97-99, pl. ix, fig. 9a (1908).



XVI PRELIMINARY NOTE ON A NEW
GENUS OF ONYCHOPHORA FROM
THE N.E. FRONTIER OF INDIA

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

The discovery of a species of *Peripatus* in the Abor country during the military expedition of 1911-12 is of interest in that it is the first occasion on which a member of the group has been found within the limits of the Indian Empire. The form proves to belong to a genus and species hitherto undescribed and, inasmuch as some time must still elapse before the complete account can be published,¹ I have thought it advisable to give a brief preliminary account of its more important characters.

The main features of the different geographical groups or genera of Onychophora have been clearly stated by the late Prof. Sedgwick,² and in the preparation of this note I have followed the lines which he has adopted in his definitions.

***Typhloperipatus williamsoni*, gen. et sp. nov.**

The species is blind and on external examination no trace of the eyes can be found. The ocular lobe is well developed but is provided with a rudimentary nerve. A loosely compacted irregular and non-cellular structure found within the lobe appears to represent the remains of retinal rods, but no trace of any other visual structure remains.

The legs vary in number from 19 to 20; in adult specimens there seem to be invariably 19 in the male and 20 in the female.

The outer jaw is provided with two, less commonly with three minor teeth; the inner has three minor teeth and a series of eight or ten small denticles separated from the others by a short diastema.

The legs have four spinous pads and in the fourth and fifth pairs the nephridial openings are situated on the third pad. The feet bear two distal papillae, one anterior and one posterior.

The genital opening, in both sexes, is situated between the legs of the penultimate pair.

In the female the ovaries are fused, but there does not appear to be any communication between the oviducts. Receptacula ovarum do not appear to exist, but large receptacula seminis are present, each communicating with the oviduct by means of two

¹ A detailed description with figures will be published in Vol. VIII of the Records of the Indian Museum.

² Sedgwick, Quart. Journ. Microsc. Sci., LII, p. 379 (1908).

ducts. The ovary is exogenous. The ova are large and heavily charged with yolk and measure from 1.5 to 2 mm. in their longest diameter. The uterine embryos are of all ages and do not possess a trophic vesicle.

In the male the testes are tubular; the vesiculae seminales are of very large size and occupy the greater part of the body-cavity between the tenth and thirteenth pairs of legs. The unpaired part of the vas deferens is of enormous length, reaching in one specimen as far as the fifth leg, in another to the interspace between the seventh and eighth pairs. The spermatophore is very long and is provided with a horny cap in front. The accessory glands of the male consist of convoluted tubes which open separately in front of the anus. Of crural glands there is a single pair in each of the legs preceding the genital opening.

The skin pigment is slowly extracted by alcohol. Living specimens were dorsally of a deep raw umber brown colour with the ends of the antennae and the tips of some of the primary tubercles pale buff. Ventrally the animal was entirely pale.

The specimens were all found in the vicinity of Rotung, on the banks of the Dihang river, living under stones at altitudes varying from 1200—2500 feet.

MISCELLANEA

TUNICATA.

SOME SALPS TAKEN BY R.I.M.S.S. "INVESTIGATOR" IN THE BAY OF BENGAL AND ANDAMAN SEA.—Hitherto, the Salpidae of Indian seas have not received much attention, but of late years owing to a more systematic use of the tow-net, and the introduction of a mid-water net on board the "Investigator," a foundation has been laid for future work.

The following remarks are merely intended to record the presence of certain species in the Andaman Sea and Bay of Bengal. The species were all obtained during the months from October to April that comprise the survey seasons of successive years: the data are quite insufficient to give any idea of the distribution or relative abundance of each species.

1. *Cyclosalpa bakeri*, Ritter, 1905.

Of this I have only found one specimen of the solitary generation, obtained in a surface tow-net near Preparis North Channel ($15^{\circ}25'N.$, $93^{\circ}45'E.$) on 16th November, 1909.

This is a small example measuring only 5.4 mm. It agrees very closely with Ritter's description (Publ. Univ. Calif., vol. 2) having muscle C and all the body muscles¹ interrupted dorsally. But the "lateral organs" number only four on each side, there being none between muscles 1 and 2. Muscle 6 also does not seem to be continued into a longitudinal band near the mid-dorsal line. In all other characters, such as the ventral inclination of the anterior end, the structure of the brain, hypophysis and viscera, the arrangement of the muscles at the branchial and atrial orifices, it exactly agrees with Ritter's description. It is evidently quite a young specimen, still possessing placenta and elaeoblast.

2. *Salpa fusiformis*, Cuvier.

A few examples of the aggregate generation, all of the typical variety, were obtained at the same locality as the previous specimen.

3. *Salpa cylindrica*, Cuvier.

Both the solitary and aggregate generations are extremely common in the neighbourhood of the Mergui Archipelago. They

¹ In the lettering and numbering of the particular muscles I have followed the designations given by Dr. Ihle in *Das Tierreich*, May, 1912

were also obtained in the northern part of the Andaman Sea in 1897-98. The shape of the test of the solitary form has been noted by W. K. Brooks ("The Genus *Salpa*": Mem. Biol. Lab. John Hopkins Univ.) but the dorso-lateral keel does not seem to be prolonged posteriorly to the same extent as he indicates.

The firm part of the test ends abruptly posteriorly and is here of a triangular sectional form, the angles being formed by the two dorso-lateral and the mid-ventral keel. On either side there are on the test two other ridges, one above the dorso-lateral keel and one between the dorso-lateral and the ventral keel. These ridges terminate posteriorly a little in front of the posterior termination of the firm part of the test.

In the aggregate generation, the ventral ends of muscle X, on the under side of the atrial aperture, come into contact one with another and then, diverging, pass forwards a short distance in the ventral wall of the atrial siphon.

4. *Salpa hexagona*, Q. and G.

One very fine example of the solitary generation was obtained in a mid-water net at station 393 (7°21'6" N., 85°7'15" E.) This measures 73 mm. from branchial to atrial apertures, the posterior processes of the test adding another 13 mm. to the length.

No specimens of the aggregate generation have been met with.

5. *Salpa confederata*, Forskål.

Numerous specimens, both of the solitary and the aggregate generations, were obtained near Preparis North Channel (15°25' N., 93°45' E.) on 16th November, 1909.

6. *Salpa multitentaculata*, Q. and G.

A few of the aggregate generation were obtained in a mid-water net at station 461 (10°15' N., 90°15' E.) on 19th April, 1912. Except for their contained embryos none of the solitary generation have been found.

7. *Salpa democratica*, Forskål.

These have been found in the northern part of the Andaman Sea and at numerous stations among the Islands of the Mergui Archipelago. The individuals are much smaller than some specimens from Plymouth, England, that are in the Indian Museum, the largest specimen of the solitary form that I have measured being only 11 mm. long. The posterior processes of the test are also relatively shorter than in those from English waters. During the last survey season, spent in the Mergui Archipelago, the only species I obtained were *S. democratica* and *S. cylindrica*. These generally occurred together, but opposite the town of Mergui, in the Tenasserim R., only the former was obtained.

8. *Salpa zonaria* (Pallas).

Both generations have been found in the northern part of the Andaman Sea and the solitary generation was found at station 393, in a mid-water net.

The German deep-sea expedition on the "Valdivia" visited neighbouring waters, passing from Sumatra to the Nicobar Is., and thence to Ceylon in February, 1899. In this region they did not find *C. bakeri*, *S. cylindrica*, *S. confederata* or *S. multitentaculata*. On the other hand, they obtained *C. pinnata*, *C. affinis*, *C. floridana*, *S. fusiformis aspera*, and *S. amboinensis*.

It appears therefore that much work remains to be done, both in studying the forms that inhabit Indian waters, and in noticing the seasonal occurrence of particular species many of which have an almost world-wide distribution.

T. L. BOMFORD.

INSECTS.

ADAPTATION IN THE HABITS OF A TABANID FLY.—In Miss Ricardo's description of the Tabanid *Haematopota litoralis* from Puri in Orissa (*Ann. Mag. Nat. Hist.* (8), ii, p. 546, 1911) it is stated that the species is common on cactus hedges in the daytime. The case is one of considerable interest from a biological point of view and I have only waited for the publication of the description to give the facts in full. In August, 1910, I found both sexes of the fly abundant on a hedge of Prickly Pear (*Opuntia elatior*, Mill.) running parallel to and some hundred yards distant from the sea. In the heat of the day they sat quietly at the base of the bunches of thorns scattered over the flattened and laterally expanded stems of this cactus, and were easily captured by inserting a small glass tube over them, except when, as was often the case, the position of the thorns rendered this manoeuvre impossible. Like other Indian species of the genus, *H. litoralis* is as a rule matutinal and crepuscular in habits, only becoming active in the morning and evening. The other species with which I am acquainted rest on rocks, walls or the bark of trees, on which their mottled wings render them extremely inconspicuous. *H. litoralis* is by no means inconspicuous on the green cactus stems, for its colouration is not markedly different from that of its allies. Its peculiar habits, moreover, expose it to another danger than those which might arise, were it not protected by the thorns, from being conspicuous; for in the high winds that often prevail on the east coast of India flies making their way on the wing to the protection of the thorns are liable to be impaled upon them. This often occurs. Doubtless, however, the advantage gained from the adoption of the habit is greater than its inherent risk, for it would be very difficult for any enemy, except of course a microscopic one, to attack the fly at the base of the thorns. The most interesting feature of the case lies in the fact that the habit must have been adopted recently, for *Opuntia elatior* was only

introduced into India at the beginning of the nineteenth century (see Burkill, *Rec. Bot. Surv. India* IV, No. 6, p. 297; 1911) and there is no plant with similarly arranged thorns indigenous in Orissa. I failed to find a single individual of the fly on walls near the cactus hedge on which it was common, and it was absent even from stems of the (imported) cactus *Cereus* and of an indigenous thorny Euphorbiaceous plant; the bunches of thorns on these plants being arranged in vertical lines on a polygonal stem instead of being scattered on a flattened and expanded one.

N. ANNANDALE.

INDIAN BLOOD-SUCKING MIDGES.—If we restrict the term “midges,” as seems legitimate, to the subfamily Culicoidinae or Ceratopogoninae of the family Chironomidae or Tendipedidae, the number of blood-sucking midges for which the habit has been authenticated in India is extremely small, and all that have been proved to exercise it in this country belong to the genus *Culicoides*, Latr., in which the mouth parts are similarly developed in the two sexes. Dr. Kieffer has recently described a considerable number of Indian and Ceylonese representatives of the genus in the *Memoirs* (vol. ii; 1910) and *Records of the Indian Museum* (vols. vi; 1911 and ix; 1913) and in vol. viii of *Spolia Zeylanica* (1912). Of these species only the following are actually known to suck mammalian blood:—

- | | |
|--|--|
| 1. <i>Culicoides molestus</i> , ¹ | 3. <i>Culicoides himalayae</i> , ³ |
| 2. <i>Culicoides oxystoma</i> , ² | 4. <i>Culicoides peregrinus</i> . ⁴ |

Of these the first two species were found sucking that of cattle and deer in the Calcutta Zoological Garden in March, 1908.

C. himalayae was originally described from Kurseong (June, 1910) and other specimens have recently been sent to the Museum by Mr. H. Stevens, who took them at Kaliponni on the Nepal-Sikkim frontier at an altitude of about 9000 feet. He refers to them as “blood-sucking flies of a particularly venomous nature.”

The type-specimens of *C. peregrinus* were taken at Puri on the coast of Orissa in March. I recently (July, 1913) found the species very abundant in a bungalow near Balugaon in the same district. One individual was killed in the act of biting my wrist, and I had reason to think that many others were attacking my ankles. The irritation was considerable but not lasting and very little swelling followed the bite. Both sexes swarmed at night in the corners of rooms, particularly in the neighbourhood of a lighted lamp; females were much commoner than males.

Mr. F. H. Gravely, to whom I am indebted for the identification, by comparison with the types, of Mr. Stevens' examples of *C. himalayae*, has recorded a curious habit of an undetermined

¹ Kieffer, *Mem. Ind. Mus.* ii, p. 193, pl. viii, fig. 9.

² *Id.*, *ibid.*, p. 193, pl. ix, fig. 1.

³ *Id.*, *Rec. Ind. Mus.* vi, p. 326.

⁴ *Id.*, *Mem. Ind. Mus.* ii, p. 191, pl. viii, fig. 1.

species of *Culicoides*,¹ viz. that of sucking the abdomen of mosquitoes of the genus *Anopheles* (s.l.), probably in order to obtain mammalian blood ingested by the larger fly. The actual species attacked was *A. rossii* and the observation was made at Port Canning in the Ganges delta.

The same habit has been attributed to a Burmese species of "*Ceratopogon*" by Major N. P. O'G. Lalor,² I.M.S., who found it sucking blood from *Anopheles fuliginosus*, *A. karwari* and *A. ludlowi*. He reports that species of this genus are abundant at Kyaukpyu on the coast of Burma in August and bite human beings.

N. ANNANDALE.

COELENTERATA.

FURTHER NOTES ON THE HABITS AND DISTRIBUTION OF *Limnognathia indica*.—In the *Records of the Indian Museum*, vol. vii, pp. 399–403, Mr. Gravely and I published some notes on the habits and distribution of *Limnognathia indica*, Annandale, based on our observations last year. I wish to include in this note further observations on the same subject which I made this year. We then expressed the conclusion "that in the life cycle of *Limnognathia indica* there is probably an asexual hydroid stage which lives attached to rocks at the bottom of deep pools, and that this hydroid produces Medusae by budding from February till April or May, when it ceases to do so whether the pool in which it lives is flooded or not, and very possibly dies." It has been my effort during the current year to find out this supposed hydroid stage.

I began my work in October, 1912, when the rains had nearly ceased. I selected Medha as the place of observation owing to its being easily accessible from Bombay. It was thought that it would be possible to induce the hydroid to grow on stones placed at different depths below the surface of the water in the pool and left undisturbed for a sufficiently long time. I, therefore, visited Medha towards the end of October, 1912, and arranged to have four slabs of the same kind of trap as that which forms the bottom and sides of the pool immersed 5, 10, 15 and 21 feet below the surface of the water. The last was resting on the bottom of the pool. The stones were secured by means of strong coir ropes to other bigger stones which were placed on a not easily accessible part of the rock in the middle of the pool. This precaution was necessary to prevent meddlesome persons from taking out the stones and preventing the growth of the hydroid. The place was also watched continually by a peon, whom I engaged for the purpose. I visited the locality again towards the middle of January, February and April, 1913, i.e. after 3, 4 and 6 months respectively. During none of these visits was I able to see on the stones any organism which could be the hydroid stage of *Limnognathia indica*. On one occasion I found a few Rotifers

¹ Gravely, *Rec. Ind. Mus.* vi, p. 45.

² *Paludism*, Sept., 1912, p. 42.

attached to one of the stones and at all times a few water beetles and some Neuropterous larvae were to be seen crawling on them or lurking in the meshes of the coir rope.

At the time of my visit in April I found Medusae in fair numbers in the pool, though nothing was found on the stones. It was clear that the effort to induce the hydroid to grow on the stones had failed, and some other means must be employed to get at the missing stage. I, therefore, tried in April, 1913, another plan suggested to me by Dr. Annandale. It was to put a number of Medusae in a wide-mouthed jar and to immerse it at the bottom of the pool after closing its mouth by means of a piece of muslin. The immersion was necessary to keep the temperature conditions as nearly natural as possible. Another reason was to make as little difference in the character of the food of the animal as possible. I used to take out the jar twice a day and observe the condition of the Medusae. The first experiment was tried on the 23rd of April, 1913, and the Medusae appeared to be perfectly healthy for two days after that. On the 26th, however, I found that some of them had died and others were not as active as they had been. An examination of the contents of the jar under a microscope failed to reveal any eggs. That the death was not natural but due to pathological changes set up by the peculiar environment, which prevented their coming to the surface of the water periodically and also circumscribed their movements to a small area, appears to be clear from the fact that the Medusae in the jar were of all sizes and ages. I tried the experiment again on the 26th, but found that the Medusae died even earlier *i.e.* on the 27th evening. There was a heavy shower of rain on that day and I thought I would do better to move to some other locality and try the experiment.

I left Medha on the 28th and reached Dhôm on the Krishna on the 29th. We had heard of the occurrence of the Medusae in this place last year but were not able to visit it. I found the Medusae here in very great abundance. The pool in which they occur is of the type found at Tambi on the Koyna. It is wide and long, about 15 ft. deep, and has a muddy and gravelly bottom. The pool is held sacred and fishing is not allowed. I was, however, permitted to catch the "flowers"—as the Medusae are called—and collected a large number. Among these are some very small specimens almost equal in size to a large pin's head. The experiment tried at Medha was also tried here but was unsuccessful. I, however, suspect that the number of Medusae put in the jar may have something to do with the success of the experiment and if it were tried with only one or two Medusae in each jar we may yet succeed. This, however, was not possible this year and I left Dhôm for Karâd at the junction of the Krishna and Koyna on the 1st of May.

At Karâd I found that I was a little too late, the Medusae having all been washed away by the rain of the 28th April. I searched the river in a boat which was available, but could not see

any Medusae. From Karâd I explored the lower Koyna but was not able to get *Limnognida* at any place, though I was told that they occur in a number of pools in the river which I was not able to visit. The best time for observations on *Limnognida* appears to be the beginning of April. Later in the month, the numerous storms which occur and the rain which they bring frequently interrupt the work.

Our knowledge of the distribution of *Limnognida* has been increased as the result of this year's work. I have been able to confirm its occurrence in the Krishna at Dhôm. While at Karâd, I obtained information about the occurrence of Medusae in the Vârnâ and Panchgangâ, both tributaries of the Krishna which have their sources in the Western Ghats. Want of time prevented my visiting these localities, but should an opportunity present itself I will do so next year.

Before concluding I have to express my best thanks to Dr. Annandale who has taken very great interest in this work. His suggestions have been very valuable and but for his generous help the work would not perhaps have been done at all.

S. P. AGHARKAR.



XVII. ON A SMALL COLLECTION OF
BIRDS FROM THE MISHMI HILLS,
N E FRONTIER OF INDIA

By E. C. STUART BAKER, F.Z.S., F.L.S., M.B.O.U.

The birds mentioned in this article were collected by Capt. R. S. Kennedy, I.M.S., in the Mishmi Hills during the months of March and April, 1913, and though but few in number form a most interesting collection. It contains a splendid specimen of *Ithaginis cruentus kuseri*, hitherto represented by two specimens only which were obtained in Yunnan.

1. *Garrulus bispecularis* (Vig.).

Blanford, *Fauna of British India*, Birds, i, p. 39.
British Museum Catalogue, iii, p. 100.

No. 25385. Not sexed. Mishmi Hills, 8500 ft., 22-iii-13.

This specimen is a fairly typical specimen of *bispecularis*, rather dark above and brightly coloured. It exactly resembles the type of *Garrulus owstoni* from Formosa, so named by Ingram, but which is merely a synonym of *bispecularis*.

2. *Nucifraga hemispila* (Vig.).

Blanford, *Fauna of British India*, Birds, i, p. 41.
British Museum Catalogue, iii, p. 54.

No. 25389. ♀, Mishmi Hills, 8000 ft., 5-iv-13.

Although now it is often accepted as such I do not consider *hemispila* a sub-species of *caryocatactes* as the former bird and *multipunctata*, which is a sub-species of the latter bird, overlap in their breeding grounds without, as far as I can see from the material in the British Museum, in any way grading into one another. *Hemispila* is the common form over the North Eastern Frontier of India and breeds in Tibet and further east, but I have also received skins of *multipunctata* killed in Tibet during the breeding season.

The three forms of nutcracker should therefore stand as follows:

Nucifraga caryocatactes caryocatactes,
Nucifraga caryocatactes multipunctata (Vig.), and
Nucifraga hemispila (Vig.).

3. *Garrulax leucolophus leucolophus* (Hardw.).

Blanford, *Fauna of British India* Birds, i, p. 77.

British Museum Catalogue, vii, p. 435.

No. 25383. Not sexed. Etalni, Mishmiland, 2200 ft., 13-ii-13.

A quite typical *leucolophus* showing no signs of an approach to *belangeri*.

4. *Yuhina gularis gularis* (Hodg.).

Blanford, *Fauna of British India*, Birds, i, p. 211.

British Museum Catalogue, viii, p. 631.

No. 25388. ♀ Mishmi Hills, 8000 ft., 5-iv-13.

On the upper parts this bird is very close to *Y. gularis yangpiensis* (Sharpe), but has not the chestnut tinge on the throat, a character which appears to be always present in *yangpiensis*.

5. *Oreocincla mollissima* (Blyth).

Blanford, *Fauna of British India*, Birds, ii, p. 154.

British Museum Catalogue, v, p. 157.

No. 25386. ♂, Mipi, Mishmi Hills, 8500 ft., 9-iii-13.

I have recently shown that the form *dixoni* must be suppressed (*Bull. B.O.C.* clxxxviii, p. 81), as the alleged differences between this and *mollissima* are not specific but merely individual and are found in a certain number of specimens throughout the whole area inhabited by this bird. The present specimen has boldly marked wings, considerably better marked than most of the birds hitherto called *dixoni*.

6. *Glaucidium brodiei* (Burton).

Blanford, *Fauna of British India*, Birds, iii, p. 307.

British Museum Catalogue, ii, p. 212.

No. 25382. ♀ Etalni, Mishmiland, 2200 ft., 13-ii-13.

7. *Tinnunculus alaudarius* (Gmel.).

Blanford, *Fauna of British India*, Birds, iii, p. 428.

British Museum Catalogue, i, p. 425.

No. 25384. ♂, Mipi, Mishmi Hills, 5000 ft., 22-iii-13.

This is a rather large specimen for a male and is in very pale abraded plumage, but otherwise is quite typical *alaudarius* and agrees closely with birds killed in Great Britain.

8. *Turtur orientalis* (Lath.).

Blanford, *Fauna of British India*, Birds, iv, p. 40.

British Museum Catalogue, xxi, p. 403.

No. 25387. ♂, Mipi, Mishmi Hills, 8500 ft., 9-iii-13.

9. *Ithaginis cruentus kuseri* (Beebe).

No. 25380. ♂, Upper Matun Valley, Mishmi Hills, 8000 ft., 28-iii-13.

This most beautiful blood pheasant was recently described by Beebe from two skins in the Museum d'Histoire Naturelle de

Paris. These two skins, both of males, were received from Tsékon, Yunnan, and were collected by R. G. Soulie; one is still in the Paris Museum and the second is now in the British Museum collection. Compared with the latter skin the present specimen is considerably brighter, the black is more intense, the crimson both of the breast and other parts is more vivid and perhaps more extended into the abdomen, the green is richer and the grey of the back deeper and clearer in tint. All these differences, however, are probably only due to the present skin being fresh whilst the others are somewhat faded.

There is, however, one other difference which calls for remark and that is in regard to the white striations on the upper parts. In the Mishmi skin these are very narrow, little more than shaft stripes in fact, whereas in the Yunnan skins the striations are decidedly broader, in some cases as much as $\frac{1}{2}$ of an inch. An examination of the series of *Ithaginis cruentus cruentus* in the Museum shows that individuals of this species vary very considerably in this respect, and I am therefore unable to assume that this characteristic is anything but individual in the present case also. If, however, at any future time more specimens be obtained and the striations be found to be constantly narrow as in this bird, it would, combined with the general more intense colouration, suffice to divide it subspecifically from *cruentus kuseri*.

It is a most remarkable and interesting fact that the same species—or sub-species—should be found inhabiting areas so wide apart as Yunnan and the Mishmi Hills, and it is a great feather in Captain Kennedy's cap securing so great a rarity. He writes about the specimen as follows:—

“The specimen was shot in the Upper Matun Valley, Mishmi Hills, at an altitude of 8000 ft., lat. $29^{\circ} 20'$ and long. $96^{\circ} 20'$ (roughly).

“In that part of the Mishmi Hills this bird occurred in considerable numbers, and one frequently saw their droppings or scratchings when searching for takin.

“They are not wary and quite a number were shot by the various parties: they formed a most welcome addition to the larder, being good to eat. I believe Capt. Bailey sent a couple of female skins to the Bombay Nat. Hist. Society.

“I do not remember seeing traces of these birds at a lower altitude than 6500 ft., and think they might be said to occur, *in winter*, from about 6000 ft. up to the snow line, which, in these hills is of course comparatively low.

“The takin, Slater's moonal and tragopan have a similar range, though perhaps the moonal and tragopan remain a little lower. The hills in which they occur are clothed with forest, largely, though not entirely, composed of fir and pine trees with an undergrowth of rhododendron. In some places the forest gives way to grassy slopes, and to these slopes the blood pheasants repair to feed, morning and evening; and it is then that one can bag them for the pot so easily. They form large flocks; I have

seen 30-40 in one flock. When startled they run away into the jungle. They can fly—I have seen them fly across a stream, when frightened, but ordinarily do not, and must be shot on the ground.

“Their call is the same as that of the common Himalayan blood pheasant which I have shot in the Chumbi Valley.”

10. *Arboricola torqueola* (Valenc.).

Blanford, *Fauna of British India*, Birds, iv, p. 125.

British Museum Catalogue, xxii, p. 107.

No. 25381. Not sexed. Mishmi Hills, 9000 ft., 5-iv-13.

Quite typical.



XVIII. NEW AND INTERESTING DIPTERA FROM THE EASTERN HIMALAYAS

By E. BRUNETTI.

(Plate xiv).

Since Lord Carmichael became Governor of Bengal he has employed several collectors to collect the insects and other smaller fauna of the country round Darjiling. His Excellency has generously arranged to distribute the specimens between several Museums in India, Australia and Great Britain, and to present sets of certain groups to the specialists who are describing them. I have been asked by Dr. Annandale of the Indian Museum, in which the types will be retained, to work out the Diptera, amongst which a number of new and rare species are represented.

Unfortunately most of the specimens have been preserved in spirit, and others in papers, so that their condition is by no means satisfactory and for this reason several which almost certainly belong to undescribed species cannot be utilized as types. The proportion of new and uncommon species, however, is sufficiently large to make further collections from the same districts eminently desirable.

Nearly a hundred species are included in all, but, mainly owing to the inferior condition of the specimens, it has been possible to determine with tolerable certainty only between thirty and forty already known, to which must be added the fourteen new ones described here.

Unless otherwise stated, the species noted simply from "Singla" were collected in April, 1913, and those noted as "Darjiling," in May, 1912; the latter at from 1000 to 3000 ft. altitude.

MYCETOPHILIDAE.

Sciara indica, Walk.

One from Senchal, v-13; it has the whole sides of the abdomen, except at the base, conspicuously red.

Leia nigra, Brun.

One ♀, Senchal, v-1913.

BIBIONIDAE.

Crapitula melanaspis, Wied.

Three (♂ ♀) from Singla, iii-13, and Senchal, v-13.

