XII. INDIAN ISOPODS

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Some time ago Dr. Annandale entrusted me with a small collection of Isopoda from the Indian Museum, mostly terrestrial species, but some of aquatic though not marine habitat. The present paper is concerned with a part of this collection, distributed between the two tribes of the Flabellifera and the Oniscidea.

In the former tribe only the genera *Alitropus* and *Sphaeroma* are here represented. But I may take this opportunity of calling attention to two other generic names included in it. The elder of these is *Rhexana*, Schiödte and Meinert, 1883, in the family Cymothoidea. It has recently been again brought into notice by Dr. Thienemann in his excellent *Contributions to the knowledge of the Isopod-fauna of East Asia*, 1910. This name, however, which is not recorded in Scudder's *Nomenclator Zoologicus*, 1882, was preoccupied by Dr. Sörensen in 1879.[1] I therefore propose as a convenient substitute for it the form *Rhexanella*, still at present contented with the single species *R. verrucosa*, for which the genus was founded. The other generic name in question is *Brotherus*, Budde-Lund (in Voeltzkow's *Reise in Ostafrika*, vol. ii, p. 306, 1908), included by its author in the family Alcironidae, Hansen, which, as pointed out in 1904, should rather be called Corallanidae. But *Brotherus* is not distinguishable from *Argathona*, which I named in 1905, in a new family Argathonidae, unless the fusion of the fourth and fifth joints in the maxillipeds of *Argathona normani* suffices to distinguish that type species generically from *Brotherus longicornis*, Budde-Lund, 1908, and *Argathona reidi*, Stebbing, 1910, in which there is no such fusion. This distinction being disregarded, all three species will belong to *Argathona*, but if on the contrary it be thought to have generic value, *Argathona reidi* must be transferred to *Brotherus*.

With regard to the tribe Oniscidea it is well known that Budde-Lund's *Isopoda Terrestria*, 1885, was for long the leading treatise on the subject. Then for a considerable period the study was left almost entirely to the industry of M. Adrien Dollfus. During the last few years, however, there has been a great change. Many capable authors have found the group attractive. Instead of scanty illustrations or none at all, copious and elaborate drawings of structural details have been supplied, especially in the works of Sars, Racovitza and Budde-Lund. The new light is somewhat

[1] *Naturhistorisk Tidsskrift*, ser. 3, vol. xii, p. 124, footnote. *Rhexana* is here substituted by Sörensen for the preoccupied name *Anelasma* which he gave to a genus of Opiliones in 1873.

dazzling. It makes the inadequacy of earlier descriptions painfully felt. The systematist is warned against placing his trust in easily observed characters, for thereby he runs the risk of obscuring important variations and of mixing up new species with old. As might be expected, the fuller study of the various organisms has led to a multiplication of genera. Many of these indeed are introduced in the disguise of subgenera, like the rich heiresses in modern works of fiction, who hire themselves out as governesses or typists, just to see how it feels. As the ladies eventually come by their own, so subgenera in due course turn into genera. Surely they might as well have been so called from the outset. Whether the status of the names be generic or subgeneric, I have in this paper argued that *Metoponorthus*, Budde-Lund, must give way to *Porcellionides*, Miers. Also I have found it necessary to introduce two new genera by the names *Paraperiscyphis* and *Exalloniscus*. Two new species are proposed, *Sphaeroma annandalei* in one tribe and *Paraperiscyphis travancorensis* in the other.

Tribe **FLABELLIFERA.**

Family AEGIDAE.

1879. *Aegidae*, Schiödte and Meinert, *Naturhist. Tidsskrift*, ser. 3, vol. xii, p. 325.
1890. ,, Hansen, *Cirolanidae*, pp. 58 (294), 79 (315).

Gen. ALITROPUS, Milne-Edwards.

1840. *Alitropus*, Milne-Edwards, *Hist. Nat. Crust.*, vol. iii, pp. 234 (*Alitrope*), 245.
1879. ,, Schiödte and Meinert, *Naturhist. Tidsskr.*, ser. 3, vol. xii, p. 403.
1890. *Rocinela* (*Alitropus*), Hansen, *Cirolanidae*, pp. 80 (316), 170 (406).
1892. *Rocinela*, Max Weber, *Zool. Ergebnisse einer Reise in Niederl. Ost-Ind.*, vol. ii, p. 553.
1893. *Alitropus* (*Rocinela*), Stebbing, *Hist. Crust.*, p. 348.