It is probable that the name *Pleciomyia*, Brun., must sink in favour of *Crapitula*, Gimm., as pointed out by Prof. Bergroth recently.¹ In my Fauna volume I overlooked the fact of *Crapitula* having been set up for *melanaspis*, and as a reference to the generic description was not possible, I accepted it as synonymous with *Plecia* in a general sense. In a letter to me some few years ago Mr. Austin told me *melanaspis* would have to be removed from *Plecia*, and as the Kertész catalogue ranked *Crapitula* as a synonym it was thus the oversight occurred. It certainly was not my desire to deliberately set up a new genus for a species already sufficiently provided for.

Bibio hortulanoides, Brun.

One ♂, Darjiling District, 1000-3000 ft., vi-1912.

Bibio nigripennis, mihi, sp. nov.

♀ Darjiling.

Long. 7 mm.

Head dull black, except for a little grey hair on underside; flat, with a small but conspicuous prominence bearing the ocelli. Eyes separated by more than one-third the width of the head. Antennae and palpi black.

Thorax black (denuded), but apparently in life with some short yellowish or yellowish-grey pubescence. Scutellum and sides of thorax black, bare or nearly so.

Abdomen black, the surface wrinkled, *sides* with some yellowish-grey hair, which probably in good specimens covers the dorsum also.

Legs.—Fore coxae bright brownish-yellow except blackish at base; remainder of legs bright brownish-yellow except posterior coxae blackish, becoming dirty yellow on apical half. Fore femora greatly incrassated; fore tibiae more or less dirty yellow; apical spines strong, long and of equal length. Last two joints of all tarsi and extreme tip of previous joint black.

Wings blackish, darker on anterior border; stigma black, obvious but ill defined. Halteres black.

Described from a single specimen from Senchal, 8000 ft., May, 1913 in inferior condition.

TIPULIDAE.

Pselliophora fuscipennis, Macq.

One ♂, Darjiling, 1000-3000 ft., one ♀, Singla.

These do not altogether answer to the description, the thorax is wholly reddish-orange instead of the disc being blackish, and

¹ Ann. Mag. Nat. Hist. (8) ii, 584.

the small pale spot around the stigma is absent, but in this genus a wholly reddish thorax is not rare in some species normally having it partly black.

***Pselliophora gaudens*, Walk. (Pl. xiv, fig. 8).**

A ♂ from Singla is probably this species, but the wings are wholly deep brown. The first seven abdominal segments are bright orange, the 8th black, the lower sternite rather enlarged and pronouncedly V-shaped, as though supporting the conspicuous genital organs, which latter are almost bare and wholly dull black. They consist of an elongate, bilobed dorsal plate and a narrow ventral stylate plate, which is apparently fused to the large obtuse basal joints of the claspers. The remainder of the claspers seem to comprise a conical bare 2nd joint with some attendant interior appendages, but the whole organ being rather closely closed an exact description is impossible.

***Pselliophora compedita*, W.¹**

One ♀, Darjiling, 1000-3000 ft. Except that the marks on the thorax are inconspicuous, though legible, and for its large size (many species vary considerably in size), 25 mm. from tip of nasus to tip of the rather short ovipositor, this specimen agrees with Wiedmann's description.

***Tipula majestica*, Brun.**

One ♂, Singla, one ♀ Darjiling, 1000-3000 ft., vi-12, one ♀ Tindharia, 3000 ft., viii-12. The expanse of the wings is no less than 90 mm.

***Tipula flava*, Brun. (Pl. xiv, fig. 7).**

One ♂, Singla, v-13, one ♀ Darjiling, 1000-3000 ft., vi-12. The species was described from a single ♂ in the Vienna Museum, from Sikkim. The ♀ has not before been seen; it is in every way identical with the ♂ except for the sexual organs.

***Tipula pulcherrima*, Brun.**

Two ♂♂, one ♀ Darjiling, 1000-3000 ft., v-13.

***Tipula carmichaeli*, mihi, sp. nov. (Pl. xiv, figs. 6, 9).**

♂ Darjiling District. Long. 38 mm.; expanse of wings 91 mm.

Head much flattened, upper side brownish yellow, fading nearly to whitish at the margins, and deepening in the median line to a moderately wide, distinct, dark brown band, extending from nape to between the eyes. Frons small but prominent, in the shape of a blunt cone, with a narrow median brown stripe

¹ See note under *Plecticus wulpii* concerning protective resemblance between these two species.

above, and a similar one on each side of the base of the prominence. The width of the frons just above the conical prominence about one-fourth that of the head. Proboscis brownish-yellow, dark above, below, and at the sides at the tip; labella brownish-yellow; palpi (only one joint remaining) and antennal 1st joint (remainder missing), brownish-yellow. Occiput, which is distinct in spite of the very large flattened top of the head, dark brown or brownish-yellow, a few concolorous hairs on underside.

Thorax.—The distinct neck dark brownish-yellow or dark brown, with, on each side, a narrow whitish longitudinal streak above and a broader one below it, well separated from each other. Prothorax well defined, dark chocolate-brown with the margins pale yellowish or yellowish-white, apparently variable. Dorsum of thorax brownish-yellow, two median chocolate-brown moderately narrow stripes (separated by about the width of one of them), from anterior margin almost to suture. On the outer side of each of these stripes, leaving a moderately wide brownish-yellow intervening space, is a large chocolate-brown spot irregularly triangular in shape, bounded by the lower margin of the dorsum and by the transverse suture. In this spot are two pale brownish-yellow approximately oval spots, placed longitudinally, one above the other, the lower one immediately in front of the wing base. The transverse suture is very deep, and the linear depression connecting it with the scutellum also, causing the hinder half of the dorsum to apparently consist of two rather conspicuous convex portions; brownish-yellow in colour, paler anteriorly, with silvery white shimmer on anterior corners and irregularly along the front margin, and with a chocolate-brown transverse band irregular in outline, narrowest in its middle, from the wing root to the sutural-scutellar depression, which latter is almost wholly chocolate-brown.

The scutellum, which is quite small, is dark chocolate-brown, with a brilliant white spot on each side of the dorsum; the frenulum well developed, dark chocolate-brown. Mesopleurae similarly coloured, a broad stripe on upper part, shining yellowish-white, and a short smaller central brownish-yellow elongate mark placed longitudinally. Sternopleurae yellowish-white, with a median dark brown stripe from anterior margin to middle, posterior to which is a round brown spot; the lower margin of the sternopleura also brown. The pteropleura extends from the wing root to between the 2nd and 3rd pair of legs, where it takes the form of a small globular piece, conspicuous, pale yellowish-white. Metapleurae brownish-yellow on upper third, chocolate-brown on middle third and black on lower third; the hinder part of the latter brownish-yellow. An oval, brilliant, shining white spot in middle of the lower third part. Hypopleurae shining white, and a similar silver white spot on extreme hinder part of metapleurae, adjacent to the metanotum, which latter is large and conspicuous, brownish-yellow, with the anterior part of the sides brilliantly silvery white, and a small elongate brown spot on inner side of each such white side spot.

Abdomen.—The 1st segment brownish-yellow, hinder part at sides dark chocolate-brown, with a large irregular oval white spot on each side, nearly or quite reaching the upper side; 2nd segment very narrow, barely wider at tip, pale yellowish, an irregular, lighter brown dorsal stripe, and at each *side* towards tip, a short dark brown stripe; tip of 2nd segment more or less white both on dorsum and at sides; 3rd and 4th segments dark chocolate-brown, with two slightly curved, narrow elongate spots (convex side inwards), from towards the sides at the base of the segment, and extending to the hind margin, where they are still widely separated. These spots are yellowish on the 3rd and chalk-white on the 4th and remaining segments but the colour may be a little variable. A couple of small whitish spots towards each hind corner of the segments. The 3rd and 4th segments are both very considerably wider at tip than base, the 5th and 6th are replicas of the 3rd and 4th, but the brown colour is lighter. The 7th segment is light brown with two nearly parallel white stripes.

Belly brownish-yellow at base, lighter chocolate-brown from 3rd segment (inclusive) to tip, with two well separated white stripes extending over the segments, the surface on the outer side of these stripes black. There is a distinct 8th sternite, lighter brown, well curved. The whole abdomen is practically bare.

Genitalia comparatively very small, mainly concealed, brown, an upper bifid oblong dorsal plate, and a pair of claspers with one or two appendages.

Legs.—Coxae white dusted, with a blackish spot on front side; remainder of legs brownish-yellow; femora at tip, tibiae at base and tip, and metatarsi at base, all with broad dark brown rings, but not well delimited.

Wings clear, very shining, absolutely bare, the whole surface transversely ribbed. The wing roots blackish, the stem of the wing considerably elongated, a distance of 9 mm. before the wing definitely widens. The 1st posterior cell extremely narrow throughout its length, the petiole of the 2nd posterior cell almost as long as the cell, and about as long as the discal cell; the 6th vein remarkably close to the 5th and taking a sudden bend at its middle.

Costal cell pale yellowish except for the clear tip; the stigmatic portion and the region around the discal cell dark brown, the colour extending uninterruptedly to hind margin of wing, embracing tip of 5th vein. This brown colour encroaches narrowly but distinctly on the apices of both basal cells, on the basal half of the submarginal cell, extending very narrowly along its upper (costal) side. The colour also fills wholly the 1st posterior cell (though here it becomes yellowish), and it borders narrowly the upper side of the 2nd posterior cell, and the basal parts more broadly of the 3rd, 4th and 5th. There is, in the brown colour filling the discal cell, a triangular clear space of moderate size and a small pale streak at tip of 1st basal cell and also just above the praefurca. The 5th longitudinal vein is rather broadly brown,

bordered on each side, except towards the tip of the 2nd basal cell, whilst a large brown spot, like a recumbent **V**, lies across the middle of both basal cells, the basal part of the **V** directed towards the wing base, and the colour continued narrowly into the costal cell where it separates the yellowish and clear areas of that cell. The very narrow anal cell dark brown throughout, except on the hinder part of its middle. The base and tip of 1st axillary cell dark brown, and a transverse dark brown band across its middle, in a line with the base of the afore-mentioned recumbent **V** and ending on the wing border at the 6th vein. The 2nd axillary cell dark brown, except the basal fourth and a large triangular space beyond the middle, adjacent to the wing border, which are clear. Halteres pale brownish-yellow.

Described from a single ♂ in good condition taken by Lord Carmichael in a bathroom at Sureil, Darjiling District, vi-13. This is the most magnificent *Tipula* it has yet been my lot to behold.

***Tipula imperfecta*, mihi, sp. nov.**

♀ Darjiling, 1000—3000 ft. Long. 22 mm. from tip of nasus, exclusive of 3 mm. ovipositor.

Head moderately dark rich brown, with traces of brownish-yellow colour on frons and face; frons forming a rather conspicuous conical prominence. The whole occiput and frons with a little black pubescence, and some longer pubescence on under side of head. Proboscis, palpi and labella concolorous brown with lighter patches here and there, all pubescent. Antennae with 1st joint long, brown, with soft black hairs, 2nd short, brownish-yellow, bare, remainder nearly black, with a whorl of four hairs at base of each segment.

Thorax rich dark brown; traces of three darker stripes on anterior margin; the ground colour lighter on dorsum behind the suture; the hind margin from wing roots up to and including the scutellum, lighter, and of a slightly livid grey tinge. Sides of thorax concolorous with dorsum; metapleurae well defined, lighter brown; metanotum rich dark brown (with a very narrow pale median line), a little lighter on hinder side. The whole thoracic dorsum, scutellum and metanotum with short soft black hairs, but sides of thorax practically bare.

Abdomen dark brown, but duller and less rich than thorax, slightly narrowed at base, widest at about the 4th segment, the whole dorsum with microscopic pubescence, which is longer towards sides of first two segments. Belly similar to dorsum. Ovipositor moderately long, bright ferruginous.

Legs only moderately long, bright reddish-brown; coxae black, femora with subapical black ring, extreme base of tibiae pale yellow; tarsi a little darker brown.

Wings.—*Anterior cross vein absent*, owing to the basal section of the 3rd longitudinal vein being so long as to reach the corner

of the discal cell before the vein turns horizontally. Ground colour of wing pale yellowish-grey; costal and subcostal cells brownish-yellow, the colour extending a little below the 1st longitudinal vein, and about the stigmatic region. The wing distad of the two basal and the anal cells, and of the yellow stigmatic region embracing the discal cell, is grey, except for clearer spots (showing the pale yellowish-grey ground colour of the wing) placed as follows:—A long one in the 1st posterior cell, occupying the major part of its apical half, and extending in its middle, narrowly into the 2nd submarginal cell, ending at the wing border near tip of lower branch of 2nd longitudinal vein. This latter cell also has a small oval pale spot at its tip. A small elongate pale spot towards the tips of 2nd, 3rd, 4th and 5th posterior cells, and traces of a small similar one at the base of the 3rd, 4th and 5th cells. Lower part of 1st basal, and apical part of 2nd basal, mainly, and some streaks in the anal and axillary cells also, pale. A narrow elongate *hyaline* spot lies across the vein separating the 1st basal and the discal cell; and there is a black oval spot on the costa at tip of 1st vein, extending to the forking of the 2nd vein; and another spot over base of 2nd vein. Halteres blackish-brown.

Described from a unique ♀ in fair condition, Darjiling, iv-1912.

There are three other apparently undescribed species of *Tipula*, one, a ♂, with blackish wings with a few small yellowish spots, taken in Government House grounds, Darjiling; the 2nd species is a ♂ from Sikkim, with pale yellowish-grey wings, and the 3rd has grey wings slightly infuscated, and comes from Senchal, represented by a ♂ and ♀. All these are in too bad condition to be set up as types.

***Dicranomyia pulchripennis*, Brun.**

One ♀, Darjiling, 1000—3000 ft.

***Eriocera nepalensis*, Westw.**

One ♂, Darjiling, 1000—3000 ft.

STRATIOMYIDAE.

***Ptilocera fastuosa*, Gerst.**

Three (♂ ♀), Darjiling, 1000—3000 ft., May and June, 1912.

STRATIOSPHECOMYIA, mihi, gen. nov.

(*Pachygastrinae*).

Head flattened, semicircular, narrower than greatest width of thorax, nearly bare; occiput not at all projecting behind eyes; ocelli on small, very distinct prominence, equidistant. Eyes in ♂ quite contiguous for a moderate distance, hinder and lower facets.

distinctly smaller than anterior and upper ones. Proboscis thick, apparently moderately long but mainly concealed within the mouth opening, probably producible; palpi elongate, a little pubescent, apparently of one joint only. Antennae elong-cylindrical, nearly filiform, two-thirds as long as head and thorax together; 1st joint about twice as long as broad, 2nd about half this length; flagellum with eight distinct annulations, subequal, except the last which is rather longer and pointed.

Thorax approximately oval, widest at level of wings, only slightly arched; microscopically pubescent here and there. Scutellum of moderate size, semicircular or sub-triangular, unspined.

Abdomen apparently 5 jointed, the emargination between the 2nd and 3rd joints extremely indefinite, possibly these forming but a single joint. The 1st joint very short, transverse, 2nd as wide as 1st at base, thence suddenly narrowing at half its length to cylindrical form, the 3rd at base as wide as tip of 2nd, rapidly widening to tip; the abdomen widening to tip of 4th segment, thence rapidly narrowing, the tip rounded, the 2nd to the 5th segments subequal in length. Abdomen with a little soft pubescence towards sides at base. Genitalia exposed, fairly complex, consisting of a dorsal plate and a pair of two-jointed hairy claspers, with, apparently, at least one other pair of appendages.

Legs quite slender, moderately long, minutely pubescent; hind legs longer and slightly stouter, hind femora barely thickened towards tips, hind metatarsi distinctly incrassated, larger and longer than the remainder of the tarsus; 4th tarsal joint of all the tarsi distinctly shorter than any others.

Wings well developed, fairly broad, a little longer than abdomen, venation as in *Pachygaster*, distinct, halteres large.

N.B.—In my table of genera (Rec. Ind. Mus. I, 89) this genus will separate from *Saldua*, Walk on the following characters: the pedunculated abdomen, the different construction of the antennae, the longer wings (unless Walker by a *lapsus calami* has written thorax instead of abdomen, which seems probable), and lastly on the greater breadth of wing. The differences in the abdomen and antennae alone are sufficient to require a new genus.

The ♀ unknown.

***Stratiosphecomyia variegata*, mihi, sp. nov.**

(Pl. xiv, figs. 14, 17).

♂ Darjiling, 1000—3000 ft.

Long. 11—12 mm.

Head.—Eyes contiguous for one-fourth the distance from vertex to antennae, vertex rather depressed, with conspicuous ocellar prominence, wholly black. Frontal triangle brownish-yellow, bare, shining, flush with eyes. Face lighter brownish-yellow, with almost microscopic whitish pubescence, and two large circular black spots below base of antennae. The hinder part of the lower part of the head black. Proboscis and palpi brownish-yellow, withdrawn, with a little pale pubescence. Antennae

cylindrical, nearly filiform, scape brownish-yellow, bare, 1st joint twice as long as 2nd, flagellum black with 8 annulations, subequal, except that the last one is a little longer and pointed.

Thorax black, microscopically pubescent, with bright lemon-yellow markings as follows:—On anterior margin of prothorax; the humeral calli; a large triangular mark at each end of the transverse suture, in front of root of wing; a broad band from shoulder to wing base; the posterior margin of dorsum of thorax broadly yellow, in the form of four contiguous triangles, the outer ones approximate to wing bases; a large spot placed diagonally on the sternopleura; a curved one between it and the wing base and a last one behind the wing, almost contiguous to the metanotum. Sides of thorax with extremely short and rather sparse pubescence, which is black or yellow in accordance with the colour of the surface.

Abdomen.—Basal segment reddish-brown, 2nd, except perhaps at extreme tip, black; remainder of abdomen reddish-brown, with a narrow indistinct transverse blackish streak at base of 4th, and a similarly coloured subquadrate large spot on base of 5th, filling the major part of the segment.

Legs.—Coxae black, tips sometimes a little paler; anterior legs yellowish, tibiae indistinctly a little darker, fore tarsi black, except metatarsus, middle metatarsi yellowish-white, rest of tarsus brownish-yellow. Hind legs brownish-yellow, with indistinct traces of brown here and there, base of femora narrowly pale yellow; tibiae rather flattened at base and slightly pinched beyond the middle, with two indistinct though fairly obvious moderately broad blackish rings, one just beyond base, the 2nd sub-apical; tarsi brownish-yellow, last two or three joints black; the 4th joint in all the tarsi much shorter than any of the others.

Wings pale grey, gradually darker on apical half, stigmatic region moderately dark brown, ill defined; halteres large, yellow. Venation as in *Pachygaster*.

Described from five ♂♂, Darjiling, 1000—3000 ft., May, 1912. All have been in papers (not in spirit) and are more or less compressed, especially the thorax.

***Craspedometopon frontale*, Kert.**

A ♂ from Darjiling, 1000—3000 ft., agreeing exactly with specimens in the Indian Museum supplied by Prof. Kertesz, in which collection are also two others from Tenasserim.

? Gen. nov. near *Acanthina*, W.

A single ♀ from Darjiling 1000—3000 ft., apparently represents an undescribed genus near *Acanthina*, but is in too bad condition to describe.

***Ptecticus wulpîi*, Brun.**

Several specimens from Darjiling, 1000—3000 ft., v-1912, and Singla, iv-1913, of this rather common Sargid. The extraordinary

resemblance in colour, size, and amount of infuscation of the wing tip between this species and the Tipulid *Pselliophora compedita*, W seems more than coincidental. Possibly one is distasteful to the birds and the mimicry of the other is protective.

***Eudmeta marginata*, F.**

Five ♂♂ from Darjiling, 1000—3000 ft., June, 1912.

***Ampsalis longispinus*, mihi, sp. nov.** (Pl. xiv, figs. 2, 4, 16).

♂ ♀ Darjiling, 1000—3000 ft. Long. 10—13 mm.

Head twice as broad as long. Eyes in ♂ contiguous for the greater part of the distance from vertex to antennae; frons shining black in ♂, in ♀ from one-fourth to one-fifth the width of the head, less shining, bare. Ocelli on a distinct prominence, yellowish. Antennae black, 1st and 2nd joints subequal, cylindrical, barely broader at the narrowly brown tips, minutely spinose; 3rd joint cylindrical, almost filiform, pointed, with 8 annulations. Occiput black, minutely pubescent.

Thorax dull black, with microscopic pubescence which in perfect examples is probably blackish or dark grey. Traces of a little brownish-yellow colour behind the wings, and the hind corners of the dorsum distinctly so coloured. Scutellum conspicuous, though of normal size; shining aeneous or blue-black, with some soft (? pale) hairs, and two apical very long and powerful reddish-brown spines, half as long as the abdomen, diverging and directed slightly upwards.

Abdomen brownish-yellow; 1st and 2nd segments mainly black, hind border of latter brownish-yellow, 3rd and 4th each with a rounded or subquadrate blackish spot of considerable size towards each side of the dorsum, but clear of the margins. In the ♀ these four spots are much larger and nearly fill the surface of these segments. The 5th and 6th segments in both sexes mainly black, but sides and hind margins brownish-yellow. Belly with 1st, 2nd, 4th and 5th segments mainly black, remainder brownish-yellow. In the ♀ the black colour is a little more extended; in both ♂ and ♀ the belly has very short yellowish pubescence over its whole surface. Genitalia in ♂ concealed, in ♀ a narrow, cylindrical tube, with a pair of rather long brownish-yellow hairy filamentous appendages.

Legs yellow; hind tibiae incrassated on apical two-thirds, black; hind tarsi longer than tibiae, the hind metatarsus black for two-thirds of its length, and being as long as the remaining joints taken together.

Wings distinctly yellowish, very shining, apical third and hind margin grey; stigma black or blackish-brown, veins blackish; halteres yellow.

Described from 3 ♂♂ and 4 ♀♀ from Darjiling, 1000—3000 ft. v, vi-1912 and Singla, iv-1913, in fair condition.

N.B.—There is nothing to materially prevent this species coming in *Ampsalis*. The head is barely as wide as the thorax at its widest part, and Walker says the scutellum is armed with two oblique ascending spines, but does not mention their great length. The only apparent discrepancy is that he says the flagellum is about twice the length of the scape, whereas in the present species it is fully three times as long, but this difference would not be generic.

***Odontomyia rufoabdominalis*, mihi, sp. nov.**

♂ Darjiling, 1000—3000 ft.

Long. 17 mm.

Head black, a little shining. Eyes absolutely contiguous for a short space, leaving a very elongate narrow vertical triangle. Vertex considerably prominent, with a few black hairs; ocelli pale yellowish. Face but little prominent, with short black and grey hairs. Antennae black, 1st and 2nd joints normal, 1st black, 2nd dull brownish (3rd missing). Two small tufts of grey hairs immediately above antennae, and a trace of grey hairs along the sides of the face.

Thorax black, slightly shining, dorsum and sides with moderately thick, not long, black and grey hairs, set in minute black sockets which give the dorsum a granulated appearance, often two or three hairs emerging from the same socket. Small patches or bunches of grey hairs occur around the base of the wing and on the pleurae. Scutellum similarly clothed to the thorax, with a fringe of rather ragged grey hair on posterior border and a short blunt spine at each hind corner.

Abdomen.—Ground colour of 1st and 2nd segments and major portion of 3rd, 4th and 5th black, a little shining, the sides of the dorsum, nearly from the shoulders to the extreme tip, and the hind margins of the 3rd, 4th and 5th and the bulk of the 6th segment all bright reddish-orange, covered with similarly coloured pubescence. The black parts are clothed with sparse black pubescence, a small patch of greyish hairs on hind corners of 2nd segment, and some yellow hairs extend along the narrow red side edges of the abdomen, nearly or quite to the shoulders. Belly dull reddish-orange, becoming brighter towards tip, the central part of most of the segments more or less black. Pubescence of belly wholly reddish-orange, short and depressed.

Legs black, with a little short greyish hair; under and inner sides of tibiae towards tips and about the apical half of the anterior and the whole of the hind tarsi (the latter lengthened) orange yellow, with short gold pubescence.

Wings yellowish-grey stigmatic region black; the major portion of the middle of the wing from anterior margin nearly to posterior border darker brown, the colour fading away gradually. Halteres buff; thoracic squamae milk-white with similarly coloured soft hair.

Described from a single ♂ in good condition, Darjiling, 1000—3000 ft., June, 1912. A very handsome species and totally unlike anything described from the East.

TABANIDAE.

All the specimens of this family are in bad condition through immersion in spirit, three species being present, one, which though I cannot identify it, appears to fall in Miss Ricardo's "group IX," represented by a short series of examples in less inferior condition than the remainder.

BOMBYLIDAE.

Hyperalonia tantalus, F.

Several from Darjiling, 1000—3000 ft.

H. flaviventris, Dol. or *oenomaus*, Rond.

One ♂ from Darjiling, 1000—3000 ft., July, 1912, is probably one or other of these species.

Argyramoeba distigma, W.

Three from Darjiling, 1000—3000 ft., and Singla.

MYDASIDAE.

Mydas carmichaeli, mihi, sp. nov.

♂ ♀ Darjiling District.

Long. ♂ 25, ♀ 27 mm.

Head black, frons slightly wider than one-third of the head, slightly wrinkled, with a moderate amount of blackish-brown pubescence; a small tuft of greyish hairs on each side of the mouth opening. Proboscis rather less than the height of the head, dark brown; palpi slender, black, reaching as far forward as a vertical line drawn through the antennal prominence, which latter is small and black. Antennae normal, black, bare, about as long as from the vertex to the tip of the proboscis. Occiput black, shortly pubescent; a little grey tomentum behind the eye border.

Thorax wholly dull velvet black with very short sparse black pubescence, which is a little longer below the wings.

Abdomen shining black with a slight indigo-blue tinge, and very short pubescence; in ♂ subcylindrical, as long as head and thorax together and barely as wide; in ♀ a little broader and longer and much more bulky. The ♂ genitalia consist of a hollow triangular piece, hairy above, with a deep keel, a pair of dark reddish-brown, nearly bare, moderately long, narrow, finger-like claspers (only one joint being visible, the organs being somewhat withdrawn), and a curved ventral plate, with black pubescence on its lower side. The ♀ genitalia appear to consist

of two telescopic cylindrical shells, the inner one ending in two small (probably) retractile lamellae.

Legs wholly black; coxae with a little short black pubescence; hind femora with two rows of spines on under side, an inner-one of about a dozen and an outer one of a few only. Hind tibiae with a row of reddish spines on under side (not at all conspicuous), and 5 or 6 such spines at the tip on the under side only. Fore tibiae with some inconspicuous spines at tip, which appear to be only the terminal ones of a row on the under side: nearly hidden by the thick though short black pubescence which clothes all the tibiae. A row of spines including the apical ones is apparently present on the middle tibiae also, though certainly much less conspicuous. Claws distinct, pulvilli pale brownish-yellow.

Wings dark blackish-brown, a little paler towards tip and hind margin, and with a strong violet tinge. Halteres and squamae black, the latter with a narrow fringe of dark brown hair.

Described from a single pair, the ♂ from Darjiling, v-1912, the ♀ from Singla, iv-1913. Both are perfect specimens and the ♂ has not been immersed in spirit.

ASILIDAE.

There are a good many specimens of this family, but nearly all are valueless from immersion in spirit. About 15 examples are fairly or quite good, representing about half that number of species, but I am at present unable to identify oriental species in this family.

SYRPHIDAE.

Baccha robusta, Brun.

Four specimens, ♂ ♀, Darjiling, 1000—3000 ft.

Didea ovata, Brun.

One ♂, Darjiling, 1000—3000 ft.

Syrphus spp.

Several specimens; two species, of which one is either *ribesii*, L., or allied to it.

Asarcina aegrotus, F.

One from Darjiling, 1000—3000 ft. The head being crushed, the sex is indeterminable.

Milesia gigas, Macq.

Three, ♂ ♀, Darjiling, 1000—3000 ft., and Singla, v-1913.

***Milesia balteata*, Kert.**

(*M. himalayensis*, Brun.).

A good series of both sexes in bad condition, Darjeeling, 1000—3000 ft., Singla and Sevoke, 1000 ft., Darjiling District, iv-1913.

***Milesia variegata*, Brun.**

Several of both sexes in bad condition from Darjiling 1000—3000 ft., and Singla.

***Milesia* ? *macularis*, W., var.**

A single ♀ from Singla is near this species but there are several discrepancies, as for instance a second, smaller pair of yellow spots on the 2nd to 4th segments, whilst the colouration of the antennae and legs is different. The specimen is not sufficiently well preserved to describe as new, but a figure is given of it.

***Milesia ferruginosa*, mihi, sp. nov. (Pl. xiv, fig. 12).**

♀ Darjiling, 1000—3000 ft.

Long. 10—17 mm.

Head rich shining yellowish-brown, a large, approximately oval, bright yellow-dusted spot on each side of middle of frons contiguous to eyes. Traces of yellow dust on cheeks and above mouth opening, where are also a few short yellow hairs. Vertex with some short stiff black hairs. Frons just above antennae one-third the width of the head, diminishing to half that width at vertex, with a few scattered black hairs. Proboscis, palpi and labella blackish, the latter rather large, antennae wholly shining yellowish-brown, 3rd joint deeper than long, the anterior edge straight, arista concolorous. Occiput bright yellow-dusted.

Thorax brownish-yellow; dorsum mainly filled by three nearly or quite contiguous black stripes of equal width, not attaining anterior margin, but the two outer stripes reaching posterior margin. The spaces between the stripes on anterior part occupied by two narrow gold dust lines, broadest in front, and extending posteriorly to just beyond the suture. Humeral calli distinct, a little brighter yellow. Whole dorsum with minute black or yellow pubescence, following the ground colour. Scutellum deep reddish, broadly black at base, whole surface with moderately long black softer pubescence and numerous isolated longer hairs. Posterior border with sparse fringe of very short golden yellow hairs. Sides of thorax black; mesopleura wholly, and the adjacent margins broadly of the pteropleura and sternopleura, with a space below the shoulders brownish-yellow.

Abdomen.—The 1st segment all black, 2nd black, with a very narrow but well defined lemon-yellow band a little beyond the base, tip of segment with short yellow hairs; 3rd and 4th segments with a moderately broad chrome-yellow band at base, followed by a narrow, not well defined, though distinct, black

band, more or less emarginate in the middle, the remainder of each segment rather bright reddish-yellow. The whole dorsum of abdomen with short recumbent yellow hairs, which are nearly whitish on the 1st segment and become more reddish-yellow on the 3rd and 4th segments. Genitalia withdrawn, apparently fairly large, reddish-yellow with black hairs. Belly black, yellow haired, posterior margins of segments narrowly yellow.

Legs.—Femora reddish-yellow or orange; basal half of posterior pairs black, front sides of anterior femora with black stiff pubescence, hinder sides with longer and softer hairs, especially on apical half. Hind femora with a small yellowish tooth just beyond two-thirds of its length, pubescence covering most of the limb yellowish, but some longer black hairs on underside. Tibiae yellow, posterior pairs paler, all with short and rather close pale yellow pubescence. Tarsi pale yellow with concolorous pubescence, fore pair with traces of blackish here and there.

Wings pale grey; yellowish-brown from costa to spurious vein, the colour extending just behind the apical half of the 3rd longitudinal vein. Halteres small, black.

Described from three ♀♀ from Darjiling, 1000–3000 ft., and Singla, also from three ♀♀ sent me for identification by Dr. Imms, taken by him in the Kumaon district, 13-v; 18-v; 18-vi-12. The species seems remarkably constant in its markings and colouration but varies considerably in size. It seems to come near *M. doriae*, Rond., described from Borneo.

***Eumerus rufoscutellatus*, mihi, sp. nov.** (Pl. xiv, fig. 13).

♂ Darjiling.

Long. 12 mm.

Head.—Eyes contiguous for only one-fourth the distance from vertex to antennae, rather suddenly separated above this space, forming a moderately wide frons which is black, with black hairs in the middle and bright yellow hairs on vertex and lowest part; facets of uniform size throughout except those immediately in front. Frons flat, not at all prominent, yellowish-grey with bright yellow hair. Antennae large, rather dark brown, first two joints normally bristly; 3rd joint a little lighter on upper side, with microscopic grey tomentum, rounded above to tip, straight on lower side, a long dorsal arista.

Thorax violet-aeneous, moderately shining, with moderately dense short brownish-yellow pubescence, and two widely separated grey tomentose longitudinal stripes from anterior margin to scutellum, and a stripe along the transverse suture, but interrupted between the two longitudinal stripes. Humeral calli aeneous, with a little yellow pubescence. Sides of thorax blackish-aeneous with a considerable amount of bright yellow hair on pleurae. Scutellum broad, violet-aeneous, covered with copious long bright yellow hair.

Abdomen dark aeneous black, not very shining, basal corners a little steel coloured viewed from certain angles; a pair of diverg-

ing, narrow, elongate, grey tomentose stripes on 2nd, 3rd and 4th segments, beginning approximately near base of segment and extending nearly to posterior corners. Surface of the abdomen with microscopic pale yellow pubescence, which is brighter and longer on hind margins of segments, and there is a patch of bright reddish-orange pubescence at basal corners of 2nd segment. Tip of abdomen with black hairs. Belly blackish, with a little sparse yellow pubescence.

Legs black; basal half and tips of anterior tibiae and the anterior tarsi brownish-yellow; hind legs black, except knees, tips of tibiae and apical part of each tarsal joint. All legs with yellow pubescence, rather long on femora and tibiae, especially on hinder and under sides; hind tarsi considerably incrassate, with bright reddish-brown pubescence.

Wings grey, stigma small, blackish; anterior cross vein at two-thirds of the discal cell, very sloping; halteres yellow.

Described from one ♂, in inferior condition from immersion in spirit, from Singla.

***Xylota annulata*, mihi, sp. nov. (Pl. xiv, figs. 11, 15).**

♂ ♀ Darjiling District.

Long. 11 mm.

Head.—♂ Eyes contiguous for half the distance from the black vertex to the face; frons a small triangle, with very short grey pubescence below the space occupied by the reddish ocelli. Face black on upper part, yellow on lower part, wholly covered with yellow tomentum except the shining black upper side of the antennal prominence. Antennae rather dark brown, shining, bare of pubescence, but with a few short bristles on two basal segments; mouth parts blackish-brown. Occiput blackish, with a little sparse yellowish-grey hair behind the eye borders. In the ♀ the frons less than one-fifth of the head at the vertex, widening distinctly down to the antennae, all black, with a little very short bright yellow pubescence which may (apparently) extend over the whole frons except perhaps towards the vertex.

Thorax aeneous, a little bronze reflection viewed from certain angles; two median well separated stripes of bright minute golden yellow hairs from anterior margin nearly to scutellum; a little similar hair on shoulders, hind corners of dorsum and at each end of the transverse suture; shoulders a little yellowish. Sides of thorax black, with a yellowish tinge to the mesopleurae, which bear a little bright yellow hair. Scutellum dull aeneous black with a little very short yellow pubescence around the margin.

Abdomen.—The 1st segment mainly yellowish, rest of dorsum black with, on each side of the 2nd and 3rd segments, a subtriangular or semicircular yellow spot, extending nearly the length of the side margins and spreading inwards until only a rather narrow median black intervening space is left. The 4th segment in ♂ and ♀ shining aeneous, brighter in ♀ (this may be mere individual variation), 5th segment in ♂ yellow; both 4th and 5th segments

in both sexes with a little short bright yellow pubescence, of which there is also a little at the basal angles of the abdomen. The whole yellow part of the dorsum with minute yellow pubescence, of which a little occurs on the belly.

Legs bright yellow, hind femora exceedingly incrassated (as in *Syritta*), with a broad black median band, widest on upper side, and a narrow black apical band. Hind tibiae and tarsi and anterior tarsi tips black.

Wings pale grey, anterior cross vein just beyond middle of discal cell and distinctly sloping; stigma pale yellow, halteres yellow, squamae yellow with yellow fringe.

Described from a ♂ from Singla, iv-13, and a ♀ from Darjiling, 1000-3000 ft., v-12.

N.B.—The hind femora are much more incrassated than is normal in *Xylota*, but the species fits into this genus better than elsewhere. It might be placed in *Syritta*, to which its general resemblance is striking, but for the position of the anterior cross vein.

***Mallota rufipes*, mihi, sp. nov.**

♂ Darjiling District.

Long. 12 mm.

Head.—Frons at vertex one-fifth total width of head, considerably wider at level of antennae; black, a little shining, with some black hairs, which apparently do not continue as far as the antennae; ocelli at vertex on the barely perceptibly raised surface. Face moderately produced, wholly black, bare, but for a little whitish-yellow pubescence. Antennae bright yellowish-brown, on a distinct, shining black prominence, the tip of which is bright yellowish-brown; 3rd joint grey-dusted, arista bright yellowish-brown, bare.

Thorax wholly dull black, with thick long black pubescence; scutellum dull reddish-brown with thick black pubescence.

Abdomen rather curved, dull black, with thick black pubescence; apical part of 4th segment and whole of 5th with a little grey tomentum. A bunch of very bright orange-yellow hairs towards sides of 2nd segment. Belly dull black, pubescent.

Legs.—Coxae and about basal half of femora black, with black pubescence; remainder bright reddish-orange, with thick dense concolorous pubescence. Hind femora almost straight, considerably deepened, with numerous small spines below towards tip; hind tibiae distinctly but not greatly curved, considerably flattened and moderately deepened. Pulvilli orange, claws orange on basal half, remainder black.

Wings pale yellowish-grey, apical half a little infuscated, embracing loop of 3rd longitudinal vein; marginal cell obviously but not widely open; anterior cross vein exactly at middle of discal cell, slightly sloping; anal vein continued straight, almost to the wing border. Halteres dull brownish-yellow.

Described from a single ♂, Singla.

N.B.—The pubescence is considerably matted in this specimen through it having been immersed in spirit, and though the colours may not have altered, they are probably brighter in fresh specimens and the black parts of the surface more shining.

***Eristalis tenax*, L.**

A ♀ from Senchal, 8000 ft., v-1913.

***Eristalis orientalis*, W**

Three ♂ ♂ from Singla.

N.B.—Two other species, a ♂ of each, are present, which cannot be identified with certainty.

***Megaspis crassus*, F.**

One ♀, Darjiling, 1000–3000 ft

***Megaspis zonalis*, F.**

Two ♀ ♀, Darjiling, 1000–3000 ft.

***Axona cyanea*, mihi, sp. nov.¹ (Pl. xiv, fig. 3).**

♂ Darjiling District.

Long. 11 mm.

Head set closely on the thorax. Eyes touching for a considerable space, chocolate-brown, upper facets distinctly larger than lower ones. Vertical triangle small, black, with a little black pubescence; ocelli red. Frons rather prominent, brilliantly shining violet, with soft black hairs. Face brilliantly shining violet, distinctly prominent, cut away below antennae and produced over mouth opening, provided on each side of the latter with a small blunt point. Mouth parts concealed, blackish. Antennae blackish-brown, 1st and 2nd joints short, normal, with a few short bristles, 3rd rounded, dull, with basal brownish-yellow bare arista (the latter under high microscopic power being seen to bear a few pale hairs towards the base). Occiput black, hind border of eyes narrowly margined with grey tomentum.

Thorax, scutellum and abdomen shining violet-blue, all covered with short stiff black hairs. Belly dark with black pubescence.

Legs black with violet-blue tinge; hind femora rather flattened and considerably deepened until just before the tip; no bristles or spines are obvious. Hind tibiae barely curved and with a slight peculiar thickening in the middle. All the legs with short soft black pubescence, tarsi with a little golden brown pubescence on underside; claws and pulvilli well developed.

Wings clear, rather pointed, marginal cell almost closed on the border; anterior cross vein immediately beyond the exact middle of the discal cell, slightly sloping; 6th longitudinal (anal) vein

¹ See addendum, p. 277.

continued almost to the wing margin, nearly straight. Alulae large, thoracic squamae rather large, dirty white with rather thick dark fringe; halteres very small, bright yellow.

Described from a single perfect ♂, Singla, April, 1913

N.B.—This species has every appearance of a large *Calliphora*. There can be little doubt of it belonging here. The head, thorax and abdomen are closely applied to one another, answering to Walker's expression "body subfusiform"; his "wings acute" is another point of resemblance, and the purplish-blue colour of the only species previously known, *chalcopyga*, W., is a final similarity.

***Ceria javana*, W.**

Four ♀ ♀, Darjiling, 1000–3000 ft.

***Ceria trinotata*, Meij**

A good series of both sexes in inferior condition from Darjiling, 1000–3000 ft., and Singla.

***Ceria triangulifera*, mihi, sp. nov. (Pl. xiv, fig. 10).**

♂ ♀ Darjiling, 1000–3000 ft.

Long. 12–13 mm.

Head.—Eyes in ♂ contiguous for a very short space only, ocellar prominence occupying the whole of the vertical surface; a little gold hair immediately above the point of junction of the eyes. Frons wholly black, remainder of front part of head down to the mouth opening rather bright lemon-yellow. A large semicircular black spot (convex side uppermost) embracing the antennal prominence, joined to the upper black part of the frons by a somewhat narrow black stripe, and also joined by a black stripe below the antennae to an irregular elongate-triangular spot on the face (apex downwards), with rounded angles and incurved on the two sides. The lowest part of this triangle does not quite reach the mouth opening. Cheeks lemon-yellow with a broad black stripe from lower corner of eye to lower corner of cheek. Mouth parts blackish. Antennal prominence ferruginous brown; basal half of 1st joint, apical half of 2nd and the 3rd joint black, the three joints forming an elongated club. A broad, bright yellow band behind the vertex and upper part of hind margin of eyes. Occiput black, yellowish towards sides.

Thorax dull black with just perceptible black pubescence and lemon-yellow more or less oval spots placed as follows: on humeral calli, at each end of transverse suture, on mesopleurae and one placed transversely on the sternopleurae. There is also a faint yellow line extending indistinctly along the suture. Scutellum yellow, with a basal, rather small, black, semicircular spot; metanotum black.

Abdomen black; 2nd segment often with a narrow dull reddish-brown tinge at base and tip. A large yellow spot at sides of 1st

segment, and the hind margins of 2nd, 3rd and 4th segments yellow; a little yellow tomentum on hind part of 4th segment.

Legs.—Coxae black; femora lemon-yellow, anterior pairs a little brown on apical half, and with a black irregular streak on underside; hind pair lemon-yellow on basal half, brownish-yellow on apical half, with an intermediate black band, which is considerably wider on the underside. Tibiae brownish-yellow, a little darker towards tips, hind pair moderately curved. Tarsi light brown.

Wings grey, anterior part as far as spurious vein on basal half, and as far as 3rd vein on apical half, rather dark brown. Halteres yellow.

Described from one ♂ and several ♀ ♀, Darjiling District, 1000–3000 ft., May, 1912.

N.B.—Three other species of *Ceria* are present, all apparently undescribed. The first is near *fruhstorferi*, represented by a good series of both sexes from Darjiling District and Singla; of the second three specimens (♂ ♀) from Singla are present; of the third, which is near *apicata*, four specimens (♂ ♀) are present from Singla.

CONOPIDAE.

***Physocephala quadrata*, mihi, sp. nov.** (Pl. xiv, fig. 5).

♂ ♀ Darjiling.

Long. $7\frac{1}{2}$ –9 mm.

Head yellow or brownish-yellow. Frons just over one-third the width of the head, barely wider on its upper part, dull yellow, more or less irregularly infuscated with black, sometimes nearly wholly black. Mouth opening more or less blackish, proboscis black, twice as long as the head. Antennal 1st joint reddish-brown, 2nd black above, reddish-brown below, brighter on apical fourth, the colour at the tip often encroaching on upper side also; 3rd joint black above, reddish-brown at least on basal part of underside. In some examples the whole tip of the 2nd and base of the 3rd are reddish-brown above as well as below. Occiput blackish, more or less black infuscated here and there.

Thorax wholly brownish-yellow; a quadrate dull black spot nearly filling the dorsum, but not attaining the margin, although connected with the anterior margin by a short broad black stripe. Scutellum and metanotum probably reddish-brown normally, the latter with a little gold tomentum at the actual sides. Sternopleurae and mesopleurae with a little silvery-white shimmer.

Abdomen brownish-yellow or reddish-yellow; 1st joint black, 2nd with a black streak on dorsum at base, 3rd with about the middle third or more black, 4th, 5th and 6th with more than basal half black, a broad band of bright gold tomentum on hind margin of 3rd and 4th segments; apical half of 5th and about the same of the 6th in ♂ (and nearly whole of 6th in ♀) similarly dusted with gold tomentum, which is, however, less bright. The 5th segment is very short in the ♂ and the 6th considerably lengthened, although in the ♀ both are normally shaped.

Genitalia in ♂ large, ellipsoid in shape, reddish-brown, smooth, shining, with a small shining bare, black 2nd joint at tip, and the usual triangular hollow appendage below 5th segment. Genitalia in ♀ small, black. The degree of slenderness of the basal part of the abdomen is slightly though distinctly variable.

Legs brownish-yellow. Coxae black, hind pair with silvery-white dust; hind femora with a broad black ring situated so that the limb is broadly brownish-yellow at base and rather narrowly so at tip. All tibiae with a silvery-white shimmer, with a tinge of pale lemon-yellow on basal part; hind pair black towards tips on inner sides. Tarsi more or less blackish above; pubescence brownish-yellow.

Wings pale grey. Anterior part moderately dark blackish-brown from costa to 3rd longitudinal vein, the colour sharply demarcated, and extending distally to level with about the middle of the 1st posterior cell, but without any sharp demarcation. Costal cell often a little paler. Halteres yellow.

Described from several of both sexes from Singla

N.B.—These specimens have all been immersed in spirit and the finer points are therefore indefinite. The characters depicted, however, appear constant, except of course those stated to be variable. The species is probably bare on the head and thorax, though this is not certain; a limited amount of very short black pubescence on the abdomen. It must bear some resemblance to *P. testacea*, Macq., *calopa*, *tenella* and *nubeculosa*, Bigot.

Conops sp.

One ♀ from Darjiling, 1000–3000 ft., in too indifferent condition to identify.

MUSCIDAE.

Of the *Muscidae* most of the calyptrates are valueless from immersion in spirit, but they include several specimens of a large Tachinid, which has a general resemblance to the common European Muscinid *Mesembrina meridiana*, except that it has a dull reddish-brown abdomen; one or two *Sarcophagae*, a *Calliphora*, a *Rutelia* and some others.

Amongst the acalyptrata there is a *Calobata*, a Trypetid, an Ortalid and one or two others, all represented with one exception by single specimens, and in addition the two following species.

Xenaspis vespoides, Meij.

Five of this very large handsome species, agreeing very well with Meijere's description and figure, from Darjiling, 1000–3000 ft.

Loxoneura ornata, mihi, sp. nov. (Pl. xiv, fig. 1).

Darjiling, 1000–3000 ft.; Dehra Dun. Long. 10–11 mm.

Head.—Frons and face to lowermost point of head almost of uniform width, one-third of the head, but slightly narrowed just

below antennae. Frons rich brownish-orange, vertex with a little more yellowish tinge, both with minute black hairs; ocellar triangle exceedingly small, barely raised above the surface. Facial triangle quite prominent and flat, pale yellowish, blackish towards tip. A narrow tomentose stripe on inner side of eyes from vertex to lower corner of eye, gradually widening from top to bottom, but when viewed from behind the whole of the sides of the face appear uniformly yellowish; the space between this stripe and the facial triangle brownish-orange as the frons. Mouth border narrowly black. Proboscis large, completely filling mouth opening, much swollen at tip, side view triangular, yellowish, labella and palpi concolorous; former with a little yellow pubescence, latter two-jointed, about as long as the 3rd antennal joint, elongo-cylindrical, with a few hairs. Antennal 1st joint very short, 2nd distinctly longer than wide, both reddish-brown, with some small black bristles on upper side; 3rd joint ovate-conical with narrower rounded tip, bare, blackish, reddish-brown at base, arista rather long, basal, black, apical half plumose above and below.

Eyes oblong, twice as high as wide; occiput flush with vertex on upper half, much swollen posteriorly on lower half, almost equal in width to the eye; wholly brownish-yellow.

A single pair of post-vertical strong bristles towards corners of eyes, and a pair of oral vibrissae.

Thorax deep metallic indigo-blue, the surface studded with almost microscopic tubercles, from each of which two or three short stiff brownish-yellow hairs emerge. Sides of thorax and scutellum of a similar nature, latter with a row of several bristles on posterior margin. Humeral calli yellowish-brown, bare, a small similar dark brown callus bearing a single spine, at each end of the transverse suture.

Abdomen much curved downwards; shining metallic deep blue, studded with hair-bearing tubercles as the thorax. Belly mainly yellowish in centre. Genitalia deep blue, small, cylindrical, with a telescopic yellow interior piece.

Legs.—Fore coxae long, slender, smooth, shining, twice as long as posterior ones, the latter a little pubescent; fore femora with a row of 8 or 10 small spines on underside, extending nearly its entire length. Legs all blue-black, microscopically pubescent; pulvilli yellow.

Wings.—Ground colour pale grey; dark brown from anterior border to 5th longitudinal vein, and distally from base to the upturned section of the 5th vein, the colour thence rather sharply delimited in an oblique line to the anterior margin; the costa broadly brown to the tip, but sometimes this apical section of the brown colour is cut off from the remainder by a very narrow clear space. Beyond the middle of the wing a large semicircular spot on costa, extending nearly as far backwards as the 4th longitudinal vein, and more yellowish in front. Halteres blackish.

Described from a single specimen in good condition amongst Lord Carmichael's Diptera from Ghumti, 4000 ft., August, 1912,

and also from four other specimens of the species in the Indian Museum from Sikkim and Dehra Dun. One of these bears a label with the present name in Bigot's handwriting, and as it is in all probability a *nomen nudum* it is allowed to stand.

HIPPOBOSCIDAE.

Hippobosca capensis, Olfers.

Five specimens from Singla.

ADDENDUM.

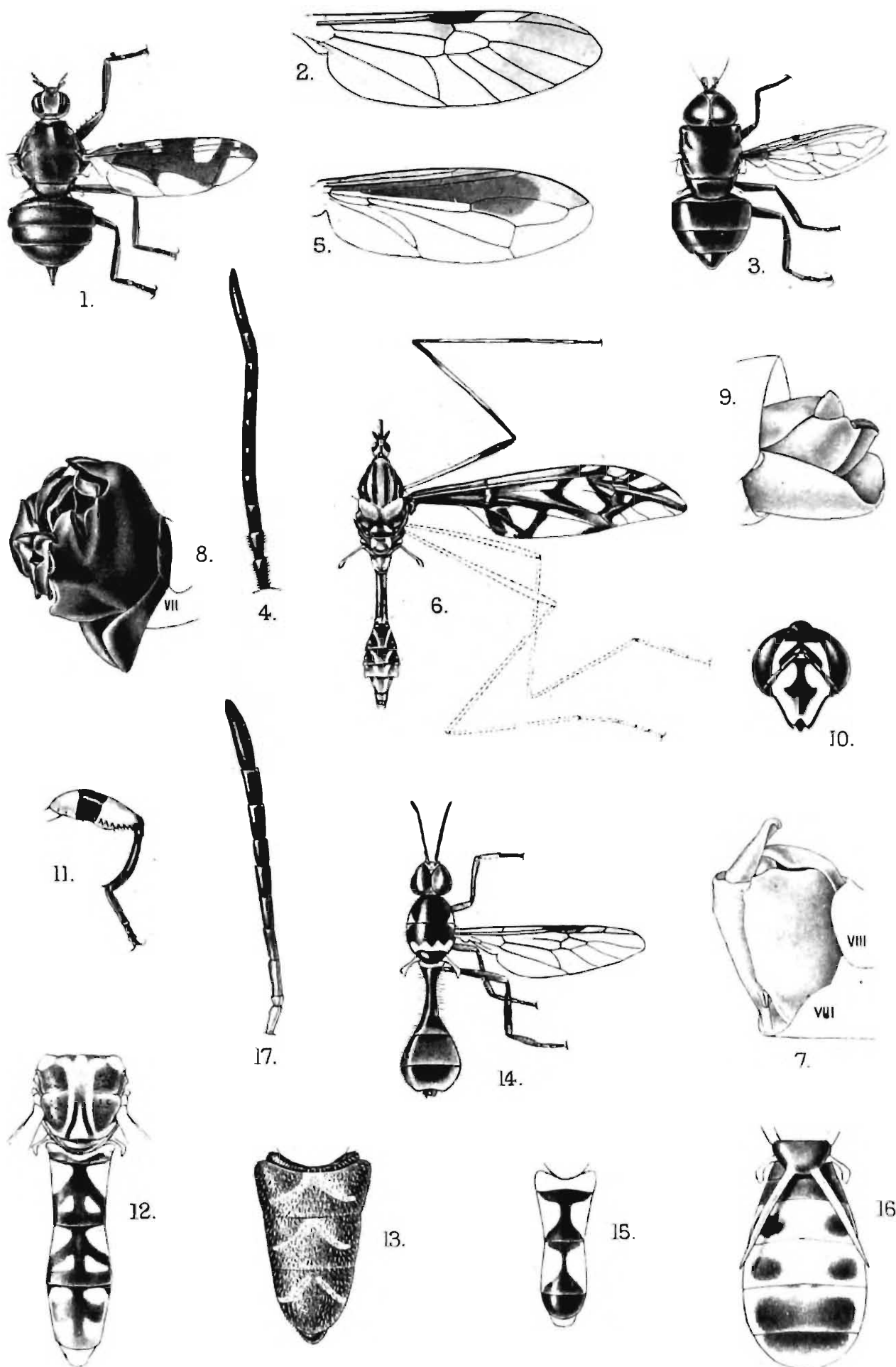
Axona cyanea, ♀

Since describing the ♂, a ♀ has been found amongst the same Diptera, from Darjiling District, June, 1913. It is similar to the ♂, the frons being one-fourth the width of the head, barely wider at level of antennae; face moderately projecting with two equal-sized bumps, not extending beyond the antennal protuberance; both frons and face being shining violet-blue.