While Hansen and Max Weber quite rightly notice the close approximation of the genera *Rocinela* and *Alitropus*, there is a notable difference between the stout structure of the anterior limbs in most species of the former and their slenderness in *Alitropus typus*. If some species allotted to *Rocinela* have these limbs slender, it may prove advisable to transfer such forms to *Alitropus*, and so help to disburden *Rocinela*, which has recently received so many additions. It is not a little unsuitable to have a *Rocinela typus* (Milne-Edwards), which is in no sense typical of Leach's *Rocinela*.

Alitropus typus, Milne-Edwards.

1840. *Alitropus typus*, Milne-Edwards, *Hist. Nat. Crust.*, vol. iii, p. 247, pl. 33, figs. 1-7.

1879. *Alitropus typus*, Schiödte and Meinert, *Naturhist. Tidsskr.*, ser. 3, vol. xii, p. 404, pl. xiii, figs. 10-12.
1892. *Rocinela typus*, Max Weber, *Zool. Ergebn. einer Reise in Niederl. Ost-Ind.*, vol. ii, p. 553.

Of the two specimens which I refer to this species one measured about 14 × 6·5 mm., the other was only 6 mm. long, the front part much narrower than the remainder, and the fifth peraeopod shorter than the fourth.

Locality.—The label states that they were obtained by Dr. Annandale, 7-xi-08, from Shasthancottah Lake, 12 miles N. N. E. of Quilon, Travancore.

Family SPHAEROMIDAE.

1910. *Sphaeromidae*, Stebbing, "South African Crustacea," Part 5, in *Annals of the S. A. Mus.*, vol. vi, p. 426.

Under the above reference the history of this long-standing and much discussed family and its leading genus *Sphaeroma* can be traced.

Gen. SPHAEROMA, Bosc.

1802. *Sphaeroma*, Bosc, *Hist. Nat. Crust.*, vol. ii, p. 49.

Sphaeroma annandalei, sp. nov.

(Plate x.)

Superficially this species bears so great a resemblance to *Sphaeroma walkeri*, Stebbing, that I was at first tempted to regard it as at most an interesting variety. Such differences as might be detected by minute comparison of the respective antennae, limbs, pleopods and uropods, could not easily be insisted on as of specific importance. Even the tuberculation of the dorsal surface, though distinctive, might be regarded as a very variable feature. In various points it also agrees with *Sphaeroma terebrans*, Bate. But a thorough examination has shown that the three forms cannot possibly be confounded together.

In the new species distinct tuberculation begins on the seventh segment of the peraeon. On the composite anterior portion of the pleon there are two strongly marked submedian tubercles, and on the telsonic portion there are two submedian pairs in succession followed by a single median tubercle and flanked on either side by a longitudinal row of three tubercles, besides some others more laterally placed. The telsonic apex is obtusely narrowed, not quite so much as in *S. terebrans*, but far more than can be truthfully shown in a dorsal view of the undissected specimen. In *S. walkeri* the apical margin is broadly rounded.

The first antennae have an elongate slender third joint, to which succeed eight to ten joints of which the first is the longest.

In the second antennae the third joint is rather shorter than the fourth, and the fourth than the fifth, all three being closely fringed with setules; the flagellum has eighteen joints each with an apical tuft of setae.

The upper lip has the margin obtusely triangular, not as in *S. walkeri* feebly trilobed and in *S. terebrans* evenly curved.

The mandibles have the cutting edge formed by two powerful well-separated teeth, not as in *S terebrans* by what appears to be a consolidated piece. Between the cutting edge and the strong molar is a series of little spines, curving towards the molar, very different from the little tuft of spines in the other species.

The lobes of the lower lip are less narrowed distally than in *S. terebrans*. The first maxillae have three plumose setae on the inner plate, not four as in *S. walkeri*, the broad outer plate strongly setulose all along the outer margin, the apical bordered with spines, nine or more, most of them serrate, and two short smooth spines at the inner angle. The second maxillae are especially distinctive by the broad subquadrate form of the inner plate, very different from the oval apically acute shape in *S. walkeri*. The maxillipeds also differ by having the antepenultimate joint more narrowed distally.

The limbs of the peraeon are substantially alike in the two species, unless any importance can be attached to the stronger feathering in the specimens here dealt with. This armature in the second and third peraeopods, helped to some extent by extraneous accretions, gave those limbs the appearance of woolly masses, in which it was extremely difficult to determine either the outlines of the several joints or the articulations between them. The body of the animal carries some scattered setae, the borders of the side-plates of the pleon are furred, the plates of the uropods have setose margins, the number of teeth on the outer margin of the movable ramus being obscured by the thickness of the accompanying fringe.

The length of the specimen figured is about 9 mm., with a breadth about half the length.

Locality.—Port Canning, brackish water pool.

[Specimens of the species are often very abundant in the larger canals of the sponge *Spongilla alba* var. *bengalensis*, a form common in brackish water in the Gangetic delta. They are referred to on p. 78 of my forthcoming volume on the freshwater sponges, etc., in the "Fauna of British India" series, as representing a species allied to *Sphaeroma walkeri*, Stebbing.—N. A.]

The specific name is given out of respect to Dr. Annandale by whom the two specimens were obtained.

Tribe ONISCIDEA.

The species about to be considered are all included in the family Oniscidae as summarized by Budde-Lund in his Revision of 1904. Without presuming to criticise the learned author's

arrangement, except to deprecate the use of sub-families, I may observe that he places the genus *Saïdjahus* in his second sub-family Spherilloninae, and that probably his seventh sub-family will cover all the rest of the genera here considered. Thus *Paraperiscyphis* will naturally stand beside *Periscyphis* in the first section, which Budde-Lund calls Armadilloidea, *Hemilepistus* and *Porcellionides* belong to his second section called Oniscoidea, and the new genus *Exalloniscus* will find its place beside Dana's *Alloniscus* in the third section Alloniscoidea. In 1908 Budde-Lund himself gives a very reasonable premonition that the last word has not yet been said on the classification of the terrestrial Isopoda. There are in fact many parts of the world and many parts of India so little explored for animals of this group, that the future may have much to learn about its constitution.

Gen. SAÏDJAHUS, Budde-Lund.

1904. *Saïdjahus*, Budde-Lund, *A Revision of "Crustacea Isopoda terrestria,"* pp. 36, 42, 49.

The genus was instituted to receive three species, *orientalis*, *elegans* and *guttatus*, all established by Dollfus in 1898 and by him referred to his genus *Mesarmadillo*, described with three other new species in 1892 (*Ann. Soc. Entom. de France*, vol. 61, p 385) Budde-Lund assigns *Saïdjahus* to his family Oniscidae, sub-family Spherilloninae. In his synoptic view he distinguishes it from other genera of the family by the combination of characters, pleural parts of the head coalesced, flagellum of second antennae two-jointed, telsonic segment narrowed behind, sub-triangular, uropods of moderate size, reaching a little beyond the telsonic segment, the lateral margin of the first peraeon segment with a rather thick duplicature. In the formal definition on p. 49 he adds that the head has the vertical marginal line produced to the eyes, that the side-plates of the first peraeon segment are fissured behind, that the sides of the telsonic segment are incurved, and that the outer branch of the uropods is small, thin, inserted in the hind side of the peduncle. He describes, with some figures, a new species, *S. crepcr*, from Borneo.

Saïdjahus, sp.

Specimens procured by Dr. Annandale at Mandapam, Pamben Passage, S. India, in sand under stones, agree with this genus. In the length of 6 mm. these agree with *S. guttatus* (Dollfus). But in the shortness of the outer branch of the uropods they are nearer to *S. elegans*, from which they are separated by having the first joint of the flagellum of the second antennae little shorter than the second, just as is the case in *S. orientalis* (Dollfus). Not knowing how much variability the species may be liable to in these respects I abstain from giving a name to the present form.