EXPLANATION OF PLATE XIV

- FIG. 1.—*Loxoneura ornata*, Brun., sp. nov., full insect.
- ,, 2.—*Ampsalis longispinus*, Brun., sp. nov., wing.
- ,, 3.—*Axona cyanea* ,, ,, full insect.
- ,, 4.—*Ampsalis longispinus* ,, ,, antenna.
- ,, 5.—*Physocephala quadrata* ,, ,, wing.
- ,, 6.—*Tipula carmichaeli* ,, ,, full insect.
- ,, 7.—*Tipula flava*, Brun., genitalia.
- ,, 8.—*Pselliophora gaudens*, Walk., genitalia.
- ,, 9.—*Tipula carmichaeli*, Brun., sp. nov., genitalia.
- ,, 10.—*Ceria triangulifera* ,, ,, head.
- ,, 11.—*Xylota annulata* ,, ,, hind leg.
- ,, 12.—*Milesia ferruginosa* ,, ,, thorax and abdomen.
- ,, 13.—*Eumerus rufoscutellatus*, Brun., sp. nov., abdomen.
- ,, 14.—*Stratiosphecomyia variegata* ,, ,, full insect.
- ,, 15.—*Xylota annulata* ,, ,, abdomen.
- ,, 16.—*Ampsalis longispinus* ,, ,, scutellum and
abdomen.
- ,, 17.—*Stratiosphecomyia variegata* ,, ,, antenna.



D. Bagchi, del.

Bemrose, Colla, Derby.

XIX. ON SOME INDIAN CESTODA

PART I.

By T. SOUTHWELL, A.R.C.S. (Lond.), F.L.S., F.Z.S.,
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The present paper on the Cestoda of British India is the first of a series which the writer proposes preparing, as opportunity permits.

Up to a very short time ago the number of species of Cestoda in the collection of the Indian Museum did not exceed twenty. These are all included in the present paper, together with much fresh material.

It is proposed in the second paper of this series to deal with Cestoda from birds, of which about 50 species have been collected up to date, and in the third with Cestoda from fish, of which we have at present about 70 species.

For the characters of the order Pseudophyllidea and the subfamily Dibothriocephalinae I am indebted to Stiles (1906).

The characters of the families Mesocestoides, Anoplocephalidae, Davaineidae, Hymenolepididae and Taenidae, with their subfamilies and genera, are those given by Ransom (1909), whilst the characters of the genera *Rhynchobothrium*, *Tetrarhynchus*, *Otobothrium*, and *Syndesmobothrium* are after Linton (1887).

Order PSEUDOPHYLLIDEA, Carus, 1863.

= BOTHRIOCEPHALOIDEA, Braun, 1903.

General diagnosis:—Cestoda. Scolex armed or unarmed, with two groove-like suckers, situated dorsally and ventrally; they are usually not highly developed, but in some cases are considerably modified by development of their walls, or by more or less coalescence of their margins; or they may unite to form a single apical sucker, or may become rudimentary, their function being performed by an unpaired apical sucker. In some cases a pseudo-scolex may form. External segmentation present or absent. Neck present or absent. Three genital pores present; uterine pore is always on one of the surfaces; the vaginal and cirrus pores may be on the same surface as the uterine, or on the opposite surface, or marginal. Genital organs usually single, rarely double. Their development progresses from anterior end, posteriorly, but does not

pass from the mature stage into an atrophying stage. Testicles numerous, situated in two more or less separated lateral fields in the medullary layer; vas deferens always highly developed, usually forming a coil. Ovary distinctly or indistinctly bipartite, situated in distal portion of segment, usually median in forms with single series of genitalia; in forms with double series, sub-median; in forms with lateral pores, on side of median line toward the pore.

“Schluckorgan” always present. Vitelline glands with numerous follicles, situated in two more or less separated lateral fields nearly always dorsal and ventral, and usually in cortical layers. Eggs quite similar to those of *Fasciola*, but not always with operculum.

Family BOTHRIOCEPHALIDÆ, Cobbold, 1864.

= DIBOTHRIOCEPHALINÆ, Lühe, 1899.

With the characters of the order.

Sub-family (I) *LIGULINÆ*, Mont. & Crety, 1891.

General characters:—Scolex armed, short and three-cornered. Suckers small and feeble. Neck absent. External segmentation present or absent. Genitalia simple. Genital pores situated ventrally, posteriorly, or close together, approximately median. Testes dorsal. Ovary median and ventral. Shell gland median and dorsal. Vitelline glands lateral. Vas deferens dorsal, strongly coiled, and lying in front of the opening of the cirrus pouch, which latter is continuous with the vesicula seminalis which is always present. Eggs covered. Adults in water-birds. Larvae in coelom of Teleosts.

Genus *Ligula*, Bloch, 1782.

General characters:—Adult form only, segmented anteriorly. These segments, however, do not coincide with the inner segmentation of the genitalia. Suckers feebly developed. Larvae without suckers and unsegmented. Larvae in coelom of Cyprinoids. Adults in water-birds.

Ligula simplicissima, Rudolphi, 1802.

Several specimens:—

Z E V $\frac{4686}{7}$ -7. No history.

Z E V $\frac{5147}{7}$. *Labeo rohita*. Berhampur, Bengal. T. Southwell.

Z E V $\frac{2382}{7}$. *Labeo rohita*. Calcutta. ?

Z E V $\frac{4698}{7}$. *Nemachilus rupicola*. Kurseong, E. Himalayas. F. H. Gravely.

Another specimen has lately been obtained by the writer from *Rasbora daniconius* from Sambalpur, Behar, June, 1913.

Synonymy:—

- Ligula intestinalis*, Gmel., 1790.
- „ *abdominalis* (Goeze, 1782), Gmel., 1790.
- „ *avium*, Bloch, 1782.
- „ *piscium*, Bloch, 1782.
- „ *monogramma*, Creplin, 1839.
- „ *diagramma*, Creplin, 1839.
- „ *uniserialis*, Rudolphi, 1810.

Literature:—

Donnadieu, 1877. Zschokke, 1884.

Sub-family (II) *DIBOTHRIOCEPHALINAE*, Lühe, 1899.

Sub-family diagnosis:—Scolex unarmed; suckers either two small grooves (one dorsal and one ventral), or two funnel-shaped organs with highly developed borders, or, by coalescence of their borders changed to sucker-tubes, or rudimentary, and then replaced by an apical sucker. Neck present or absent. External segmentation complete. Genital organs single or double. Genital pores ventral, median or sub-median; cirrus, vagina and uterine pores in a longitudinal row, in order named; genital atrium, into which cirrus and vagina open, is provided with numerous papillae. Ovary ventral and shell gland dorsal, always median in forms with single sets of pores. Vitelline follicles always in cortical layer. Vas deferens very sinuous, running dorsally, and changing to a globular, or pyriform vesicula seminalis before opening into the cirrus pouch. Testicles in the medullary layer, for the greater part outside of the longitudinal bands. The vagina, extending ventrally, crosses the uterus near its pore, and widens to a receptaculum seminalis (the limits of which are not distinctly defined distally, but distinctly defined proximally) opposite the narrow and short seminal canal which unites with the oviduct to form the fertilization canal. Uterus often forms a "rosette." Eggs with operculum. Larval stages, for most species, unknown; adults in intestine of mammals, birds and reptiles.

(1) Genus *Duthiersia*, Perrier, 1873.

General characters:—The characteristic form of the head (three-cornered with the base anterior) is occasioned by the strongly curved funnel-shaped sucking organs. These are not perforated posteriorly as figures generally show, but are blind.¹ Neck absent. Yolk glands situated superficially. A sphincter vagina is present. Loops of the uterus not numerous, and on this account the rosette is seldom obvious. In *Varanus* spp.

Type-species *Duthiersia fimbriata* (Diesing, 1850) Mont. and Crety, 1891.

¹ See, however, Shipley, 1903. The perforations are quite distinct in our specimens.

Duthiersia fimbriata (Diesing, 1850), Mont. and Crety, 1891.

Four specimens:—

Z E V $\frac{3664}{7}$. *Varanus exacanthematicus*. Katagum, N. Nigeria. Dr. J. H. Ashworth.

(Two specimens, presented by Dr. Ashworth.)

Z E V $\frac{5506}{7}$. *Varanus* sp. Berhampur, Bengal. Major Clayton Lane, I.M.S.

Synonymy:—

Solenophorous fimbriatus, Diesing, 1854?.*Duthiersia expansa*, Perrier, 1873.*Duthiersia elegans*, Perrier, 1873.

Literature:—

Lühe, 1899. Perrier, 1873. Montecelli and Crety, 1891.

The head-folds in our specimens had become so contorted during preservation that the identification was somewhat difficult. A similar contortion is figured by Shipley (1903).

(2) Genus **Bothridium**, Blainville, 1824.

General characters:—Scolex with two muscular sucking tubes, bearing openings at their anterior and posterior ends, which have been developed from bothridia by the growth of their free edges. In their walls there is a sphincter for each opening. Neck short. The yolk glands lie chiefly between the inner and outer longitudinal muscles. Uterus does not form a "rosette," but consists of two large cavities, connected with a delicate passage.

Bothridium pithonis, Blainville, 1824.

Several hundred specimens.

Z E V $\frac{4667-8}{7}$. *Python reticularis*. Goalundo, E. Bengal. Purchased.Z E V $\frac{2772}{7}$. *Felis tigris*. Onchagaon, Naini Tal, U. P. R. Hodgart, Museum Collector.

(It appears certain that this tiger had been feeding on a python.)

Z E V $\frac{4681}{7}$. *Python molurus*. Nepal Terai. B. Warren.

Synonymy:—

Botrynocephalus pithonis (Retzius, 1830), Nordm, 1840.*Prodicoclia ditrema*, Leblond, 1836.*Solenophorus megaloccephalus*, Creplin, 1839.

Literature:—

Blainville, 1828.

Sub-family (III) **PTYCHOBOTHRIINAE**, Lühe, 1899.

General characters:—Scolex unarmed with two flattish suckers, which may, however, possess accessory suckers, or may be modified by a proliferation of their edges. Neck absent. All the genital openings lie on the surfaces of the segments. The cirrus

and the vagina open dorsally, uterus ventrally. The latter is coiled and runs dorsally. A vesicula seminalis, situated outside the cirrus-sac, is absent. The vagina crosses the uterus, and in this way reaches the ventral surface. A separate receptaculum seminalis is usually absent. Ovary ventral, and, in the case of single genital organs, always median. Shell gland median and dorsal. Yolk glands lateral, or even on the edges. Testes lateral, a large part of them lie external to the longitudinal nerves, which latter are situated much further inwards. The uterus never forms a "rosette." Genitalia often double. Eggs thin-shelled and without cover. In fish.

(1) Genus **Bothriocephalus**, Rudolphi, 1808.

General characters:—Scolex long. Suckers weakly developed. Neck wanting. Segments incomplete. Yolk glands in skin layer. Ovary median, ventral. No receptaculum seminalis. Mouth of uterus ventral and median, both other openings dorsal and median.

Bothriocephalus (Anchistrocephalus) polyptera (Leyd),
1853.

Two slide specimens only.

Z E V ⁵¹⁹⁸/₇. *Labeo rohita* and *Ophiocephalus striatus*. Berhampur, Bengal. T. Southwell.

Literature:—

Lühe, 1899. Southwell, 1913.

Family MESOCESTOIDIDAE, Fuhrmann, 1907.

= MESOCESTOIDINAE, Lühe, 1894.

= MESOCESTOIDAE, Ariola, 1899.

Family diagnosis:—Taenioidea. Scolex without rostellum or hooks. Suckers unarmed. A single set of reproductive organs in each segment. Genital pores located in the ventral surface of the segment. Vagina opens in front of, or besides, the cirrus pouch. Eggs in gravid segments enclosed in a single thick-walled egg capsule. Adults in mammals and birds.

Type-genus *Mesocestoides*, Vaillant, 1863.

(1) Genus **Mesocestoides**, Vaillant, 1853.

= *Monodoridaum*, Walter, 1866 (type *Taenia utriculifera*, Walter, 1866).

= *Ptychophysa*, Hamann, 1885 (type *Taenia canis-lagopodis*, Rudolphi, 1810).

Generic diagnosis:—Mesocestoididae, with the characters of the family. Adults in mammals and birds.

Type-species *Mesocestoides ambiguus*, Vaillant, 1863.

Mesocestoides lineatus (Goeze, 1782), Railliet, 1893.

One specimen, without head, probably from the Zoological Gardens, Calcutta.

Z E V $\frac{1683}{7}$. *Felis tigris*. ? ?.

Synonymy:—

Taenia canis-lagopodis, Rudolphi, 1810.

„ *pseudo-cucumerina*, Baillet, 1863.

„ *pseudo-elliptica*, Baillet, 1863.

Ptychophysa lineata (Goeze, 1782), Hamann, 1885.

Literature:—

Ransom, 1909. Lühe, 1894. Ariola, 1899. Fuhrmann, 1907. Walter, 1866. Hamann, 1885.

Family ANOPLOCEPHALIDAE, Fuhrmann, 1907.

Family diagnosis:—Taenioidea. Scolex unarmed, without rostellum. Suckers relatively large, unarmed. Neck absent. Segments usually broader than long. A single or double set of reproductive organs in each segment. Genital pores marginal and bilateral, unilateral, or irregularly alternate or (?) absent. Testicles numerous or rarely (*Triplotaenia*) one in each lateral half of the segment. Median axis of female glands lateral of the median axis of segment. Uterus persistent, and transversely elongated, either tubular, sac-like, branched or reticular; or not persistent replaced by egg capsules whose formation may, or may not, be preceded by the appearance of para-uterine organs. Eggs with thin transparent shells, with or without a pyriform apparatus. Adults in mammals and birds.

Sub-family (I) ANOPLOCEPHALINAE, Blanchard, 1891.

Sub-family diagnosis:—Anoplocephalidae. Uterus persistent and tubular, sac-like, branched or reticular. Adults in mammals and birds.

Type-genus *Anoplocephala*, E. Blanchard, 1848.

Genus Anoplocephala, E. Blanchard, 1848.

= *Plagiotaenia*, Peters, 1871 (type *Taenia gigantea*, Peters, 1857).

Generic diagnosis:—Anoplocephalinae. Segments usually much broader than long, occasionally longer than broad. A single set of reproductive organs in each segment. Genital pores unilateral, or irregularly alternate. Genital canals pass on the dorsal side of the longitudinal excretory vessels and nerve. Testicles and female glands in the median field; female glands toward the pore side of the segment, testicles toward the opposite side. Uterus a transversely elongated sac with pocket-like appendages, anteriorly and posteriorly. Eggs with well-developed pyriform apparatus. Adults in mammals.

Type-species *Anoplocephala perfoliata* (Goeze, 1782), E. Blanchard, 1848.

(1) *Anoplocephala plicata* (Zed., 1800), R. Blanchard, 1891.

One specimen:—

Z E V $\frac{467.0}{7}$. Horse (*Equus caballus*). Lahore. Punjab Civil Veterinary Department.

Synonymy:—

Taenia plicata (Zed., 1800), Rudolphi, 1805.

„ *equina*, Pallas, 1781.

„ *magna*, Abeldg. in Mueller, 1789.

Alyselminthus plicatus, Zeder, 1800.

Literature:—

Rudolphi, 1810. Neumann, 1892.

(2) *Anoplocephala gigantea* (Peters, 1856), R. Blanchard, 1891.

Five specimens:—

Z E V $\frac{467.0}{7}$. *Rhinoceros unicornis*. Janakpur, Nepal Terai. Museum Collector, R. Hodgart.

Synonymy:—

Taenia gigantea, Peters, 1857.

Plagiotaenia gigantea, Peters, 1871.

Literature:—

Peters, 1857 and 1871.

Sub-family (II) *THYSANOSOMINAE*, Fuhrmann, 1907.

Sub-family diagnosis:—Anoplocephalidae. Uterus transversely elongated, consisting of several or numerous communicating sacs, with parenchymatous para-uterine organs, into which the eggs probably pass in the oldest segments. Adults in mammals.

Type-genus *Thysanosoma*, Diesing, 1835.

(1) Genus *Thysanosoma*, Diesing, 1835.

Generic diagnosis:—Thysanosominae. Segments much broader than long, end segments only showing a tendency to become longer and narrower. A double set of reproductive organs, but only a single uterus in each segment, with opposite, or with irregularly alternating pores, those of one side, with the corresponding cirrus pouch, ovary, and vagina having been suppressed. Genital canals pass between the longitudinal excretory vessels, and dorsal of the nerve. Uterus transverse, undulating, composed of numerous ascon-like pouches, each supplied with a para-uterine organ. Horns of pyriform apparatus absent. Adults in mammals (ruminants).

Type-species *Thysanosoma actinioides*, Diesing, 1835.

Thysanosoma actinioides, Diesing, 1835.

Two specimens:—

Z E V $\frac{4680}{7}$. *Rhinoceros sondiacus*. ? ?

Synonymy:—

Taenia fimbriata, Diesing, 1850.

Literature:—

Curtice, 1890.

(2) Genus **Cittotaenia**, Riehm, 1881.= *Ctenotaenia*, Railliet, 1893 (type *Taenia marmotae*, Frolich, 1802).= *Coelodela*, Shipley, 1900 (type *Coelodela kuvavia*, Shipley, 1900). (See also Fuhrmann, 1902).

Generic diagnosis :—Anoplocephalinae. Segments broader than long. Two sets of reproductive organs in each segment. Genital pores bilateral. Genital canals pass dorsal of longitudinal excretory vessels and nerves. Interproglottidal glands absent. Vagina ventral of cirrus pouch on both sides of segment. Uterus single or double (one on each side of median line), transversely elongated, tubular generally, with simple anterior and posterior outpocketings. Eggs with well-developed pyriform apparatus, the horns of which are long, crossing each other, or in some cases without this apparatus (see Fuhrmann, 1902, p. 142). Adults in mammals and birds.

Type-species *Cittotaenia latissima*, Riehm, 1881 = *Cittotaenia denticulata* (Rudolphi, 1804), Stiles and Hassall, 1896.

(i) **Cittotaenia bursaria**, Linstow, 1906.

Several specimens:—

Z E V $\frac{2171}{7}$. *Lepus ruficaudatus*. Songara, Gondar Dist., U.P. Museum Collector, R. Hodgart.

Literature:—

Linstow, 1906.

(ii) **Cittotaenia pectinata** (Goeze, 1782, *partim*, Riehm, 1881), Stiles and Hassall, 1896.

Several specimens:—

Z E V $\frac{5510}{7}$. Hare (*Lepus ? hispidus*). Berhampur, Bengal. Major Clayton Lane, I.M.S.

Literature:—

Goeze, 1782. Riehm, 1881. Stiles and Hassall, 1896.

Family HYMENOLEPIDIDAE, Railliet and Henry, 1909.

= HYMENOLEPIDAE, Ariola, 1899 (type-genus *Hymenolepsis*).= ECHINOCOTYLIDAE, Ariola, 1899 (type-genus *Echinocotyle*).= DILEPINIDAE, Fuhrmann, 1907 (type-genus *Dilepis*).

Family diagnosis:—Taenioidea. Scolex with an armed rostellum, or without rostellum. Hooks on rostellum not hammer shaped. Suckers usually unarmed. A single, or rarely a double set of reproductive organs in each segment. Genital pores marginal and bilateral, unilateral, or regularly or irregularly alternate. Egg with thin transparent shell. Adults in birds, mammals, reptiles and amphibia.

Type-genus *Hymenolepis*, Weinland, 1858.

Sub-family (I) *DIPYLIDIINAE*, Stiles, 1896.

- =Rhynchotaenia, Diesing, 1850.
- =Malacolepidota, Weinland, 1858.
- =Cystoideae, Leuckart, 1863.
- =Cystoidotaeniae, Railliet, 1886.
- =Microtaenia, Claus, 1891.
- =Dipylidinae, Railliet, 1896.
- =Dilepininae, Fuhrmann, 1907.
- =Dilepidinae, Railliet and Henry, 1909.

Sub-family diagnosis:—Hymenolepididae. Rostellum armed or rarely absent. Suckers unarmed. A single set, or rarely a double set of reproductive organs in each segment. Uterus sac-like, simple or lobulated, or not persistent, breaking down into numerous egg capsules, each containing one or several eggs. Para-uterine organs not developed. Adults in birds, mammals and reptiles.

Type-genus *Dipylidium*, Leuckart, 1863.

Genus *Dipylidium*, Leuckart, 1863.

Generic diagnosis:—Dipylidiinae. Rostellum armed with several rings of rose-thorn hooklets, which usually have a discoidal base. Suckers unarmed. Gravid segments generally longer than broad. A double set of reproductive organs in each segment. Genital pores double and opposite. Testicles very numerous and scattered throughout entire medullary parenchyma. Vas deferens coiled, seminal vesicle absent. Uterus at first reticular, later breaking up into egg capsules, each containing one or more eggs. Eggs with two shells. Adults in mammals and birds.

Type-species *Dipylidium caninum* (Linn.), 1758.

Dipylidium caninum (Linn., 1758).

Numerous specimens:—

- | | | | |
|-----------------------------|----------------------------------|------------------|-------------------------------------|
| Z E V $\frac{5.5.0.5}{7}$. | Dog (<i>Canis familiaris</i>) | ? | ? |
| Z E V $\frac{5.5.0.7}{7}$. | Dog (<i>Canis familiaris</i>). | Colombo, Ceylon. | T. Southwell. |
| Z E V $\frac{2.9.7.9}{7}$. | Cat (<i>Felis domestica</i>). | Egypt. | London School of Tropical Medicine. |
| Z E V $\frac{4.9.7.5}{7}$. | Dog (<i>Canis familiaris</i>). | Lahore, Punjab. | Punjab Civil Veterinary Department. |

Synonymy :—

Alyselminthus ellypticus (Batsch, 1786), Zeder, 1800.

Cryptocystis trichodectis, Villot, 1882.

Halysis ellyptica (Batsch, 1786), Zed., 1803.

Taenia canina, Linn., 1758.

„ *cateniformis*, Goeze, 1782.

„ *cateniformis-canina* (Linn., 1758), Gmel., 1790.

„ *ccteniformis-felis*, Gmel., 1790.

„ *cucumerina*, Bloch, 1782.

„ *elliptica*, Goeze, 1782.

„ *moniliformis*, Pallas, ? 1781.

Literature :—

Linnaeus, 1758. Neumann, 1892.

Sub-family (II) *PARUTERININAE*, Ransom, 1909.

= Paruterinae, Fuhrmann, 1907.

Sub-family diagnosis:—Hymenolepididae. Scolex usually armed, rarely without rostellum. A single (double in *Stilesia*, provisionally placed by Ransom in this sub-family) set of reproductive organs in each segment. Uterus simple or double, with a single para-uterine organ, or multiple with several para-uterine organs, into which the eggs pass in the final stage of development of the segment. Adults in birds and amphibia (*Stilesia* in mammals).

Type-genus *Paruterina*, Fuhrmann, 1906.

Genus *Stilesia*, Railliet, 1893

Generic diagnosis:—(?) Paruterininae. Head unarmed, without rostellum. Neck present. Segments broader than long. A double set of reproductive organs in each segment, with opposite pore, or with irregularly alternating pore, those on one side with the corresponding cirrus pouch, vagina and ovary having been suppressed, both of which conditions may occur in the same stobila. Genital canals pass between the longitudinal excretory vessels and dorsal of the nerve. Dorsal excretory vessel a considerable distance mediad from the ventral vessel. Testicles relatively few (six to twelve in each set), in the lateral portions of the segment in the neighbourhood of the longitudinal excretory vessel. Ovary small, globose, between the dorsal and ventral excretory vessel on pore side of segment. Yolk glands not apparent. Uterus small, spherical, sac-like, one in each lateral half of the segment between the dorsal and ventral excretory vessels. When the ovary is absent from one side eggs from the opposite side of the segment appear to pass across through the median field, in a manner not understood, and enter the uterus of the side in which the ovary is lacking. Immediately anterior and mediad of each uterus, a para-uterine organ develops, into which the eggs probably pass. Eggs with two envelopes. Adults in mammals (ruminants).

Type-species *Stilesia globipunctata* (Rivolta, 1874), Railliet, 1893.

Stilesia globipunctata (Rivolta, 1874), Railliet, 1893.

A few specimens :—

Z E V $\frac{5511}{7}$. Goat (*Capra hircus*). Kasauli. Major Clayton Lane, I.M.S.

Z E V $\frac{4673}{7}$. Sheep (*Ovis aries*). Lahore, Punjab. Punjab Civil Veterinary Department.

Synonymy :—

Taenia globipunctata, Rivolta, 1874.

Literature :—

Curtice, 1890.

Family DAVAINIIDAE, Fuhrmann, 1907.

Family diagnosis :—Taenioidea. Scolex with simple rostellum, armed with double row (rarely a simple row) of very numerous (and generally very small) hammer-shaped hooks. Suckers armed, or, rarely unarmed. A single or double set of reproductive organs in each segment. Genital pores marginal, and bilateral, unilateral, or alternating. Uterus sac-like, persisting, or sac-like or branched not persistent, replaced either by numerous egg capsules, or by a single egg capsule, whose formation is preceded by the appearance of a para-uterine organ. Egg with thin transparent shell. Adults in mammals and birds.

Type-genus *Davainea*, Blanchard and Railliet, 1891.

Sub-family OPHRYOCOTYLINAE, Fuhrmann, 1907.

Sub-family diagnosis :—Davaineidae.* Rostellum very broad, armed with a double row of hooks on the border. Surface of suckers armed only near the anterior border. A single set of reproductive organs in each segment. Genital pores irregularly alternate. Uterus sac-like, slightly bilobed, persistent. Adults in birds.

Type-genus *Ophryocotyle*, Friis, 1870.

Genus *Ophryocotyle*, Friis, 1870.

Generic diagnosis :—Ophryocotylinae, with the characters of the sub-family.

Type-species *Ophryocotyle proteus*, Friis, 1870.

Ophryocotyle bengalensis, Southwell, 1913.

About 60 specimens :—

Z E V $\frac{5162}{7}$. *Labeo rohita* and *Ophiocephalus striatus*. Berhampur, Bengal ... T. Southwell.
(TYPES).

Z E V $\frac{5169}{7}$. *Wallago attu*. Berhampur, Bengal ... T. Southwell.

Literature:—

Southwell, 1913. See also Friis, 1870. Fuhrmann, 1908. Fuhrmann, 1909.

The occurrence of a species of *Ophryocotyle* in a fish is remarkable, as this genus has, up to the present, only been recorded from birds. The species is placed provisionally in this genus pending a more careful anatomical examination than has been found possible up to the present.

Family TAENIIDAE, Ludwig, 1886.

Family diagnosis:—Taenioidea. Scolex usually with well-developed rostellum, armed with a double crown of hooks, rarely with rudimentary unarmed rostellum. Suckers unarmed. Gravid segments longer than broad. A single set of reproductive organs in each segment. Genital pores irregularly alternate. Vas deferens coiled. Seminal vesicle absent. Testicles numerous, usually very numerous, and scattered throughout the medullary parenchyma, except in the posterior median portion, occupied by the double ovary, posterior of which is the double yolk gland. Uterus with median stem, and, when fully developed, with lateral branches. Eggs with a thin outer membrane, and a thick brown radially-striated inner shell. Adults in mammals and birds.

Type-genus *Taenia*, Linnaeus, 1758.

Genus *Taenia*, Linnaeus, 1758.

Generic diagnosis:—Taeniidae, with the characters of the family. Adult in mammals and birds.

Type-species *Taenia solium*, Linnaeus, 1758.

(i) *Taenia saginata* (Goeze, 1782), Leuck., 1867.

Two specimens:—

Z E V $\frac{11.80}{7}$.	Man.	Calcutta.	Major L. Rogers, I.M.S.
Z E V $\frac{46.90}{7}$.	Man.	Calcutta.	?

Synonymy:—

Taenia solium var. *mediocanellata*, Kuech., 1854.

„ *dentata*, Batsch, 1786.

„ *tropica* (Schmidtmueller, 1847), Moq.-Tandon, 1860.

„ *mediocanellata*, Kuechenmeister, 1852.

„ *cucurbitina*, Pallas, 1766.

„ *inermis*, Laboulbène, 1876.

„ *lata*, Moq.-Tandon, 1860.

Literature:—

Goeze, 1782. Leuckart (Hoyle's translation), 1886.

(ii) *Taenia solium*, Linnaeus, 1758.

One specimen, fragmented.

Z E V $\frac{46.88}{7}$.	Man.	Calcutta.	?
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Synonymy:—

- Taenia cucurbitina*, Pallas, 1766.
 „ „ *plana pellucida*, Goeze, 1782.
 „ *dentata*, Batsch, 1786.
 „ *vulgaris*, Linnaeus, 1758.
 „ *humana armata*, Rudolphi, 1810 ?.
Halysis solium (Linn., 1758), Zeder, 1803.

Literature:—

Leuckart (Hoyle's translation), 1886.

(iii) *Taenia echinococcus*, Von Siebold, 1853.**One specimen:—**

Z E V $\frac{5509}{7}$. *Canis familiaris*. Berhampur, Bengal. Major Clayton Lane, I.M.S.

For synonymy see Stiles and Hassall, 1898.

Literature:—

Von Siebold, 1853.

(iv) *Taenia serialis* (Gerv., 1847), Baillet, 1863.**Numerous specimens:—**

Z E V $\frac{4671}{7}$. *Canis familiaris*. Lahore, Punjab. Civil Vety. Department.
 Z E V $\frac{5506}{7}$. *Canis familiaris*. Angul, Orissa. Vety. Asstt., Angul.

For synonymy see Stiles and Stevenson, 1905.

Literature:—

Baillet, 1863. Neumann (Fleming's translation), 1892.

(v) *Taenia serrata*, Goeze, 1782.**Several specimens:—**

Z E V $\frac{4669}{7}$. *Canis familiaris*. Lahore, Punjab. Civil Vety. Depart.
 Z E V $\frac{4682}{7}$. *Felis tigris*. Burduar, Nepal Terai. B. Warren.
 Z E V $\frac{4685}{7}$. *Canis aureus*. Museum compound, Calcutta.

For synonymy see Stiles and Stevenson, 1905.

Literature:—

Goeze, 1782. Neumann (Fleming's translation), 1892.

LARVAL FORMS OF THE GENUS *Taenia*, Linn.**(1) *Coenurus serialis*, Gervais, 1847.**

(Larval form of *Taenia serialis*, Baillet.)

One large specimen:—

Z E V $\frac{4676}{7}$. Goat (*Capra hircus*). Lahore, Punjab. Punjab Civil Veterinary Department.

Synonymy:—

- (a) Adult. *Taenia coenuri-canícula*, Diesing, 1864.
 (b) Larva. *Coenurus-cerebralis leporis-canícula*, Diesing, 1863.

Literature:—

Gervais, 1847.

(2) *Cysticercus tenuicollis*, Rudolphi, 1810.

(Larval form of *Taenia marginata*, Batsch.)

One very large specimen:—

Z E V $\frac{4674}{7}$. Sheep (*Ovis aries*). Lahore, Punjab. Punjab Civil Veterinary Department.

For synonymy see:—

Stiles and Stevenson, 1905.

Stiles and Hassall, 1912, except in the case of *Cysticercus cellulosae*.

Literature:—

Rudolphi, 1810. Neumann, 1892.

(3) *Cysticercus fasciolaris*, Rudolphi, 1808.

(Larval form of *Taenia crassicollis*, Rudolphi.)

About 10 specimens:—

Z E V $\frac{4367}{7}$. *Mus decumanus*. Calcutta?. Col. A. Alcock, I.M.S.

Z E V $\frac{4672}{7}$. *Mus rattus*. Lahore, Punjab. Punjab Civil Veterinary Department.

Z E V $\frac{4689}{7}$. No history.

For synonymy see:—

Stiles and Stevenson, 1905. Stiles and Hassall, 1912.

(4) *Cysticercus pisiformis*, Zeder, 1803.

(Larval form of *Taenia serrata* (Goeze)).

Very numerous specimens:—

Z E V $\frac{5146}{7}$. *Mus rattus*? Berhampur, Bengal. Major Clayton Lane, I.M.S.

Z E V $\frac{927}{7}$. *Mus rattus*? Calcutta. Major R. Milne, I.M.S.

Z E V $\frac{4677-8}{7}$. *Mus rattus* (liver). Amritsar, Punjab. Capt. G. I. Davys, I.M.S.

For synonymy see:—

Stiles and Stevenson, 1905. Stiles and Hassall, 1912.

Literature:—

Zeder, 1803. Neumann, 1892.

(5) *Cysticercus cellulosae* (Gmel., 1790), Rudolphi, 1808.

(Larval form of *Taenia solium*, Linn., 1758.)

Several specimens:—

Z E V $\frac{5927}{7}$. Human brain. Ceylon. Medical College, Colombo.

Z E V $\frac{5929}{7}$. *Bos taurus* (muscles). Ceylon. T Southwell.

Synonymy:—

- Cysticercus albopunctatus* (Treutler, 1793), Zed., 1803.
 „ *pyriformis*, (Treutler, 1793), Zed., 1803.
 „ *finna* (Gmel., 1790), Zed., 1803.
Finna humana, Fisher in Werner, 1786.
Hydalis finna (Gmel., 1790), Bosc, 1802.
Taenia albopunctata, Treutler, 1793.
 „ *cellulosae*, Gmel., 1790.
 „ *finna*, Gmel., 1790.
 „ *hydatigena-anomala*, Steinbuch, 1801.
 „ *hydatigena-suilla*, Fischer of Chiaje, 1825.
 „ *muscularis*, Joerdens, 1802.
 „ *pyriformis*, Rudolphi, 1810.
 ? *Vermes vesicularis*, Bloch, 1780.
Vesicaria finna (suilla), Schrank, 1793.
 „ *hygroma (humana)*, Schrank, 1793.
 „ *lobata*, Fabr., 1783.

Literature:—

Stiles, 1906.

The occurrence of *Cysticercus cellulosae* in the muscles of the cow is somewhat remarkable, and, as far as I have been able to ascertain, this is the first record for this host. My first impression was that these cysts were those of *C. bovis*, but subsequent examination showed that the head was armed.

(6) *Echinococcus granulosus* (Batsch, 1786), Rudolphi, 1805.

(Larval form of *Taenia echinococcus* (Zed., 1803), Siebold, 1853.)

One specimen:—

Z E V ⁵⁹²⁸₇. Lungs of *Bos taurus*. Colombo, Ceylon. T. Southwell.

For the synonymy, which is very extensive, see:—

Stiles and Hassall, 1905. Stiles, 1906.

Literature:—

Stiles, 1906.

Order **TRYPANORHYNCHA**, Dies., 1863.

General characters:—Head with two or four bothridia and with four retractile and armed proboscides. Segmentation complete. Segments detach themselves usually before fully ripe. Genital pores marginal or sub-marginal. Uterus opening? Genitalia as in the Tetraphyllidea. Larvae in various marine animals. Adults mostly in gut of Plagiostomes.

(I) Genus **Rhynchobothrium**, Rudolphi, 1819.

Tetrarhynchus of authors.

General characters:—Body taeniaeform. Neck tubular. Head continuous with neck, with two opposite bothridia, parallel or converging at the apices, lateral or marginal, entire or undivided, or, either bilocular with a longitudinal partition, or

bilobed or divided. Proboscides four, terminal, armed, retractile in the neck, for the most part longer than the head. Genital apertures, male marginal, female lateral, or male and female marginal, approximate.

I. *Rhynchobothrium* sp.

Numerous specimens :—

Z E V $\frac{5914}{7}$. *Cybius guttatum*. Puri, Orissa. T Southwell.

Literature :—

Southwell, 1912 and 1913.

II. *Rhynchobothrium* sp.

Numerous specimens :—

Z E V $\frac{5917}{7}$. *Serranus undulosus*. Pearl Banks, Ceylon. T. Southwell.

Literature :—

Southwell, 1912.

III. *Rhynchobothrium* sp. I.

Numerous specimens :—

Z E V $\frac{5915}{7}$. *Cybius guttatum* and *Chorinemus lysan*.
Pearl Banks, Ceylon ... T. Southwell.

Literature :—

Southwell, 1912 and 1913.

IV. *Rhynchobothrium* sp. II.

Numerous specimens :—

Z E V $\frac{5919}{7}$.	<i>Lutianus argentimaculatus</i> ,	} Pearl Banks, Ceylon.	T Southwell.
	<i>Drepane punctata</i> ,		
	<i>Diagramma</i> sp.		
	<i>Serranus undulosus</i> .		

Literature :—

Southwell, 1912.

V. *Rhynchobothrium* sp. III.

Numerous specimens :—

Z E V $\frac{5916}{7}$. *Balistes*, sp. Pearl Banks, Ceylon. T. Southwell.

Literature :—

Southwell, 1912.

VI. *Rhynchobothrium* spp. A, B, & C.

Few specimens :—

Z E V $\frac{5918}{7}$.	<i>Serranus undulosus</i> ,	} Pearl Banks, Ceylon.	T Southwell.
	<i>Lutianus gibbus</i> ,		
	<i>Psettodes erumei</i> .		

Literature:—

Southwell, 1912.

The above species appear to differ from those described by Shipley and Hornell (1906) from the same region, and from the same species of fish.

(II) Genus **Tetrarhynchus**, Rudolphi, 1809.= *Tetrarhynchobothrium*, Diesing, 1850.

General characters:—Body articulate, taeniaeform. Neck tubular. Head with four bothridia in two lateral pairs, parallel with the head. Proboscides four, terminal, filiform, armed, retractile in the neck, free, *i.e.* not running through the bothria. Genital apertures marginal or lateral.

(1) **Tetrarhynchus gangeticus**, Shipley and Hornell, 1906.

Larvae. About 100 specimens.

Z E V $\frac{5920}{7}$. *Sphyraena jello*. Pearl Banks, Ceylon. T. Southwell.

Literature:—

Shipley and Hornell, 1906. Southwell, 1912.

(2) Larva of **Tetrarhynchus platycephalus**, Shipley and Hornell, 1906.

Few specimens:—

Z E V $\frac{5921}{7}$. *Trygon walga*. Pearl Banks, Ceylon. T. Southwell.

Literature:—

Shipley and Hornell, 1906.

(3) **Tetrarhynchus** sp.

Larvae. Numerous specimens:—

Z E V $\frac{5922}{7}$. *Balistes* sp. Pearl Banks, Ceylon. T. Southwell.(4) **Tetrarhynchus** sp.

Larvae. Many specimens:—

Z E V $\frac{5923}{7}$. *Lutianus* sp. Pearl Banks, Ceylon. T. Southwell.(5) **Tetrarhynchus** sp.

Larvae. Many specimens:—

Z E V $\frac{5924}{7}$. *Serranus undulosus*. Pearl Banks, Ceylon. T. Southwell.(III) Genus **Otobothrium**, Linton, 1891.

General characters:—Body articulate, taeniaeform, head separated from body by a neck. Bothridia two, opposite, lateral,

each with two supplemental ciliated pits at the posterior free angles. Proboscides four, terminal, filiform, armed, retractile in neck. Reproductive apertures marginal.

Larva of *Otobothrium insigne*, Linton, 1905.

Many specimens:—

Z E V $\frac{5925}{7}$. *Diagramma crassispinum*,
Serranus undulosus,
Balistes sp. } Pearl Banks,
 Ceylon ... T. Southwell.

Literature:—

Linton, 1887. Southwell, 1912.

(IV) Genus *Syndesmobothrium*, Diesing, 1854.

=*Synbothrium*, Diesing, 1850.

General characters:—Body articulate, taeniaeform, neck tubular, rounded at base. Head tetragonal, with four terminal prominent bothridia, attached to head by posterior margin, cruciformly disposed, oval, slightly curved, joined with each other at the base by a membrane. Proboscides four, filiform, armed, each one running through a bothridium (pedicel) excurrent at apex, long, retractile in the neck. Genital apertures marginal (?).

Syndesmobothrium filicolle, Linton, 1889.

Larvae. Few specimens.

Z E V $\frac{5926}{7}$. *Clupea ilisha*. Calcutta. T. Southwell.

This species was also obtained from the mesenteries of *Cybius guttatus* and *Chorinemus lysan* in Ceylon waters.

Literature:—

Linton, 1887. Southwell, 1912.

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XX SOME NEW AND INTERESTING
BATRACHIA AND LIZARDS FROM
INDIA, CEYLON AND BORNEO.

(Plate xv.)

By N. ANNANDALE, D.Sc., F.A.S B., Superintendent, Indian
Museum.

The species described or commented on in this paper are represented by specimens recently presented to the Indian Museum or collected by members of its staff.

BATRACHIA.

Fam. CAECILIIDAE.

Since Mr. Boulenger published his volume on the Reptiles and Batrachia in the *Fauna of British India* (1890) the discovery by Col. Alcock¹ of a species of *Herpele* from Assam has not only added a very interesting form to the fauna but has also greatly extended the known range of the genus, which had previously been recorded only from Africa and America. The only other addition as yet made to the Indian list in the group is a new variety of the widely distributed Oriental species *Ichthyophis glutinosus* (*I.g. var. tricolor*) described from Travancore by myself.² I have here to add, from the southern part of the Malabar Zone, a new species of the South Indian and African genus *Uraeotyphlus*.

Uraeotyphlus menoni, sp. nov.

Teeth moderate, both rows on the mandible well developed.

Head triangular, short, with the snout rounded; snout about as long as the distance between the eyes, by no means prominent.

Tentacle below and slightly in advance of the nostril.

Eyes distinct.

Body cylindrical, slender, with about 170 rings; circular folds narrowly interrupted in the midventral line on the fore part of the body, alternating with longer and shorter interruptions on the hind part.

¹ *Ann. Mag. Nat. Hist.* (7) XIV, p. 271, pl. vii (1904).

² *Rec. Ind. Mus.* III, p. 186 (1909).

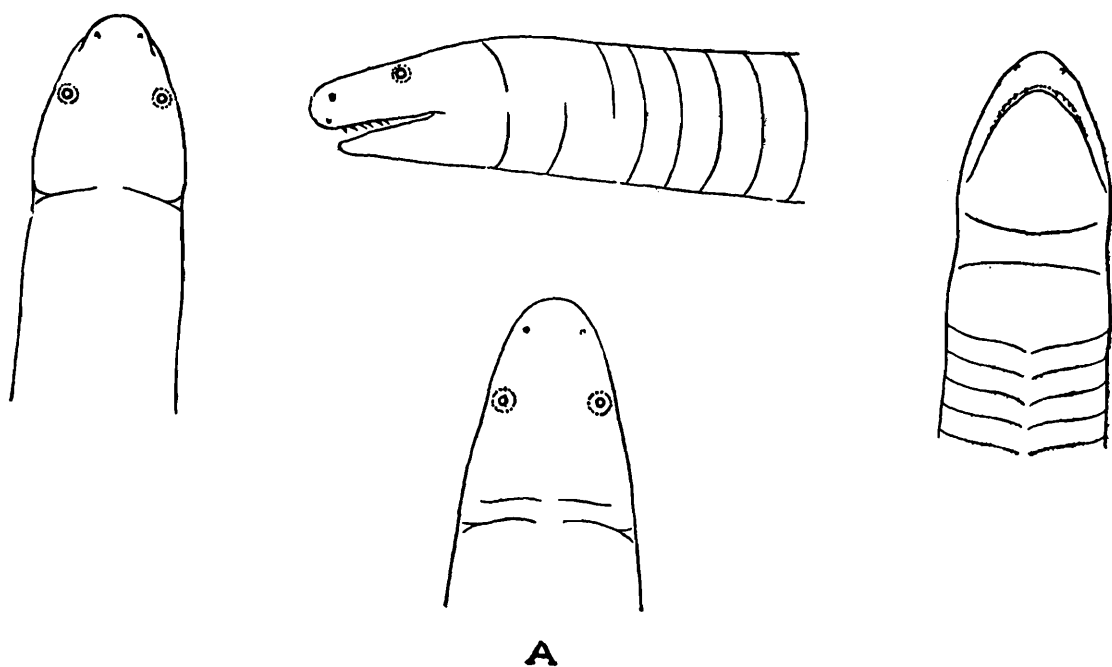
Tail short, pointed, bearing about 10 complete rings; its length 5.6 of its breadth at the base.

Colouration. Dorsal surface slate-grey; throat a little paler; lips narrowly pale; ventral surface of the body white blotched with slate-grey, becoming darker posteriorly; the white extending for some distance up each fold on the side; tail uniform slate-grey; a pale spot round the vent.

Type No. 16707; *Co-type* No. 16695, *Rept. Ind. Mus.*

Distribution. Coastal districts of the southern part of the Malabar Zone.

I have examined two specimens, one (the type) from Trichur in Cochin, and the other from Kondatti in the S. Malabar district.



Head of *Uraeotyphlus menoni*, sp. nov., with that of *U. oxyurus* (A) for comparison.

Both were collected and presented to the Indian Museum by Prof. K. Rammuni Menon of Madras.

Uraeotyphlus menoni is closely related to *U. oxyurus*, from which it differs in its shorter head, in the less numerous rings on its body, in the more forward position of its nostril and in colouration.

***Uraeotyphlus oxyurus*, D. & B.**

Numerous specimens from Cochin have recently been presented to the Indian Museum by Prof. K. Rammuni Menon.

***Herpele fulleri*, Alcock.**

The type is numbered 14759 in our register of Reptiles and Batrachia. No further specimens have been obtained.

Fam. BUFONIDAE.

***Bufo stomaticus*, Lütken.**

Annandale, *Rec. Ind. Mus.* III, p. 283 (1909).

This toad has not hitherto been recorded from Peninsular India south of the Indus and the Ganges. A fine specimen was, however, recently obtained by Mr. F. H. Gravely and myself at Purulia in Chota Nagpur. It was found under a stone in the middle of a ploughed field.

The Arabian toad assigned by Mr. Boulenger to his *B. andersoni* (which is undoubtedly synonymous, so far as Indian specimens are concerned, with *B. stomaticus*) apparently differs from the Indian species in having a true as distinct from an artificial tarsal fold.

Fam. RANIDAE.

***Ixalus leucorhinus*, Martens.**

I. leucorhinus, Boulenger, *Faun. Ind., Rept.*, p. 483 (1890).

I. nasutus, Annandale (*nec* Günther), *Rec. Ind. Mus.* III, p. 286 (1909).

This species, which is recorded from both Ceylon and S. India, is easily confused with *I. nasutus*, which is apparently confined to Ceylon. The latter species may be distinguished by possessing a middorsal row of prominent whitish glands of very small size.

I. leucorhinus is not uncommon at the base of the Western Ghats in Travancore on the western side of the range. I have not seen specimens from Ceylon.

***Ixalus variabilis*, Günther.**

Colouration seems to have literally no specific significance in this frog. Six specimens were taken on one occasion by Mr. F. H. Gravely at Pattipola in the Central Province of Ceylon at an altitude of about 6000 ft. In one the whole of the dorsal surface is pale bluish grey with a bold irregular reticulation of black lines; in another it is of an almost uniform deep brown, except that the limbs are obscurely barred and that there is a very conspicuous white lozenge-shaped mark on the snout; a third has a distinct M-shaped dark mark on the back and a dark cross-bar between the eyes; while the colouration of the others is of a less striking character, but different in each case.

Besides Mr. Gravely's specimens we have others from Golconda, the Anamalai Hills and Tinneveli, all from Beddome's collection, as well as a large series from "S. India," "Malabar" and "Ceylon."

***Ixalus signatus*, Boulenger.**

A fine specimen of this species was recently taken at Coonoor in the Nilghiris (alt. *ca.* 6500 ft.) by Capt. R. B. Seymour Sewell, I.M.S. It is, therefore, not confined to the Malabar Zone.

***Ixalus cinerascens*, Stoliczka.**

(Plate xv, fig. 4.)

Ixalus cinerascens, Stoliczka, *Proc. As. Soc. Bengal* 1870, p. 273, and 1872, p. 109.
Leptobrachium monticola, Boulenger (*part.*), *Faun. Brit. Ind.*, p. 510 (1890).
Ixalus cinerascens, Sclater, *Proc. Zool. Soc. London* 1892, p. 347.

This species, of which the type is in the Indian Museum, is, as Slater has pointed out, a true *Ixalus*. It was probably obtained in the first instance in the Dawna Hills inland from Moulmein. I took a specimen at an altitude of about 3000 ft. on the western side of that range in 1908.

There is no conical papilla on the tongue. A noteworthy feature is the prominence of the warts on the upper eyelid. The colouration is probably variable, my own specimen being much browner than Stoliczka's.

***Ixalus chalazodes*, Günther.**

Mr. T. Bainbrigge Fletcher recently presented to the Indian Museum a specimen he had taken in the Anamalai Hills at an altitude of 4000 ft. It agrees well with examples from Beddome's collection labelled simply "S. India."

***Ixalus glandulosus*, Jerdon.**

This is much the commonest species of the genus at moderate heights in the hills of Southern and South-western India. I have recently examined specimens from the following localities in the Western Ghats:—Satara, Kachal, Taloshi and Tambi (2000-2100 ft.) and Mahableshwar (4200 ft.) in the Satara district of the Bombay Presidency; also from Macara in Coorg and the Anamalai Hills (4000 ft.). These specimens were taken by Messrs. F. H. Gravely, S. P. Agharkar and T. Bainbrigge Fletcher.

***Ixalus annandalei*, Boulenger.**

Boulenger, *Journ. As. Soc. Bengal* 1906, (2), p. 385; Annandale, *Rec. Ind. Mus.* VIII, p. 16, pl. iii, fig. 2 (1912).

The tadpole of this species closely resembles that of *Rhacophorus maculatus himalayensis*,¹ together with which it is often abundant in pools of rain-water in the neighbourhood of Kurseong during the "rains." It may be distinguished by the following characters:—

1. The pigment is paler and more evenly disposed.
2. The tail is relatively shorter and much deeper at the base and tapers more abruptly at the tip. It has a broadly lanceolate form as a whole.
3. The upper profile of the head and body forms a more even curve.

¹ *Rec. Ind. Mus.* VIII, p. 24, pl. iv, fig. 5.

The young frog, immediately after its metamorphosis is complete, is already almost as large as the adult.

Ixalus semiruber, sp. nov.

(Plate xv, fig. 3.)

Size very small, the length from snout to vent being not more than 12 mm.

Habit stout; limbs moderate, tibio-tarsal articulation reaching a point midway between the eye and the tip of the snout.

Head. Snout bluntly rounded, about as long as diameter of orbit, with the nostril slightly nearer to its tip than to the eye; loreal region slightly concave; tympanum concealed; eyes large and prominent; dorsal surface of head slightly concave; inter-orbital space broader than upper eyelid. Tongue with a small free papilla; lower jaw with a tooth at the tip.

Skin of dorsal surface smooth, highly glandular but without prominent single glands; of throat and chest smooth, of belly and (to a less extent) of lower surface of thighs granular; a fold from the eye to the shoulder.

Digits with very small but distinct terminal disks; fingers with a vestigial web; toes about $1/3$ webbed; 1st finger shorter than 2nd; subarticular tubercles large, rounded; metacarpal tubercles distinctly indicated; a large oval inner metatarsal tubercle present; no tarsal fold.

Colouration. Dorsal surface of head, fore limbs and anterior part of body dark brown; posterior part of body and hind limbs pale brown (in life red); throat and chest suffused with dark pigment; belly pale brown with whitish granules; fore limbs obscurely banded; all the digits more distinctly so; no reticulate markings.

Type No. 17401, *Rept. Ind. Mus.* •

Habitat. Pattipola near Nuwara Eliya, Central Province, Ceylon; alt. ca. 6000 ft.

This little frog is related to the common S. Indian species *I. glandulosus*, from which it differs in its smaller size, stouter habit, less blunt snout, smooth chest and totally different colouration. It is common under fallen tree-trunks in the jungle round Pattipola and has probably escaped notice hitherto on account of its small size. I collected only a single specimen, although I saw more, in October, 1911.

LACERTILIA.

Fam. GECKONIDAE.

Alsophylax himalayensis, sp. nov.

(Plate xv, fig. 1.)

Habit stout, not at all depressed.

Head strongly convex in lateral view; snout bluntly pointed, about as long as the distance from the eye to the ear; forehead

slightly concave; eyes large; ear-opening elliptical, vertical, about a third as large as the eye.

Limbs short, the hind limb barely reaching the axilla and the fore limb the eye; digits rather stout; their inferior lamellae without projecting tubercles.

Tail stout, tapering, slightly flattened above at the base.

Lepidosis. Snout covered with small, convex, polygonal scales, between two of which, with the rostral and first labial, the nostril is pierced; forehead and vertex with smaller, rounded, feebly keeled granules; 11 upper and 9 lower labials; mental broad, pointed but not produced behind; a single pair of large chin-shields, which form a long suture behind the mental and are followed on each side by a row of smaller enlarged scales that decrease in size from before backwards. Dorsal surface of body covered with granules similar to those on vertex but larger, among which are scattered irregularly still larger but by no means prominent keeled tubercles; tail verticillate, clothed above in imbricating, convex, leaf-shaped scales, some of which project from the surface and are larger than others, below with smaller imbricating scales of similar form; throat covered with small rounded granules, chest and belly with smooth imbricating scales rather larger than the granules on the back; about 27 scales across mid-belly.

Colouration. Dorsal surface pale grey with numerous scriptiform transverse black marks, which are regularly interrupted in the mid-line of the back and take on the tail and digits the form of more or less distinct cross-bars; ventral surface pale, each scale on the belly bearing several microscopic black dots.

Type No. 17195, *Rept. Ind. Mus.*

Habitat. Dharampur, Simla dist., Western Himalayas; alt. ca. 4500 ft. The only specimen (a female) of this very distinct species as yet obtained was found under a stone by one of the Museum collectors.

Gehyra beebei, sp. nov.

(Plate xv, fig. 2.)

Habit stout, depressed; a distinct but not at all web-like fold of skin along each side of the body.

Head ovate, flattened; snout rounded, a little longer than the distance between the eye and the ear; ear-opening nearly circular, about half as large as eye; forehead flat.

Limbs short and flattened, with a distinct fold of skin extending along their posterior margins and in the case of the hind limbs forming a regular web; digits cylindrical at the base and widely expanded distally; digital web absent from fore feet, vestigial on hind feet; subdigital lamellae, with the exception of the terminal lamella, entirely divided by a longitudinal groove and separated at the proximal end of the digital expansion in each case by one or more minute scales; lamellae curved; 8 under

inner and 8 under middle toe; 6 under inner and 7 under middle finger.

Tail flat, tapering, pointed at the tip, expanded and swollen at the base.

Lepidosis. Snout covered with small convex granules; nostril surrounded by two larger and flatter scales, with the rostral and the first labial; granules on forehead and vertex smaller than but similar to those on snout; 10 upper, 8 lower labials; two pairs of enlarged chin-shields followed on each side by several smaller scales; first pair of shields forming a very long suture behind the mental, which is pointed but not produced. Dorsal surface of body and limbs covered with small, almost uniform convex granules, which are replaced on the tail by imbricating scales of about the same size. The whole of the ventral surface of the body covered with small, imbricating, flat scales, which are larger on the belly than elsewhere; ventral surface of tail with a single series of transverse plates occupying about one third of the breadth.

Colouration of dorsal surface dull pinkish grey with numerous small paler dark-edged ocelli scattered on the back; ventral surface suffused with black pigment, which becomes intense on the digital lamellae and on some of the scales and transverse plates below the tail.

Type No. 17402, *Rept. Ind. Mus.*

Habitat. Kapit, Sarawak, Borneo.

A single female specimen was taken by Mr. R. Hodgart, zoological collector in the Indian Museum, who accompanied Mr. C. W. Beebe on his ornithological expedition to Borneo in 1910. The species is related to *G. butleri*, Blgr., from the Malay Peninsula. It is distinguished by having all but the terminal subdigital lamellae completely divided, as well as by other characters.

EXPLANATION OF PLATE XV

FIG. 1.—*Alsophylax himalayensis*, sp. nov. (Type).

1a. Hind leg from below; 1b. Profile of head; 1c. Chin-shields.

„ 2.—*Gehyra beebei*, sp. nov. (Type).

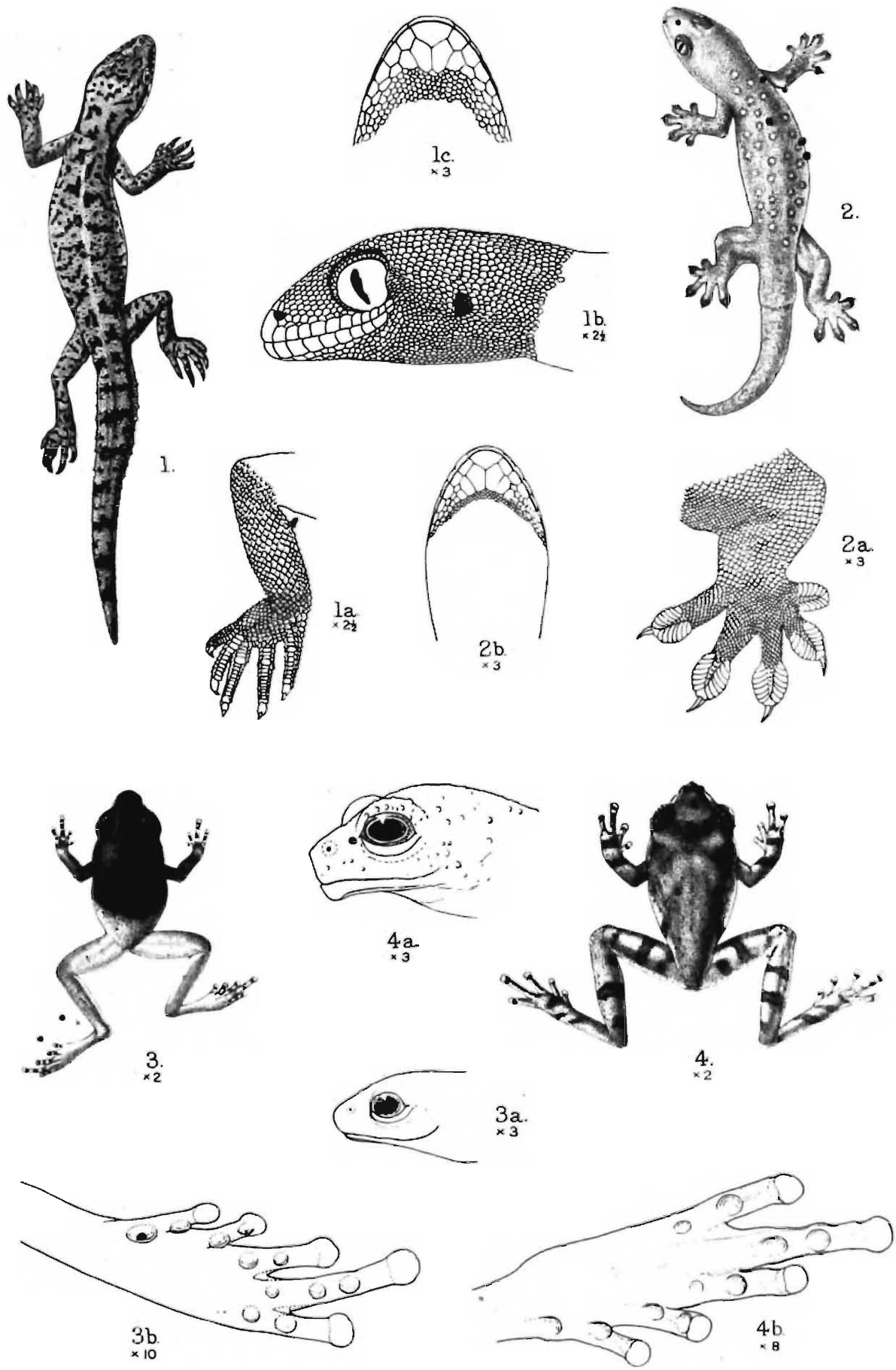
2a. Hind leg from below; 2b. Chin-shields.

„ 3.—*Ixalus semiruber*, sp. nov. (Type).

3a. Profile of head; 3b. Lower surface of hind foot.

„ 4.—*Ixalus cinerascens*, Stoliczka. (Specimen from the Dawna Hills).

4a. Profile of head; 4b. Lower surface of hind foot.



XXI THE INDIAN GECKOS OF THE GENUS *GYMNODACTYLUS*.

By N. ANNANDALE, D.Sc., F.A.S.B., Superintendent,
Indian Museum.

(Plates xvi-xvii.)

In his account of the reptiles of the Indian Empire and Ceylon in the *Fauna of British India* (1890) Mr. Boulenger recognized 18 species of *Gymnodactylus* as occurring within the geographical boundaries prescribed for that series. Three years later¹ he added two new species of the genus to the fauna of Burma; in 1905² I added another from the same country and in the following year³ one from the Darjiling district. I have now to describe another from that district, while the form assigned provisionally by Mr. Boulenger in 1890 to *G. fedtschenkoi*, Strauch, proves to be distinct and must be given a new name. Including all these species, the number now known to inhabit our area is 23, if we include *G. brevipes*, which has actually been found only in Persian territory but probably also occurs in British Baluchistan.

In the following list the specific names of those species of which specimens have been examined in connection with this revision are printed in italics, the fact that the type or types are preserved in the Indian Museum being indicated by an asterisk. The numbers in brackets after the names are those assigned to the species in the "Fauna."

SPECIES OF *GYMNODACTYLUS* FOUND IN INDIA, BURMA AND CEYLON.

- | | |
|---|---|
| <i>G. montium salsorum</i> ,* nov. (51). | <i>G. jeyporensis</i> , Beddome (58). |
| <i>G. scaber</i> (Rüppel) (52). | <i>G. nebulosus</i> , Beddome (57). |
| [<i>G. brevipes</i> ,* Blanford (53).] | <i>G. deccanensis</i> , Günther (59). |
| <i>G. kachhensis</i> ,* Stoliczka (54). | <i>G. albofasciatus</i> , Boulenger (60). |
| <i>G. stoliczkai</i> , Steindachner (55). | <i>G. peguensis</i> , Boulenger. |
| <i>G. lawderanus</i> ,* Stoliczka (56). | <i>G. consobrinoides</i> ,* Annandale. |
| <i>G. gubernatoris</i> ,* nov. | <i>G. fasciolatus</i> * (Blyth) (68). |
| <i>G. rubidus</i> * (Blyth) (65). | <i>G. frenatus</i> , Günther (63). |
| <i>G. himalayicus</i> ,* Annandale. | <i>G. pulchellus</i> (Gray) (66). |
| <i>G. khasiensis</i> * (Jerdon) (64). | <i>G. variegatus</i> * (Blyth) (67). |
| <i>G. oldhamii</i> ,* Theobald (61). | <i>G. feae</i> , Boulenger. |
| <i>G. tædrus</i> , Günther (62). | |

¹ *Ann. Mus. Civ. Genova* (2) XIII (XXXIII), pp. 313, 314, pl. vii, figs. 1, 2 (1893).

² *Journ. As. Soc. Bengal* (n. s.) I, p. 82 (1905).

³ *Ibid.* II, p. 287 (1906), and *Rec. Ind. Mus.*, I, pl. vi, fig. 1 (1907).

Convenient in some respects as is the order of species adopted in the "Fauna", it seems possible to find one that exhibits their affinities more clearly. The species now assigned to *Gymnodactylus* have at one time or another been distributed in several generic groups, but these, by the consent of herpetologists, have either been abandoned altogether or else restricted to lizards no longer included with the forms to be considered here. In the case of the abandoned genera there can be no doubt that the characters on which separation was based were not of a sufficiently definite nature to bear the interpretation put upon them. Nevertheless, the genus as now restricted falls naturally into several groups, distinguished by biological and geographical and to some extent anatomical features. Among the Indian, Burmese and Ceylonese forms it is possible to recognize 5 such groups, as follows:—

Group I. Type: *Stenodactylus scaber*, Rüppel.

The lizards of this group are small ground-geckos mainly diurnal in habits and of moderately stout form, although usually somewhat depressed. Their colouration is always indefinite and their most striking structural feature lies in the regular longitudinal series of large and prominent keeled tubercles that ornament their backs. Their tails, which are cylindrical or subcylindrical, are not prehensile. The distribution of the group is essentially Palaearctic and its representatives are found only in the north-western districts of our area. Indian species are *G. montium-salsorum*, *G. scaber*, [*G. brevipes*] and *G. kachhensis*. Among the extra-Indian forms is *G. elongatus*, Blanford, of which the types are in the Indian Museum (Nos. 5848-9, 15851 and 4208). It is found in Eastern Turkestan.

Group II. Type: *Gymnodactylus stoliczkai*, Steindachner.

This species is an isolated one, distinguished from those of the previous group by its comparatively smooth back, flattened form and expanded tail. It inhabits Eastern Turkestan and the neighbouring parts of Kashmir

Group III. Type: *Puellula rubida*, Blyth.

The species of this group are slender lizards of moderate size and mainly nocturnal and arboreal in habits, although they often hide on the ground by day. Their colouration is never conspicuous,¹ but they bear narrow, irregular cross-bars on the dorsal surface. The dorsal lepidosis consists of minute rounded granules with larger and more prominent tubercles scattered amongst them; transverse subcaudal plates are never present. The group is an Oriental one, ranging as far east as the Philippines and no further

¹ As a rule it is less so in fresh specimens than in those which have been for a long time in spirit.

north or west than the Eastern Himalayas. Its species are found in dense "equatorial" forests. Those that occur in our area are *G. gubernatoris*, *G. rubidus*, *G. himalayicus* and *G. khasiensis*.

Group IV Type: ***Gymnodactylus nebulosus***, Beddome.

The species of this group are stoutly-built arboreal lizards with comparatively short tapering tails, which are probably prehensile and never have subcaudal plates. The colouration is always very conspicuous. The dorsal lepidosis varies considerably. All the species known are found in Peninsular India, Burma and Ceylon, none occurring in Assam and the Himalayas or in Malaysia, and only one in Burma. They are *G. oldhamii*, *G. triedrus*, *G. jeyporensis*, *G. nebulosus*, *G. deccanensis* and *G. albofasciatus*.

Group V Type: ***Cyrtodactylus pulchellus***, Gray.

The lizards associated with this species resemble those of group III in general structure and in habits, but are distinguished from them by their conspicuous colouration and by the fact that transverse plates are always developed under the tail. Some species attain a fairly large size. The headquarters of the group appears to be in Burma, whence no less than five species are known; several occur in Malaysia, one in Ceylon and one in the Western Himalayas. The species from India, Burma and Ceylon are *G. peguensis*, *G. consobrinoides*, *G. fasciolatus*, *G. frenatus*, *G. pulchellus*, *G. variegatus* and *G. feae*.

G. lawderanus cannot be definitely assigned to any of these groups but may be associated provisionally with *G. stoliczkaei*. It is only known from a single deformed specimen.

The genus as a whole has a remarkable distribution, ranging from the shores of the Mediterranean through the mainland of Asia to the Malay Archipelago, Australia, Oceania, S. America and the West Indies. Most of the northern forms belong to my group I; the Malaysian species are distributed in groups III and V; all others probably belong to groups not represented in the Indian fauna. Apparently there are no true Ethiopian species. In the following paper, for the sake of reference, I either quote already published descriptions or give new ones of the species described since the issue of the *Fauna of British India, Reptiles and Batrachia* (1890).

In the notes on the different species I have included, under the heading of each, a list of the specimens in the collection of the Indian Museum. A large proportion of these were obtained by zoologists now no longer living, notably by Blyth, Stoliczka, W. T. Blanford, Theobald and Wood-Mason. Of recent years we have, in addition to specimens collected by the staff of the Museum, received examples of rare species from Mr. C. G. Rogers, I.F.S..

Major F. Wall, I.M.S., Lieut.-Col. A. R. S. Anderson, I.M.S., and
H. E. Lord Carmichael, Governor of Bengal.

KEY TO THE SPECIES.

- I. Dorsal keeled tubercles regularly arranged in about 12 longitudinal rows.
 - A. Dorsal tubercles half as large as eye; both femoral and praeanal pores in the male; (subcaudal plates transverse) ... *G. montium-salsorum*.
 - B. Dorsal tubercles much less than half as large as eye; only praeanal pores in the male.
 1. About 20 ventral scales across mid-belly; subcaudal plates enlarged.
 - a. Subcaudal plates much longer than wide, entire ... *G. scaber*.
 - b. Subcaudal plates as wide as long, often divided ... [*G. brevipes*.]
 2. About 30 ventral scales across mid-belly; no enlarged subcaudal plates ... *G. kachhensis*.
- II. Dorsal tubercles, if present, scattered or arranged in over 12 irregular rows.
 - A. Tail flattened and expanded at base ... *G. stoliczkai*.
 - B. Tail cylindrical or subcylindrical.
 - i. No enlarged transverse subcaudal plates.
 - a. Dorsal surface covered with minute rounded tubercles among which are scattered a comparatively small number of larger ones; colouration inconspicuous; male pores present.
 - i. Back almost smooth; larger tubercles feebly developed ... *G. lawderanus* (W. Himalayas).
 - ii. Larger tubercles prominent and conspicuous under a hand lens.
 - a. Male with both femoral and praeanal pores ... *G. gubernatoris* (Darjiling district, below 4000 ft.)
 - b. Male without femoral pores.
 - a. Praeanal pores of male in a deep longitudinal groove ... *G. rubidus* (Andaman Is.)
 - b. No pubic groove.
 - i. No lateral fold ... *G. himalayicus* (Darjiling district, 5000 ft.)
 - ii. A slight fold separating ventral from lateral region on each side ... *G. khasiensis* (N. Burma; Assam).
 - b. Dorsal surface covered with small rounded tubercles with much larger and more prominent ones arranged in numerous rows, dark with small pale spots; (no femoral pores in male).
 - i. A double white line forming a nuchal collar ... *G. oldhamii* (Tenasserim).
 - ii. No white lines on the neck ... *G. triedrus* (Ceylon).
 - c. Dorsal scales never prominent; dark, pale-edged spots or stripes always conspicuous on dorsal surface; no male pores.

- i. Subcaudal scales imbricate.
 - a. Dorsal scales uniform, angular, arranged with great regularity ... *G. jeyporensis.*
 - β. Dorsal scales rounded, by no means uniform, arranged irregularly ... *G. nebulosus.*
- ii. Subcaudal scales juxtaposed, verticillate.
 - a. Dorsal scales homogeneous ... *G. deccanensis.*
 - β. Larger dorsal scales separated by much smaller and less regular ones ... *G. albofasciatus.*
- 2. Enlarged transverse subcaudal plates present; (dark, pale-edged cross-bars or spots conspicuous on dorsal surface; male pores present).
 - a. Enlarged transverse plates absent from proximal part of tail ... *G. peguensis* (Hills of Pegu; Malay States).
- Plates extending forwards to posterior end of postanal swelling at base of tail.
 Dark cross-bars on back much narrower than pale interspaces; (no femoral pores in male) ... *G. consobrinoides* (Tavoy).
- i. Dark cross-bars or transverse spots on back at least nearly as wide as paler interspaces.
 - a. No femoral pores in male.
 - a Male with 10 to 12 praeanal pores ... *G. fasciolatus* (W. Himalayas).
 - β Male with only 4 praeanal pores ... *G. frenatus* (Ceylon).
 - β. Both femoral and praeanal pores in male.
 - a Some of male praeanal pores in a longitudinal groove ... *G. pulchellus* (L. Burma; Malaysia).
 - β No pubic groove in male.
 - i. 22 to 26 ventral scales across mid-belly ... *G. variegatus* (Dawna Hills, Tenasserim.)
 - ii. About 35 ventral scales across mid-belly ... *G. feae* (U. Burma).

GROUP I.

***Gymnodactylus montium-salsorum*, sp. nov.**

(Plate xvii, fig. 1).

G. geckoides, Blyth (*nec* Spix), *Journ. As. Soc. Bengal*, XXII, p. 410 (1853).*G. caspius*, Stoliczka (*nec* Eichwald), *Proc. As. Soc. Bengal*, 1872, p. 80; Theobald, *Cat. Rept. Brit. Ind.*, p. 91 (1876).*G. fedtschenkoi*, Boulenger (*nec* Strauch), *Faun. Brit. Ind., Rept.*, p. 61 (1892); Annandale, *Ann. Mag. Nat. Hist.* (7) XV, p. 26 (1905).

Habit slender, moderately depressed. Limbs moderate; hind limb reaching axilla; fore limb reaching tip of snout. Tail slender, cylindrical, tapering.

Head ovoid but narrowly rounded at tip of snout, not depressed posteriorly; snout somewhat depressed but not spatulate, a little longer than distance between eye and ear; forehead somewhat concave; ear-opening of medium size, vertical.

Digits slender; subdigital lamellae narrow.

Lipidosis.—Back bearing about twelve longitudinal rows of very large and prominent trihedral keeled tubercles, which are in contact or almost in contact longitudinally on the hinder parts and are only separated transversely by minute irregular scales; keeled tubercles less close to one another on shoulders. Snout covered with prominent rounded tubercles as a rule feebly keeled and almost homogeneous; tubercles on occiput similar but more heterogeneous; those on sides of head prominent and strongly keeled. Upper arms and femora, except near the joints, covered above with large imbricate keeled scales; scales on limb-joints small; forearm and shin (especially latter) with large non-imbricate scales above; lower surface of limbs clad in fairly uniform smooth imbricate scales. Tail bearing numerous large keeled trihedral tubercles arranged on the dorsal surface and sides in transverse bands; lower surface with somewhat irregular enlarged median transverse plates. Ventral surface of body with smooth imbricate scales in from 15 to 18 rows and limited at either side by a row of small rounded tubercles. Throat with scales like those on belly; two pairs of chin-shields, the anterior pair of which meet so as to form a suture behind the mental. About 11 upper and 11 lower labials.

Pores.—A straight uninterrupted series of 32—34 femoral and praeanal pores in the male.

Colouration.—Five or six indistinct rows of spots arranged transversely on dorsal surface; general colour dull sandy or earthy.

Length of head	18 mm.
Length of body	31 „
Length of tail (partly reproduced)	55 „
Length of fore limb	20 „
Length of hind limb	24 „

Type.—No. 6185 *Rept. Ind. Mus.*

Habitat.—Salt Range, Punjab.

This lizard, although closely related to *G. fedtschenkoi*, Strauch, is, to judge from Nikolski's¹ figures, distinguished from that species by its much larger abdominal scales, less spatulate snout, differently arranged mental shields and other minor characters. From *G. scaber*, Strauch, it is at once distinguished by its longer snout and by the possession of femoral pores in the male. My description is not altogether in accord with those on which Boulenger based that in the "Fauna", but the actual discrepancies are small and the only specimens I have had before me are those which were examined many years ago by Blyth, Theobald and Stoliczka. In counting the ventral scales I have omitted the little rounded tubercles that separate them from the lateral tubercles, although the former are not very clearly differentiated.

¹ *Herpet. Turanica*, pl. iv, fig. 1 (1899) in Fedtschenko's *Reise in Turkestan*.

The specimens on which the new species is founded were sent to Calcutta sixty years ago and are not in good condition. They have totally lost their natural colours and, like some other very old specimens of lizards in our collection, are stained of a peculiar greenish shade. One, which I have labelled as the type, is, however, sufficiently complete to be figured. One was sent some years ago to the British Museum under the name *Gymnodactylus fedtschenkoi*.

6181, 6184 } 6185 (Type)	Salt Range, Punjab.	Dr. W. Theobald.
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***Gymnodactylus scaber* (Rüppel).**

Boulenger, *Fauna*, p. 62.

The distribution of this well-known species extends from Egypt and Abyssinia through south-western Asia to Afghanistan and Sind, thus resembling that of the fish *Cyprinodon dispar*.

Specimens:—

13455-9, 13450.	Bushire, Persian Gulf.	W. D. Cumming, Esq.
14328-9.	Afghanistan.	Dr. C. R. Green.
14589.	Malakhand.	Capt. McMahon.
14979, 14980-1.	Sind, Bombay Pres.	?

[*Gymnodactylus brevipes*, Blanford.]

Blanford, *Ann. Mag. Nat. Hist.* (4) XIII, p. 453 (1874) and *Eastern Persia* II, p. 344, pl. xxii, fig. 2; Boulenger, *Fauna*, p. 63.

I have nothing to add to Blanford's excellent description. The type, which is in good condition and has apparently retained its natural colouration, still remains unique. As it was found in Persian territory, the species should not, strictly speaking, be included in the Indian fauna.

3465 (Type). Aptan near Bampur, Persian Baluchistan (3000 ft.). Dr. W. T. Blanford.

***Gymnodactylus kachhensis*, Stoliczka.**

Boulenger, *Fauna*, p. 63.

The range of this species and that of *G. scaber* overlap, but the latter is probably not found south of the Indus. The type of *G. kachhensis* is in fair condition, but the tail is loose. Other specimens in the collection are apparently cotypes or paratypes.

Specimens:—

13462.	Bushire, Persian Gulf.	W. D. Cumming, Esq.
14726-7	Quetta, Baluchistan.	Major C. G. Nurse.
13946.	N. Baluchistan, nr.	Dr. Maynard and Capt.
	Afghanistan frontier.	McMahon.
11963, 11965-9, 11971-3	Sind.	J. A. W. Murray, Esq.
6192-6	Kachh.	Dr. F. Stoliczka.
5162 (Type)	"	" "

GROUP II.

Gymnodactylus stoliczkai, Steindachner.

Steindachner, *Novara Reise, Rept.* p. 5, pl. ii, fig. 2; Anderson (*Cyrtodactylus yarkandensis*), *Proc. Zool. Soc. London* 1872. p. 381, fig.; Boulenger (*G. stoliczkae*), *Fauna*, p. 63.

The representatives of this species in our collection apparently include the types of Anderson's *Cyrtodactylus yarkandensis*, but there is no evidence that either of his specimens was originally designated as such. The whole series was obtained on the Second (Forsyth's) Yarkand Expedition by F. Stoliczka. Some of the specimens are in excellent condition. The species is evidently common in Ladak.

Specimens :—

3792-3.	Yarkand (E. Turkestan).	Forsyth's Expedition.
3796-9,	Kargil, Ladak.	" "
3801-3.		
5845.	Sneema, Ladak.	" "
3771, 3774-6,	} Ladak.	" "
3778-82.		
3789, 3793,		
3795, 3777,		
3799, 3792.		
3794, 3783.	} Chiliscoombe, Ladak.	" "
3762, 3764,		
3766, 3768-		
70.		

Gymnodactylus lawderanus, Stoliczka.

Stoliczka, *Fourn. As. Soc. Beng.* XI.1, p. 105, pl. ii, fig. 4 (1872); Boulenger, *Fauna*, p. 64.

It is evident from Stoliczka's figure that the type-specimen was deformed, probably owing to the tail having been reproduced. This specimen still remains unique and has, perhaps fortunately, lost its tail, the lepidosis of which was evidently abnormal. Otherwise it is in good condition. It does not, however, offer sufficient evidence, although the species is undoubtedly distinct, for a dogmatic statement as to the correct position of *G. lawderanus* in the genus. It may be allied to *G. mauritanicus* (Gray).

5890 (Type). Almora, Kumaon, W. Himalayas. Dr. F. Stoliczka.

GROUP III.

Gymnodactylus gubernatoris, sp. nov.

(Plate xvii, fig. 3.)

Very closely allied to *G. marmoratus*,¹ D. & B., but distinguished from that species by its darker colouration, smaller and

¹ As to the authors of this species see Barbour, *Mem. Mus. Harvard* XLIV (i), p. 79 (1912).

relatively shorter head, slighter habit, smaller ear-opening, larger ventral scales, smaller dorsal granules and more divergent series of praeanal pores.

Habit slender, moderately depressed. Limbs rather stout; hind limb reaching shoulder, fore limb a point midway between eye and tip of snout; tail slender, tapering, cylindrical, $1\frac{1}{3}$ times as long as the head and body.

Head somewhat broadly ovoid, moderately depressed, flat on dorsal surface; forehead not concave; snout bluntly pointed, a little longer than distance between eye and ear, flat above; ear-opening small, its diameter not more than twice that of a dorsal tubercle.

Digits rather stout, transverse plates on ventral surface of proximal phalanges well developed; tubercles below joints large and prominent; transverse plates on distal phalanges reaching almost across digit.

Lepidosis.—Snout covered with small, regular, rounded granules considerably larger than those on occiput, the latter a little smaller than those on back, having mixed with them small rounded tubercles not much larger than granules on snout; back and dorsal surface of femora and shins covered with granules among which are mixed numerous fairly prominent round tubercles considerably larger than those on occiput; dorsal surface of fore limbs bearing small granules and tubercles; 11 upper, 9 lower labials; nostril between rostral, first labial and several small scales; rostral quadrilateral, deeply grooved in the upper half of its middle line, three small plates running transversely across its upper end, the two outer plates being much larger than the inner one; mental large, produced backwards and sharply pointed; two large chin-shields, forming a long suture behind mental and followed by several irregular plates; throat covered with small, smooth granules; ventral surface of body and limbs bearing small leaf-shaped imbricate scales; about 30 scales across mid-belly; a well-defined row of enlarged tubercles separating ventral from lateral region on either side; tail covered above with small, flat, juxtaposed plates; those on its ventral surface larger, more irregular and with a tendency to become imbricate.

Male pores.—A widely divergent series of 9 praeanal pores and, widely separated from them, 6 femoral pores on either side; the latter not joined to praeanal pores by a row of enlarged scales; several large scales in fork of praeanal series.

Colouration.—Dorsal surface dark brown, marbled with a paler shade and with numerous narrow irregular, zig-zag black cross-bars on back; many of the dorsal tubercles white; a black band extending from eye to ear on either side and connected with its fellow across back of occiput; ventral surface pale brownish; tail banded with alternate bars of grey and dark brown, those of the latter shade being the broader.

Type.—No. 17275 *Rept. Ind. Mus.*

Habitat.—Sikhim Himalayas (Darjiling) at low altitudes.

Measurements :—

Total length ..	.	115 mm.
Head and body ..		52 „
Tail ..	.	62 „
Head ..	.	15 „
Breadth of head ..		10 „
Hind limb ..	.	25 „
Fore limb ..		19 „

Closely allied as this species is to the Malayan *G. marmoratus*, it can be distinguished by the characters given in the first paragraph of the foregoing description. From *G. himalayicus*, the only related species known from the Sikkim Himalayas, the femoral pores of the male and the line of tubercles along each side are sound diagnostic features. I have seen only the following examples, the second of which is very young.

Specimens :—

17275 (Type).	Darjiling dist. (1000-3000 ft.).	H. E. Lord Carmichael of Skirling.
17276 (juv.)	„	

***Gymnodactylus rubidus* (Blyth).**

Boulenger, *Fauna*, p. 69; Annandale, *Journ. As. Soc. Bengal LXXIII* (2) Suppl., pp. 13, 14 (1904).

This species is confined to the Andaman group, on all the wooded islands of which, including the isolated Narcondam, it is abundant. Although usually seen on tree-trunks, it is also found on the ground under flowerpots in the gardens of the settlement of Port Blair. Its nearest ally is apparently *G. philippinicus* (Gray) from the Philippines but the subdigital lamellae of the latter are much more feebly developed. All the members of this group, to which *G. marmoratus* and *G. philippinicus* belong as well as the Indian forms, are very closely related, the strongest distinguishing features lying in the secondary sexual characters of the males.

The type is in good condition, except that the natural colouration has completely disappeared, as is the case with most of Blyth's types of lizards.

Specimens :—

6208 (Type).	Andamans.	Capt. Hodge.
5622-5, 5628-30, 5632-3,	„	Capt. Hodge, Dr. Dobson,
5636, 6302-7, 6209-10,	„	J. Wood-Mason, Esq.,
6212-8, 14675.	„	Major A. R. S. Anderson.
13888.	Little Andaman I.	F. Finn, Esq.
17149.	Ross I., Andamans.	C. A. Paiva, Esq.
15013-15.	Narcondam I.	Major A. R. S. Anderson.

***Gymnodactylus himalayicus*, Annandale.**

Journ. As. Soc. Bengal (n. s.) II, p. 287 (1906); *Rec. Ind. Mus.* I, pl. iv, fig. 1 (1907).

Closely related as this species is to *G. khasiensis*, it totally lacks either a row of enlarged tubercles or a fold of skin separating the ventral from the lateral regions on the side. The type, which still remains unique, is in excellent condition. It was caught on the floor of a room of one of the hotels in a well-known Himalayan hill-station. I reprint the original description.

Description.—Head large, rather narrow, depressed, ovoid; snout slightly longer than orbit, obtusely pointed; forehead concave. Habit slender; digits compressed throughout; tail slightly longer than head and body, rounded, tapering. Dorsal surface of head and body granular, with numerous small conical tubercles on the body, base of head and hind limbs; on the back these tubercles tend to be arranged in 16 irregular lines: they are very much smaller than the ear-opening. Ventral scales small, leaf-shaped, imbricate; about 35 across middle of belly. No lateral fold or enlarged scales in its place. Rostal grooved; nostril between rostral, first labial and several small scales; ten upper and ten lower labials. Ear-opening ovoid, slanting, one-third as large as eye. Subdigital lamellae moderate, larger on proximal than on distal joints. Eleven praeanal pores arranged in a continuous, wide, V-shaped series; the scales posterior to them, between the arms of the V, enlarged; three postanal papillae (in the male) on either side; base of tail swollen below; no public groove; no femoral pores. Colouration as in *G. marmoratus*.

Measurements:—

Total length	.	111 mm.
Head and body		53 „
Tail	.	58 „
Hind limb		25 „
Fore limb	..	20 „
Breadth of head	.	9 „

15716 (Type). Kurseong, Darjiling dist. Dr. N. Annandale.
(5,000 ft.).

***Gymnodactylus khasiensis* (Jerdon).**

Boulenger, *Fauna*, p. 68; Annandale, *Rec. Ind. Mus.* VIII, p. 39 (1912).

This species is found in the hills of north-eastern Burma and in those of Assam both north and south of the Brahmaputra. It thus occurs in the extreme east of the Himalayan foot-hills.

Specimens:—

6197, 6199 (Type).	Khasi Hills, Assam.	Dr. Jerdon.
5818-9, 5835-3 }	Cherrapunji, Khasi	Lieut. Bourne.
5831, 5837-8 }	Hills.	

16896-7.	Kobo, Abor Hills (400 ft.).	} S. W. Kemp, Esq. (Abor Exp. 1911-1912).
16879.	Upper Rotung, Abor Hills (2000 ft.).	
16918.	Upper Renging, Abor Hills (2150 ft.).	

GROUP IV

Gymnodactylus oldhamii, Theobald.

(Plate xvii, fig. 2.)

Theobald, *Cat. Ind. Rept.* p. 81 (1876); Boulenger, *Fauna*, p. 67; Annandale, *Fourn. As. Soc. Bengal* (n. s.) I, p. 83 (1905).

This species is closely allied to *G. triedrus* of Ceylon, differing therefrom chiefly in its longer and narrower head and less strongly keeled dorsal tubercles. The double white line extending backwards from the eye to meet its fellow of the opposite side is also a distinctive feature. There are about 30 ventral scales across the mid-belly.

In spite of Theobald's statement that the enlarged scales in the praeanal region are not pierced "probably owing to the sex of the specimen", the type is a male and one scale of this series bears a distinct pore. In two other males examined there are 4 praeanal pores arranged in two pairs, which are separated by an unpierced scale in the middle line. In the type, moreover, the scales corresponding to those which bear pores in these specimens, if not actually pierced, bear distinct impressions resembling pores in size and position. It is evident, therefore, that the normal number of praeanal pores is 4. As I have already pointed out (1905) elsewhere, there is no real evidence that this lizard occurs in South India. Beddome merely suggested that it might do so (see page 322 *post.*) and the history of the type, which is from Stoliczka's collection, is unknown. The other specimens since discovered are from Tenasserim.

Specimens :—

5858 (Type).	?	Dr. F. Stoliczka.
12660.	Mintao, Tavoy dist., Tenasserim.	Tenasserim Exp.
12675.	Tavoy.	Mus. colltr. (Moti Ram).

Gymnodactylus triedrus, Günther.

Boulenger, *Fauna*, p. 67.

This species is found in the hill-country of Ceylon at low altitudes.

Specimens :—

15082.	Ceylon.	Brit. Mus. (Ex.)
16710.	Peradeniya, Ceylon (ca. 1500 ft.).	F. H. Gravely, Esq.

***Gymnodactylus jeyporensis*, Beddome.**

Beddome, *Proc. Zool. Soc. London* 1877, p. 685; Boulenger, *Cat. Liz. Brit. Mus.* I, p. 36, pl. iv, fig. 1 (1885), and *Fauna*, p. 65.

This species, which I have not seen, is only known from Patinghe Hill in the Madras Jeypur, situated in the north-eastern part of that Presidency.

***Gymnodactylus nebulosus*, Beddome.**

Gymnodactylus nebulosus, Beddome, *Madras Fourn. Med. Sci.* 1870; Boulenger, *Cat. Liz. Brit. Mus.* I, p. 34, pl. iv, figs. 1, 1a and *Fauna*, p. 64; Annandale, *Spol. Zeyl.* III, p. 189 (1906).

Gymnodactylus speciosus, Beddome, *loc. cit.*

Gymnodactylus collegalensis, Beddome, *loc. cit.*

Three distinct colour-forms exist of this species, which as a whole appears to be the most widely distributed of its group. The typical form (C of Boulenger's "Catalogue") bears on its back transverse spots, which are of a somewhat clouded nature and tend to be joined in pairs on the middle line. This form is perhaps endemic in the central parts of southern Peninsular India, but the two others do not appear to be localized apart from one another. Seemingly they occur together in the extreme southern and south-eastern part of the Peninsula and in Ceylon. One of them, which was described by Beddome as a distinct species under the name *G. collegalensis*, is distinguished from the typical form by its broader and more clearly defined spots, which are always separated in the middle line. This is form B of the "Catalogue." In the third form (*G. speciosus*, Beddome=form A, Boulenger) there are three broad cross-bars and no oval spots on the back. The specimen from Nelamba in the Indian Museum and two of the other three belong to the typical form, the fourth representing the var. *collegalensis*.

Specimens:—

12479 (typical).	Nelamba.	Purchased.
5881-1 (")	S. India.	Col. Beddome.
4311 (var. <i>collegalensis</i>).	"	Col. Beddome.

***Gymnodactylus deccanensis*, Günther.**

Günther, *Rept. Brit. Ind.*, p. 115, pl. xii, fig. E (1864); Boulenger, *Fauna*, p. 66.

This species apparently inhabits the northern part of the Western Ghats, being replaced in the southern part of the same range by the closely allied *G. albofasciatus*.

Specimens:—

7531.	Matheran, W. Ghats, Bombay Presidency.	Brit. Mus. (Ex.).
17219.	Helvak, Koyna Valley, Satara dist., Bombay (2000 ft.).	F. H. Gravely, Esq.

Gymnodactylus albofasciatus, Boulenger.

Cat. Liz. Brit. Mus. I, p. 37, pl. iv, fig. 2 and *Fauna*, p. 66.

This species differs greatly both in lepidosis and in colouration from *G. oldhamii*, with which Beddome confused it (see Boulenger, *Cat. Liz.* 1, p. 35). It is probably to this confusion that the belief of the occurrence in South India of the latter species is due (p. 320).

The only specimen in the Indian Museum is apparently a co-type.

15232. S. Canara, Western Madras. Brit. Mus. (Ex.)
(*ex coll.* Beddome).

GROUP V.

Gymnodactylus feae, Boulenger.

Ann. Mus. Civ. Stor. Nat. Genova (1) XIII (XXXIII), p. 313, pl. vii, fig. 1 (1893).

I have not seen this species, for the specimens I referred to it in 1905 (*Ann. Mag. Nat. Hist.* (7) XV, p. 27) were actually young examples of *G. consobrinus*, Peters. That this was so was first suggested to me by Dr. F. de Rooy after an examination of one of these specimens. As the original description of *G. feae* is not always available to Indian herpetologists I quote the essential parts of it.

“Head large, oviform; snout longer than the orbit, which equals its distance from the ear-opening; forehead and loreal region concave; ear-opening small, oval, oblique. Limbs elongate; digits strong, scarcely depressed at the base, strongly compressed distally; the basal phalanx with well-developed plates beneath. Head granular, the granules intermixed with small round tubercles from between the eyes to the nape, where they increase in size; rostral twice as broad as deep, with median cleft above; rostral and first labial entering the nostrils; seven or eight upper and eight or nine lower labials; mental triangular; two pairs of chin-shields, anterior largest and forming a suture behind the mental; throat minutely granulate. Body and limbs granular above, with numerous small, round, keeled tubercles; a series of small tubercles, on a slight fold, limiting the abdominal region; ventral scales small, cycloid, imbricate, 35 across the middle of the belly. Male with a cutaneous series of 32 pores along the thighs and across the praeanal region. Tail cylindrical, tapering, covered with minute granules intermixed with a few large flat, smooth tubercles, which do not form regular rings, except quite at the base; a series of large transverse plates below. Dark brown above, with four black bars, bordered with white tubercles, on the back, and a crescentic black, white-edged band from eye to eye across the nape; upper surface of head with large black spots,

separated by a whitish network; lower parts dark brown; tail black, with nine white cross-bands above." (Boulenger).

Gymnodactylus peguensis, Boulenger.

Boulenger, *Ann. Mus. Civ. Stor. Nat. Genova* (1) XIII (XXXIII), p. 315, pl. vii, fig. 2 (1893); and *Fauna Malay Pen., Rept.*, p. 136 (1912); Laidlaw, *Proc. Zool. Soc. London* 1911 (1), p. 304; Annandale, *Rec. Ind. Mus.* VII, p. 91 (1912).

I have nothing to add to Mr. Boulenger's excellent descriptions (one of which I quote in full from the *Fauna of the Malay Peninsula*), except to say that the U-shaped band on the back of the head may be broken up into a series of large spots.

"Ear-opening subtriangular, half the diameter of the eye. Limbs moderate; toes short, scarcely depressed at the base, the plates under the basal phalanx small, much narrower than the digit, roundish, convex. Head granular, with minute tubercles on the occiput; rostral with median cleft above, entering the nostril; 9 upper and 7 or 8 lower labials; symphysial triangular; four pairs of chin-shields, the median largest and forming a suture behind the symphysial. Body and limbs granulate above, with numerous small, round, keeled tubercles; a feeble fold along the side; ventral scales small; imbricate about 45 in a transverse series. Males with a angular series of 7 or 8 praeanal pores; no femoral pores. Tail covered with small scales. Pale grey above, with blackish-brown markings edged with whitish, viz. several spots on the tip of the head, a U-shaped band from eye to eye across the nape, two series of large spots on the back, and a series of smaller spots along each side, lower parts whitish. From snout to vent 64 millim; tail 64." (Boulenger).

G. peguensis seems to me to be most nearly related to *G. variegatus* (Blyth) from the Amherst district of Tenasserim. Males of the two species are easily recognized by the number and arrangement of the pores; females can be distinguished only by slight differences in colouration and in the conformation of the head and by the smaller and more numerous ventral scales of *G. peguensis*. From *G. rubidus* (Blyth), with which Boulenger compares his species, it is distinguished by its conspicuous colouration, its much stouter habit, the form and lepidosis of its tail and other important characters. Laidlaw has recorded *G. peguensis* from the central region of the Siamese Malay States and his record is confirmed by Boulenger. In Burma it has only been found in the hilly districts of Pegu and Arrakan. In the Dawna range, in the interior of the Amherst district of Tenasserim, it is apparently replaced by *G. variegatus*.

Specimens:—

16719.	E. Yoma forest reserve, Thayetmyo dist., Pegu Yomas ca. 1000 ft.	C. G. Rogers, Esq.
17220.	Henzada dist., Arrakan Yomas.	"

Gymnodactylus consobrinoides, Annandale.

(Plate xvi, fig. 1).

Journ. As. Soc. Bengal (n. s.) I, p. 82 (1905).

I have to thank the authorities of the Amsterdam Museum for giving me an opportunity of comparing the type of *G. consobrinoides* with an adult specimen of *G. consobrinus*, Peters. They are not so closely related as I thought; I take this opportunity to redescribe my own species.

Habit slender, cylindrical; limbs moderate, hind limbs reaching axilla, forelimb anterior border of eye; tail slender, cylindrical, tapering.

Head narrow and elongate, moderately flat, forehead not concave; snout slightly convex above, rounded at tip, slightly longer than distance between eye and ear; ear-openings minute.

Lepidosis.—Snout covered with rounded granules of somewhat unequal size, larger than those on the back of the head; latter mixed with small round keeled tubercles; dorsal lepidosis consisting of granules like those on the snout mixed with numerous round keeled tubercles of moderate size; no row of enlarged tubercles or fold of skin separating side from belly; tail covered with smooth imbricate scales above, with well-developed transverse plates below; scales on the throat granular, smooth; those on the belly smooth, imbricate; about 20 across mid-belly; rostral quadrangular, cleft, with several somewhat irregular enlarged scales behind it; nostril between rostral and several small scales; 10 upper, 9 lower labials; mental moderate, not produced backwards; a single pair of very large chin-shields forming a long suture behind mental and followed by several smaller enlarged scales in two rows on each side.

Male pores.—No femoral pores; an uninterrupted divergent series of 5 praeanal pores followed on the thighs by a row of enlarged scales which may bear impressions but are not pierced; no public groove.

Digits short and rather stout; subdigital lamellae by no means strongly developed.

Colouration.—Dorsal surface dull brown with several dark insulariform spots on the head, a U-shaped dark bar extending from eye to eye and 7 dark bars, much narrower than the interspaces and only reaching a short distance down the sides, on the back; the first of these bars consisting of two convergent wedge-shaped marks; tail barred; dorsal surface pale brown.

Measurements:—

Total length	.	110 mm.
Head and body	.	50 "
Tail	.	64 "
Head	.	16 "
Breadth of head	.	8 "
Hind limb	.	21 "
Fore limb	.	19 "

Only one specimen is now in the collection of the Indian Museum, the co-type having been sent to the British Museum some years ago.

12741 (Type). Tavoy dist., Tenasserim. Mus. colltr. (Moti Ram).

***Gymnodactylus fasciolatus* (Blyth).**

(Plate xvi, fig. 3).

Naultinus fasciolatus, Blyth, *Fourn. As. Soc. Bengal* XXIX, p. 114 (1860); Boulenger (*Gymnodactylus*), *Fauna*, p. 71.

The type and co-type are in good condition, except that the markings have almost completely disappeared. A female recently taken by Major Wall at Almora differs from them in having only six perfect dark cross-bars on the body, the seventh being represented by a few irregular marks. The complete cross-bars are broader than the interspaces and have sinuous margins. There are 30 (not 36) ventral scales across the mid-belly in the type; the other specimens agree in this respect.

The species is apparently endemic in the Western Himalayas at low and moderate elevations.

Specimens:—

6589 (Type).	Subathu, Simla dist. (foot hills).	W. Atkinson, Esq.
6595 (Co-type).	" "	" "
56514.	Almora, Kumaon (5300 ft.).	Major F. Wall.

***Gymnodactylus frenatus*, Günther.**

Günther, *Rept. Brit. Ind.*, p. 113, pl. xii, fig. D. (1864); Boulenger, *Fauna*, p. 68; Annandale, *Spol. Zeyl.* III, p. 189 (1906).

Specimens:—

12470.	Ceylon.	Purchased.
15337.	"	Ceylon Museum.

***Gymnodactylus pulchellus* (Gray).**

Boulenger, *Cat. Liz. Brit. Mus.* I, p. 46, *Faun. Brit. Ind. Rept.*, p. 169; and *Fauna Malay Pen., Rept.*, p. 36.

A specimen in the British Museum labelled "Bengal" seems to be the only evidence for the occurrence of this not uncommon Malayan species north of Tenasserim. None of those in the Indian Museum are from Indian territory. In the Malay Peninsula *G. pulchellus* is found both in limestone caves and on tree-trunks.

Specimens:—

1769.	Johore, Malay Peninsula.	J. Wood-Mason, Esq.
15010.	Bukit Kutu, Selangor.	Selangor Mus. (Ex.)
15011.	Gunong Anging, Negri Sembilan.	" " "

Gymnodactylus variegatus (Blyth).

(Plate xvi, fig. 2).

Nautilinus variegatus, Blyth, *Journ. As. Soc. Bengal* XXVIII, p. 279 (1829) ; Boulenger (*Gymnodactylus*), *Faun. Brit. Ind., Rept.*, p. 70.

A reference to the original description shows that the type came not from Moulmein but from the interior of what is now the Amherst district: probably from the Dawna Hills, in which our second specimen was recently captured.

The type is in excellent condition, except that its colours have faded considerably, preserving only the outlines of the original markings.

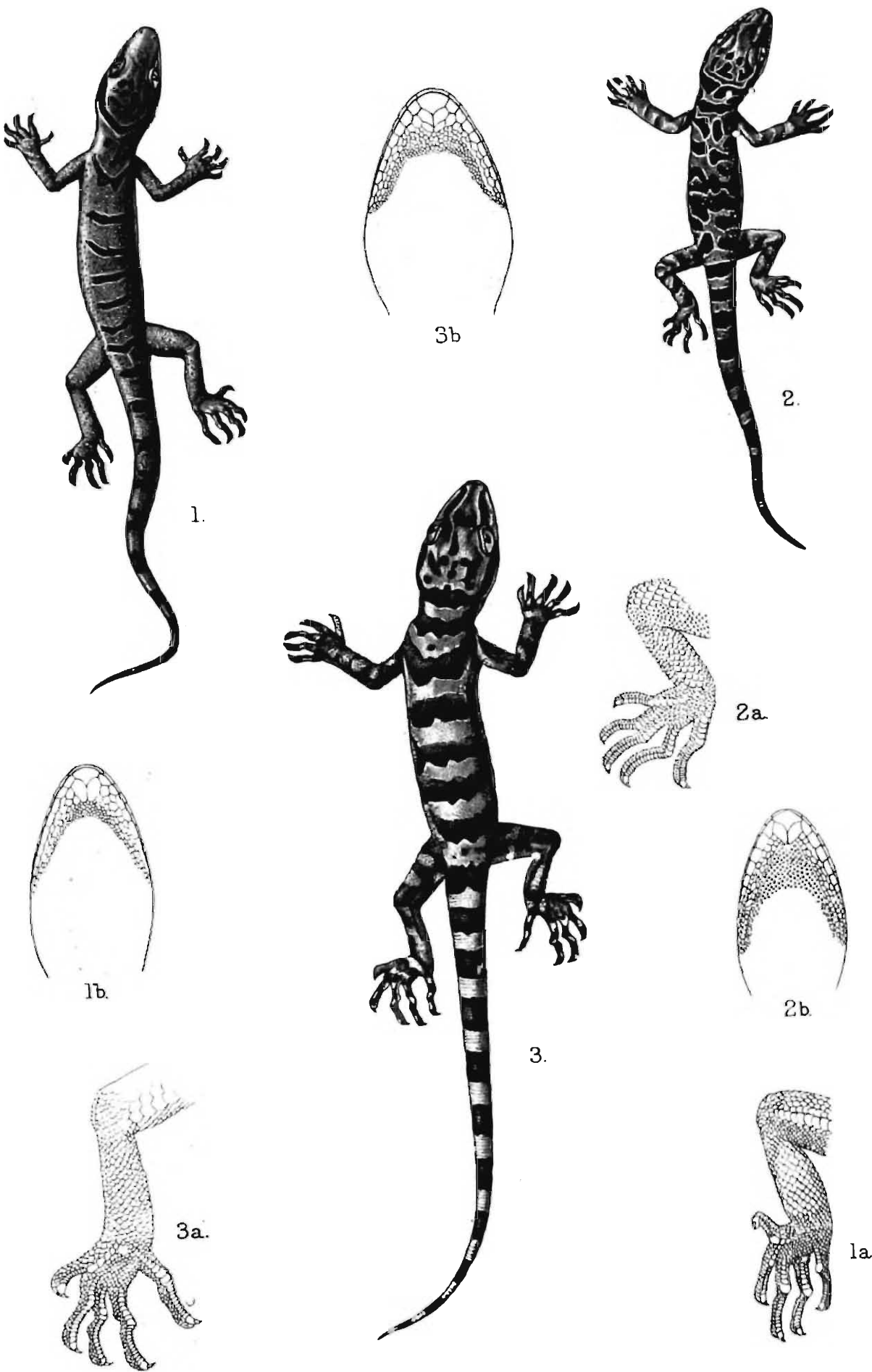
Specimens :—

6188 (Type).	Country inland from Moulmein.	W. Atkinson, Esq.
16732.	Between Thingannyinaung and Sukli, Dawna Hills, Amherst dist., Tenasserim.	F. H. Gravely, Esq.



EXPLANATION OF PLATE XVI.

- FIG. 1.—*Gymnodactylus consobrinoides*, Annand. Type, ♂
FIG. 1*a*, hind leg, $\times 2$. FIG. 1*b*, chin-shields, $\times 2$.
,, 2.—*Gymnodactylus variegatus* (Blyth). Young female from
Dawna Hills.
FIG. 2*a*, hind leg, $\times 2\frac{1}{2}$. FIG. 2*b*, chin-shields, $\times 2$.
,, 3.—*Gymnodactylus fasciolatus* (Blyth). Male from Kumaon.
FIG. 3*a*, hind leg, $\times 2$. FIG. 3*b*, chin-shields, $\times 2$.



C. Chowdhary, del.

Barnes, Collis, Derby.

INDIAN SPECIES OF GYMNODACTYLUS.

EXPLANATION OF PLATE XVII.

FIG. 1.--*Gymnodactylus montium salsorum*, Annand. Type, ♂.

FIG. 1*a*, hind leg, × 2. FIG. 1*b*, head in profile, × 2.

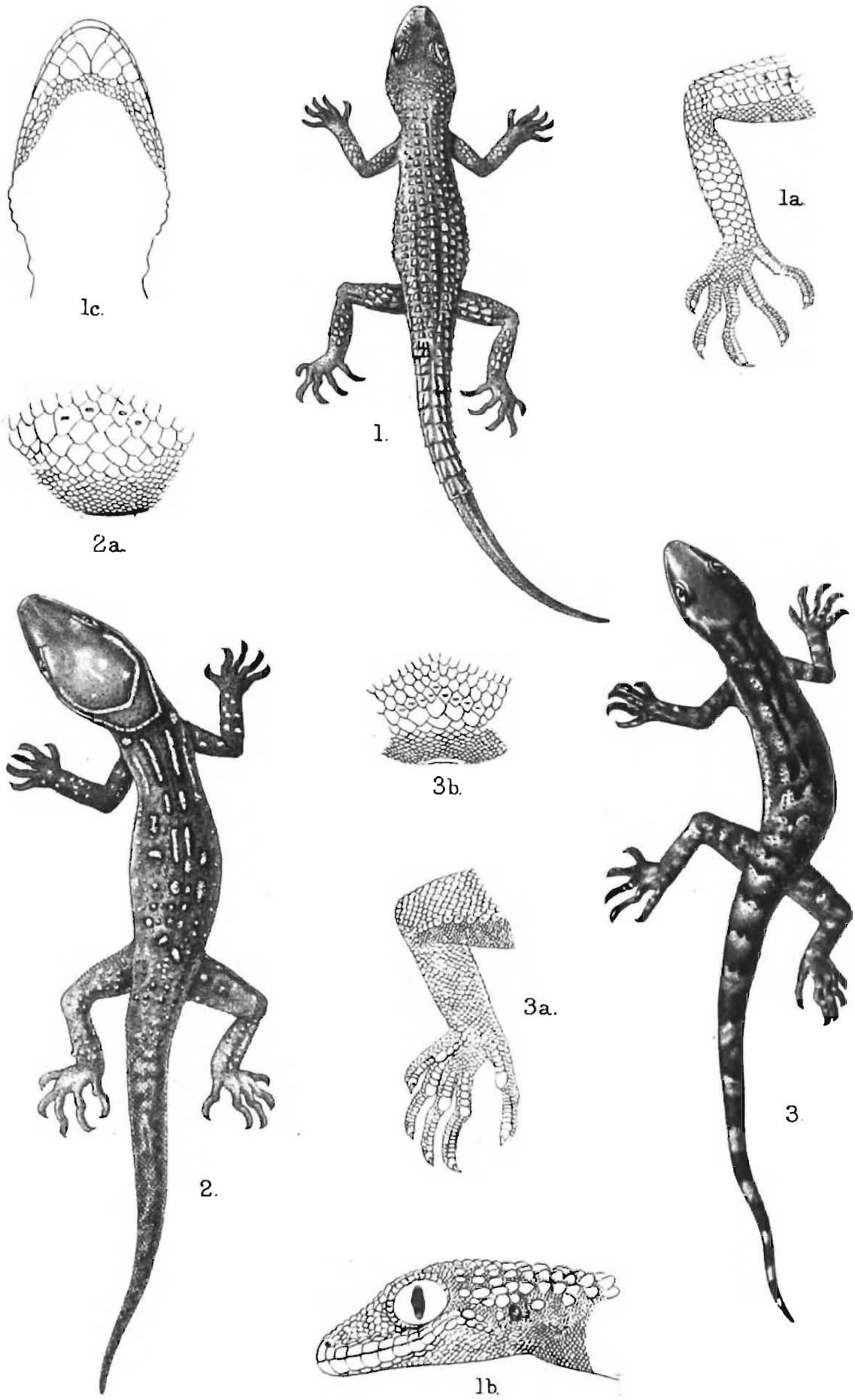
FIG. 1*c*, chin-shields, × 2.

„ 2.—*Gymnodactylus oldhamii*, Theobald. Type, ♂.

FIG. 2*a*, praeanal pores of normal male, × 3.

„ 3.—*Gymnodactylus gubernatoris*, Annand. Type, ♂.

FIG. 3*a*, hind leg, × 2. FIG. 3*b*, praeanal pores, × 3



A.C. Chowdhary, del.

Bemrose, Colla, Del by

INDIAN SPECIES OF GYMNODACTYLUS.

XXII BUTTERFLIES OF THE GENUS
PARNASSIUS
IN THE COLLECTION OF THE INDIAN
MUSEUM

By ANDRÉ AVINOFF, F.E.S.

In the summer of 1912 I made a journey by way of Kashmir, Ladak, the Karakorum and Chinese Turkestan from India to Russia for the purpose of lepidopterological investigations. On my way through Calcutta I received the kind permission of Dr. Annandale to look through the collection of butterflies in the Indian Museum. I was very sorry not to be able to spend more time in studying these precious documents; for I had just time to gain an idea of the great scientific value of the material present in the collection, which contains the types of Lionel de Nicéville and other entomologists.

In the following paper I give a list of the forms of the genus *Parnassius* preserved in the collection of the Museum. The order adopted seems to show the natural gradation of the development of the *Parnassius* type, connecting it systematically with *Doritis*, a genus which links *Parnassius* with the other Papilionidae.

1. *Parnassius charltonius*, Gray.

Tehri Garhwal; Kulu Kharbu, 13,000 feet; Kokser, Lahaul, 22-vii; Nila Valley, Kutie Pass, Ladak, ix.

The specimens from these localities seem to belong to the typical form, though strictly the real *charltonius* was described from Chinese Tartary (from some place in Tibet near the frontier of Ladak). They are of rather small size and have the red ocelli reduced.

I found this form at Rupshu, Sumkil, at 16,000 feet (18-vii) and the Shera-la Pass in Ladak.

var. *deckerti*, Verity.

Northern side of Darkot Pass, ca. 12,000 feet; 15-vii-95 (A. W. Alcock): quite typical. Shundar, Chitral; 1-viii.

Shera-la specimens are transitional.

var. *princeps*, Gr. Gr.

Turkestan. Probably from Trans-Alai or Alai, as this is the locality in which the form was found by Grum in 1884 and caught by me in 1908.

2. *Parnassius imperator*, Oberth.

Ta-Tsien-lou. From Ch. Oberthür's collection.

var. *angustus*, Frust.

Kamba-jong, Tibet; vii-1903.

The specimens in my own collection also came from Kamba-jong.

3. *Parnassius delphius*, Ev., var. *fuldussica*, Verity.

Tian-Chian, Fuldus, 9000 feet; vii-1879, caught by S. Alpheraky.

var. *staudingeri*, Bang-Hass.

Hissar Mountains.

var. *chitralica*, Verity.

Shundar, Chitral, 10-viii. Very few examples of this form are known. There are two in the British Museum and four in my own collection. Localities:—Kila-drosh, Shundar, Baroghil.

var. *stoliczkanus*, Moore.

W Tibet, Rupshu, Lachu Ling Pass, 16,000 feet; vii.

Bara Lacha Pass, N. of Lahoul, 16,000 feet; 18-iv-79.

The specimens in my collection come from Rupshu, Sumkil and Tagalang-la, ca. 17,000 feet; vii.

4. *Parnassius hardwickii*, Gray.

This very variable species has different geographical and seasonal forms. Some of the specimens in the Indian Museum are as dark as ab. *charino*, Kirby, and some as pale as ab. *otos*, Frust.

Punjab: Sutlej Valley, 10,000 feet; viii. Kulu. Lahoul. Pangi, 10,000 to 13,000 feet; vii (light form = *otos*, Frust.). Kangra, Jalauri (pale form).

Tibet: Nila (an aberration with the red ocelli of the upper and lower wings absent). Phari-jong; viii-ix (pale form). Chumbi (pale and dark forms).

Sikkim: Gnatong (dark form).

The last form represents the typical *charino*, Kirby.

5. *Parnassius acco*, Gray.

Tibet near Sulphur Springs; 10-vii-96.

This butterfly is represented in very few collections. I have it from Kangma (Tibet), S. W. Tibet, Shera-la in Ladak, Rupshu, Tagalang-la and Sumkil. The specimens in the British Museum come from S. W. Tibet; Tibet lat. 34° 47' 10" N., long. 81° 40'

20" E.; Lupsang; Karakorum and Chumbi. M. Ch. Oberthür and the Hon. W. Rothschild have it from S. Tibet near the Sikkim Boundary.

6. *Parnassius szechenyi*, Friv.

Kuku-nor.

var. *germanae*, Aust.

Ta-Tsien-lou.

7. *Parnassius tenedius*, Ev.

Siberia (probably Altai Mts.).

8. *Parnassius honrathi*, Stgr.

Bokhara.

Known in other collections from Hissar Mts., Gharm in Bokhara, Chorog in the Pamirs, etc.

9. *Parnassius apollonius*, Ev.

Kuldja.

10. *Parnassius apollo*, L., var. *pyrenaicus*, Harc.

Pyrenees.

var. *geminus*, Stich.

Alps.

var. *alpherakyi*, Krulik.

Altai.

var. *sibirica*, Nordm.

Tian-Chian.

Not *hesebolus*, as on the label.

var. *chryseis*, Oberth.

Syr-Darja.

This locality indicates not the river Syr-Darja but the province. The specimen comes very probably from some place near Issyk-kul (lake) in the Alexander mountains.

11. *Parnassius nomion*, Fisch.-Wald.

Siberia (some locality in the Altai).

var. *nomius*, Gr. Gr.

Kuku-nor.

12. *Parnassius delius*, Esp.

Alps.

var. *intermedius*, Men.

(=*altaica*, Men., =*phoebus*, Fab.)

Altai.

var. *smintheus*, Doubl.
Colorado.

13. *Parnassius discobolus*, Alph. (Stgr.).
Tian-Chian.

var. *insignis*, Stgr.

Shundar. The only two other known specimens of *discobolus* from British limits are in my collection (also from Shundar, Chitral).

Another *insignis* in the Museum has the label Kuku-nor, which is sure to be wrong.

var. *romanovi*, Gr. Gr.
Pamir (most probably from Trans-Alai).

14. *Parnassius thibetanus*, Ober.
Ta-Tsien-lou.

15. *Parnassius mercurius*, Gr. Gr.
Kuku-nor (not Pamir, as written on the label).

16. *Parnassius actius*, Ev.
Kisil Art, 14,000 feet.

17. *Parnassius himalayensis*, Elwes.
(=*jacquemontii*, Boisd.)

Garhwal: Phulaldaru, viii. Tehri Garhwal, vii. Nilung Pass, 15,000 feet, vii. Kulu.

Punjab: Kailang, Lahoul; 20-vii-79.

Ladak: Chang-la, 4000 feet.

Chitral, 12,000 feet.

Badakshan.

The last locality is especially interesting, as so little is known of the fauna of Afghanistan.

18. *Parnassius rhodius*, Honr., var. *variabilis*, Stich.
Djirg-thal (Alai Mts.).

var. *chitralensis*, Verity.
Shundar, 1—10-viii; Darkot, 15-vii-95.

19. *Parnassius epaphus*, Boisd.

Tibet near Sulphur Springs, 17,600 feet; vii-96 (rather small, like my specimen from Rupshu).

N. of Chang-la (not *P. jacquemonti* as marked on the label).

var. *cachemiriensis*, Ober.

Kashmir: Deosai Plains; 13,000 feet, 12-viii.

Baltistan: Scoro-la; 15,000 ft., 3-viii.

var. *sikkimensis*, Elwes.

Sikkim: Lachen to Lachung 12,000-18,000 feet.

Tibet: Phari Jong.

var. *poeta*, Ober.

Ta-Tsien-lou.

20. *Parnassius orleans*, Ober.

Ta-Tsien-lou.

var. *groumi*, Ober.

Kuku-nor.

Not the typical *orleans* as on the label.

21. *Parnassius eversmanni*, Men.

N. Siberia: Lena; 20-vi.

22. *Parnassius clarius*, Ev.

Altai.

ab. *dentata*, Aust.

Altai.

23. *Parnassius nordmanni*, Men., var. *minima*, Honr.

Caucasus: Dagestan.

24. *Parnassius mnemosyne*, L.

Scandinavia; S.W. Russia.

25. *Parnassius stubbendorfi*, Men.

Probably Altai.

var. *tartarus*, Aust.

Kuku-nor.

var. *koreana*, Verity.

Korea.

var. *citrinarius*, Motsch.

Japan.

XXIII NEMESTRINIDEN (DIPT.) AUS DEM INDIAN MUSEUM IN CALCUTTA.

Von B. LICHTWARDT, Charlottenburg.

1. *Hirmoneura cingulata*, Lichtw.

Ist von mir nach einem ♀ aus dem Brit. Mus. "India, ex coll. Saunders" beschrieben worden (Deutsch. Ent. Zeitschr. 644, 50; 1909). Es liegen 2 ♂ vor, welche von Herrn Superintendent Annandale in Phagu, Simla Hills, 9000 ft., 12-v-09, gefangen sind. Augen dicht und stark pubescent. Stirn kaum schmaler, als wie bei dem ♀, so dass die Augen des ♂ deutlich getrennt sind. Die Behaarung ist reichlicher und etwas länger und mehr gelblich. Dadurch hebt sich die ring-förmige schwarze Behaarung der Hinterleibs-segmente besser hervor; sie bildet an den Seitenrändern fast kleine Büschel von abwechselnd gelben und schwarzen Härchen. Die grau tingierten Flügel sind im costalen Teil leicht gebräunt. Fühler, Taster und Beine gelbrot, Tarsen kaum dunkler. Schinger schwarzbraun. 11-12 mm.

2. *Hirmoneura annandalei*, sp. nov.

Diese neue Art, welche ich dem Entdecker zur Ehre und zugleich als Zeichen meines Dankes für Unterstützung meiner Arbeit benenne, gleicht der *H. cingulata* ganz ungemein in Grösse und Färbung. Doch trennen die vollkommen kahlen Augen der neuen Art auf den ersten Blick diese beiden Verwandten. Bei *H. cingulata* sind durch die längere Behaarung die Ringe deutlich; bei *H. annandalei* ist die sonst gleich gefärbte Behaarung sehr kurz, wodurch die braune Farbe des Körpers mehr sichtbar wird und das Tier mehr uniform wirkt, was besonders bei den ♀ auffällt. Fühler, Taster, Beine gelbrot, Schwinger schwärzlich, Bauch und Thorax-unterseite weissgrau, Flügel deutlich grau tingiert mit dunklerem Vorderrand. 11-13 mm.

5 ♂ 3 ♀, Simla, W. Himalayas, 7000 ft., 9-v-10 und Kufri, Simla Hills, 8000 ft., 11-v-09 (*Annandale*), "common near Simla, hovering in the air in sunny spots on the road (often a considerable number of individuals together) and sometimes settling on the mud at the edge of pools of water."

3. *Hirmoneura basalis*, Lichtw.

Ich hatte diese ansehnliche Art von einem Händler gekauft mit der Vaterlands-angabe: "Ecuador, iii-1899" und "Deutsch.

Ent. Zeitschr. 595, 92-93, fig. 3 (1910)“ veröffentlicht. Diese Angabe ist sicher falsch gewesen, wie der genaue Vergleich mit einem ♂ des Ind. Mus. ergibt. Das vorliegende Stück ein ♂ trägt den Zettel: Dawna Hills, 2000-3000 ft., L. Burma, 3 iii-08 (N.A.). Beide Tiere sind ♂ und vorzüglich erhalten. Die schöne, dunkel zimtbraune Fliege mit der elfenbeinweiss gefärbten Basis des Hinterleibes ist leicht kenntlich. Die vorderen Beinpaare sind hellbrann, dünn weisslich pubescent, sowie die Hinterschenkel; die Hinterschienen und Tarsen aber dunkelbraun durch dichte schwärzliche Pubescenz dick erscheinend. Das Datum des Fanges scheint für mein Exemplar richtig zu sein “iii-1899.” Es war auf einem besonderen kleinen Zettel vermerkt; so ist die Patria-Angabe wohl verloren gegangen oder durch Unachtsamkeit das vorliegende Stück in einen falschen Kasten gesteckt worden. “Bei der überaus genauen Angabe im Indian Museum über Ort, Zeit und besondere Fang gelegenheit, welche den Tieren (Nemestriniden wie zahlreichen Dolichopodiden) beigegeben ist, kann mein Exemplar nur aus Nord-Indien stammen.”

4. *Hirmoneura opaca*, Lichtw.

D.E.Z. 643, 49 (1909).

Von dieser Art liegen 5 ♂ 8 ♀ vor, welche sich durch die stark behaarten Augen sogleich von *H. austeni* oder *ochracea* unterscheiden. Bei Gelegenheit der Beschreibung von *H. obscura*, Meig. und *villosula*, Lw. (l. c. 514; 1909) bemerkte ich bereits, dass die Augen nicht “nackt” sind, wie Schiner (F.A.i. 46) angibt. Bei diesen Arten ist die Pubescenz der Augen so zart, dass sie nur mit einer guten Lupe erkannt werden kann; bei *austeni*, *ochracea*, *cingulata* stark pubescent; bei *opaca* sind die Augen deutlich behaart, so dass man die Härchen ohne Lupe erkennen kann. Diese Eigentümlichkeit bietet ein gutes Merkmal für die Art; als Gattungsmerkmal ist es nicht zu verwenden. Düstere, schwärzliche, grau bestäubte Art mit dünner, zarter, grauer Behaarung; ca. 15 mm; Taster und Fühler schwarz, Stirn mit langen, schwarzen Haaren. Gesicht, Kinn, Brust und Thorax seiten mit gelblichgrauen längeren Härchen. Die ganze Oberseite zeigt einen dünnen schiefergrauen Reif. Auf den Hinterleibssegmenten liegt eine schwer erkennbare Zeichnung von einem Mittelfleck und zwei queren Seitenfleckchen. Diese ist nur an frischen Stücken bei auffallendem Licht sichtbar; die vorliegenden Stücke sind alle etwas “ölig.” Die Flügel sind dunkel schwarzgrau. Ein Stück ist von derselben Herkunft wie die Type im Brit. Mus. 1 ♀ Kangra valley, N.-W Himalayas, India, 4500 ft., Nov., 1899 (G. C. Dudgeon). Die übrigen ♀ aus Mussooree, W. Himalayas, ein ♀ aus Pharping, Nepal.—Die Männchen machen zunächst den Eindruck, als wenn sie einer anderen Art angehören könnten. Zwei der Exemplare sind einigermassen erhalten, die drei anderen stark durch Schimmel incrustiert. Bei dem einen dieser Stücke war nach gründlicher Reinigung die characteri-

stische Zeichnung der Tergite erkennbar: auf schiefergrauem Grunde ein Mittel und zwei quere Seitenflecke. Die Sternite sind mehr oder weniger rötlichbraun mit hellgrauer (♀) oder gelblicher (♂) Behaarung. Augen deutlich getrennt, lang und dicht, dunkelbraun behaart. Stirn über den Fühlern mit langen schwarzen Haaren. Thorax und Hinterleib möchte ich als "stichelhaarig" bezeichnen. Ueber die allgemeine starke, dunkelbraune Pubescenz ragen bleiche gelbe, bei auffallendem Licht seidenglänzende, und auch einzelne ganz schwarze Haare hervor, welche besonders an den Seiten der Tergite dichter stehen; 3 ♂ aus Mussooree, 2 ♂ von den Simla Hills.

5. *Nemestrinus niveus*, Lichtw.

♂ und ♀ aus Kogyar, Eastern-Turkestan (*Stoliczka*). (Zeitschr. f. Hym. und Dipt. 440. 1. 1907 und D.E.Z. 113. 1. 1909). Die beiden Stücke sind wohl einst in Spiritus gesammelt worden, so dass man von der rötlichen Farbe des Leibes und der Beine mehr sieht als von der schneeweissen, seidenglänzenden Behaarung, welche sonst die schönen Tiere schmückt.—Ein letztes Exemplar, ein *Nemestrinus* mit halbkugeligem Kopf und zusammen stossenden Augen und bandiertem Hinterleib—"no history"—bildet den Schlusspatium der kleinen interessanten Sammlung. Schlechte Conservierung und das Fehlen der Vaterlandsangabe machen eine Beschreibung unmöglich.

MISCELLANEA.

MAMMALS.

A SUBFOSSIL BAT'S SKULL FROM RODRIGUEZ I.—[In the late Dr. J. Anderson's Catalogue of the Mammals in the Indian Museum (pt. I, p. 100; 1881) a subfossil bat's skull from the Rodriguez Island is referred to *Pteropus rodricensis*. As some doubts were felt as to the correctness of this identification, the specimen was recently sent to Dr. Knud Andersen, who reports on it as follows.]

"The subfossil *Pteropus* skull from the island of Rodriguez is that of a *Pteropus niger* (not, as believed by the late Dr. John Anderson, the widely different *Pt. rodricensis*).

"For two reasons this specimen is of more than ordinary interest:—First, because the species is said now to be very rare, if not actually extinct; second, because (so far as I am aware) it was hitherto known from Réunion and Mauritius only, so that this would mean to be the first record from the more outlying island of Rodriguez.

"The skull is that of an aged individual, whereas that figured in Cat. Chir. B. M., 2nd edition, I, p. 217 is subadult only."

KNUD ANDERSEN.

REPTILES.

A LIST OF THE REPTILES OBTAINED BY MR. H. STEVENS IN UPPER ASSAM AND THE EASTERN HIMALAYAS.—Apart from a lizard, *Gymnodactylus khasiensis*, Jerdon, obtained at Dejoo, North Lakhimpur, Upper Assam, and a frog, *Rana liebighii*, Gthr., from 11,500 ft. altitude at Sandakpho (Nepal-Sikkim frontier), the species represented in the small collection submitted to me for identification belong to the Ophidia.

1. *Typhlops diardi*, Schleg.

Dejoo; Silonibari; base of Daffa hills, Upper Assam.

2. *Tropidonotus parallelus*, Blgr.

Maikola valley, East Nepal, 7000—10000 ft.

Two specimens, ♂ (V. 196; C. 102) and ♀ (V. 172; C. 86).

The former is remarkable for the high number of ventral and subcaudal shields. Back olive-green, sides brown, the light dorso-lateral band scarcely indicated; sides of ventral and subcaudals red.

3. *Tropidonotus piscator*, Schneid.
Dejoo, North Lakhimpur, Upper Assam.
4. *Tropidonotus himalayanus*, Gthr.
Dejoo, North Lakhimpur, Upper Assam.
5. *Tropidonotus stolatus*, L.
Dejoo, North Lakhimpur, Upper Assam.
6. *Tropidonotus chrysargus*, Schleg.
Silonibari, North Lakhimpur, Upper Assam.
7. *Pseudoxenodon macrops*, Blyth.
Maikola valley, East Nepal.
8. *Blythia reticulata*, Blyth.
Dejoo, North Lakhimpur, Upper Assam, and base of
Dafla hills.
9. *Lycodon jara*, Shaw.
Dejoo, North Lakhimpur, Upper Assam.
10. *Coluber radiatus*, Schleg.
Dejoo, North Lakhimpur, Upper Assam.
11. *Simotes albocinctus*, Cantor.
Dejoo and base of Dafla hills.
The specimens belong to the typical form.
12. *Dipsadomorphus hexagonotus*, Blyth.
North Lakhimpur ; base of Dafla hills.
13. *Psammodynastes pulverulentus*, Boie.
North Lakhimpur ; base of Dafla hills.
14. *Dryophis prasinus*, Boie.
Dejoo, North Lakhimpur, Upper Assam.
15. *Naia tripudians*, Merr.
North Lakhimpur ; base of Dafla hills.
A young specimen referable to the var. *fasciata*, Gray,
with 25 scales across hood, 21 across body ; V. 196 ;
C. 62.
16. *Lachesis gramineus* (Shaw).
North Lakhimpur ; base of Dafla hills.

G. A. BOULENGER.

CRUSTACEA.

NOTES ON PLANKTON FROM THE CHILKA LAKE.—The tow-nettings on which the following notes are based were taken by Dr. Annandale and Mr. Kemp on the surface of the Chilka Lake off Barkul in the Puri district of Orissa in July, 1913.

Of three samples that I have examined, the first contained only a number of immature Mysids, and a small quantity of detritus. The remaining two samples, however, contained a certain number of planktonic organisms.

The main bulk of the plankton in sample II consists of vegetable debris and Copepoda, while the third sample contained numerous Algae.

By far the commonest Diatom present was a species of *Nitzschia*: in addition there were present several different species of *Chaetoceras*, among which I was able to recognize *G. diversum*, *C. peruvianum* and *C. lorenzianum*. A single species of *Rhizosolenia*, closely allied to if not identical with *R. setigera*, was present, but was extremely rare, only a very few individuals being found, while a few examples of species of *Ditonula* and *Melosira* were also seen, and a few filaments of a species of both *Nostoe* and *Oscillaria*.

Dinoflagellates were present in considerable numbers, and of these by far the commonest was *Ceratium fusus*, Ehr. Dr. Annandale tells me that at the time the collections were made numerous minute phosphorescent points were seen, and these were no doubt due to these individuals. Among other forms were at least two species of Peridinium's that I have been unable to identify.

The Copepoda obtained belong to three species.

1. *Paracalanus crassirostris*, Dahl.

Paracalanus crassirostris, Dahl. "Die Copepoden Fauna des unteren Amazonas". Berichte der Naturforschenden Gesellschaft zu Freiburg. Zool. Abhand. n. ser. Vol. 8, p. 21, pl. i, figs. 27-28. Freiburg and Leipzig, 1894.

? *Paracalanus pygmaeus*, T. Scott. "Entomostraca from the Gulf of Guinea". Trans. Linn. Soc. Zoology, series 2, Vol. VI, p. 27, pl. i, figs. 1-8. London, 1893.

Paracalanus crassirostris, Thompson and A. Scott. "The Copepoda". Ceylon Pearl Oyster Fisheries and Marine Biology, pt. I, p. 243. Royal Society, London, 1903.

Numerous examples of this species (both ♂ and ♀) were present in the collections. The form of the rostrum, the general proportions of the body and abdomen and the structure of the 5th pair of legs in the female exactly correspond with the figures given by Dahl, and I have no doubt that the present specimens belong to his species.

Dahl only obtained examples of the female and as the male differs in several details, I have given below a few notes on the main points of its structure.

♂. - Total length 0.39 mm.

Proportions of cephalothorax and abdomen 3 : 1.

The head and 1st thoracic segment are fused completely and the 4th and 5th thoracic segments are partially so, but the line of separation can in most cases be detected towards the ventral side.

The abdomen consists of the usual five segments having with the furcal rami the following proportions:—6 : 7 : 5 : 4 : 7 : 7.

The furcal rami are not quite twice as long as broad and have convex inner borders.

The 1st antennae, as in other members of the genus, have a large basal portion consisting of several fused segments, and reach as far as the posterior thoracic margin.

The 2nd antennae also show the nipple-like termination of the exopodite as in all adult males of both *Paracalanus* and *Acrocalanus*.

As regards the swimming legs, these closely resemble those of *Paracalanus parvus*: in the 2nd-4th pairs of legs, both exopod 2 and 3 have serrated margins, and the distal as well as the proximal part of the border of the 3rd exopod bears teeth.

The 5th pair of legs is asymmetrical, but the most striking feature in this species is the remarkable length of the right leg; this consists of the usual number of segments, but when folded back it reaches beyond the tip of the furca by the last two segments, whereas in the other males of the genera, it only reaches to the last abdominal segment.

T. Scott has described a form *P. pygmaeus* from the Gulf of Guinea; according to Giesbrecht this is the same as *P. crassirostris*, Dahl; but his description of the female, which was the only sex he obtained, while closely resembling the present specimens as regards the general shape of the body, yet differs very materially in the arrangement of the spines on the swimming feet: according to him, his examples possessed spines on both the last joints of the 2nd-4th swimming feet: in the present specimens, spinulation was completely absent in exopod 2 in all the swimming feet of the ♀, nor in this sex was there any trace of spines on the distal part of the margin in exopod 3. I am inclined, therefore, to believe, that these two forms are not the same.

Thompson and Scott have recorded *P. crassirostris* from the coastal waters of Ceylon. I have recently examined a large collection from the Ceylon Pearl Banks, but have seen no examples of this species.

It is interesting to note that Dahl's specimens were obtained in brackish water having a salinity ranging from 11.8 to 12.8.

2. *Acartia centrura*, Giesbrecht.

This species seems to be a common inhabitant of Indian waters. The examples in the present collection are interesting in that they are slightly smaller than the normal, measuring ♂ 1.028: ♀ 1.13.

In both sexes the general structure of the body and appendages is as in normal examples, but the spines on the posterior thoracic margin, and the distal border of the abdominal segments are much smaller than is the case in specimens obtained in the open sea. It would seem probable that these are a "depauperized" form.

3. *Oithona* sp.

Not only were numerous adults of all species present, but also a large number of immature forms and nauplii larvae, thus showing that the three species were all actively breeding in the lake.

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