Gen. PARAPERISCYPHIS, nov.

Periscyphis was instituted by Gerstaecker in 1873, according to Budde-Lund, who refers to the account then given of "Die Gliederthier-Fauna des Sansibar-Gebietes, nach dem Material der v. d. Deckenschen Expedition, p. 526." Budde-Lund gives a fresh definition of the genus in 1908 (*Results of the Swedish Zool. Exp. to Egypt*, No. 26A, p. 10), and names the species included under it ("Isopoda von Madagaskar und Ostafrika," Voeltzkow's *Reise*, vol. 2, p. 278). To the genus thus defined *Paraperiscyphis* is approximate in regard to the mouth-organs, but is separated from it by the following characters:—

In the second antennae the first joint of the flagellum is not longer than the second; the telsonic segment is very obtusely triangular, not narrowly produced at the apex; the inner branch of the uropods is attached not to a projection of the peduncle's base but to a notch far down the inner margin, while still further down is attached the outer branch, not especially small, both branches extending beyond the peduncle, and the peduncle itself extending beyond the telsonic segment.

Paraperiscyphis travancorensis, sp. nov.

(Plate xi.)

The present species should be taken as the type of the new genus. But *Periscyphus weberi*, Dollfus (in Max Weber's *Zool. Ergebn. einer Reise in Niederl. Ost-Indien*, vol. iv, p. 371, pl. 14, fig. 16, and in text-figs. 16 a—d, 1898), is probably congeneric.[1] For that species, however, no account is given of the mouth-organs, so that its generic position is rather uncertain. No reason is given for the spelling *Periscyphus* instead of *Periscyphis*, but there can be no doubt that Gerstaecker's genus was intended.

From the species taken at Sumatra, described and figured by Dollfus, the present form differs in various points. The rather broad conglobating body is not smooth, but covered with little minutely setulose warts. A much deeper transverse furrow than that shown by Dollfus separates the convex part of the head which carries the round prominent eyes from the forward part, which in both species shows a little median triangle between two broad lobes. While Dollfus speaks of the first segment of the peraeon as having the hind margin a little sinuous, in the present species the sides of that margin are angularly produced backward in quite an exceptional manner, with the second and third segments following suit hardly less conspicuously. In the second antennae Dollfus says that the flagellum of his species has the first joint one-third shorter than the second; in ours the second is but slightly longer than the first, apart from the apical seta which has

[1] In Lanchester's "Malay Crustacea of the Skeat Exp." (*Proc. Zool. Soc.*, p. 380, 1902) Budde-Lund, describing *Toradjia conglobator*, n. sp., says of that genus, "The *Periscyphus weberi* Df. may be placed here."

its distal half abruptly narrower than the proximal. Dollfus describes and figures the peduncle of the uropods as obtusely quadrangular, which does not at all correspond with the graceful curves of both inner and outer margins in our species. He represents the branches as narrowly cylindrical, and says that the inner equals about half the length of the outer, though his figures no doubt rightly show that the inner is the longer, as in the new species, in which these branches reach about equally far back, the inner carrying two apical setae. The New Zealand species *Actaecia opihensis*, Chilton, 1901, has uropods very similar to those of our species.

Between the antennae the head is ventrally carinate. In the first maxillae I could only make out eight apical spines, and the armature of the inner plate was undecipherable in the dried condition. The maxillipeds are very broad as in *Periscyphis*. The limbs are fringed with numerous spines, most of them pointed, but one on the apical border of the fifth joint is shown in the first gnathopod as having an obtuse plumose apex.

The larger of the two specimens measured 11 mm. in length, by about 6 mm. in breadth.

Locality.—Maddathorai, western base of Western Ghats, Travancore.

The specific name is taken from that of the region whence Dr. Annandale procured this species.

Gen. HEMILEPISTUS, Budde-Lund.

1879. *Hemilepistus*, Budde-Lund, *Prospectus Isop. terrestrium*, p. 4.
1885. ,, ,, *Crustacea Isopoda terrestria*, pp. 76, 151.
1896. ,, Dollfus, *Mém. Soc. Zool. de France*, vol. ix, pp. 526, 546.
1904. ,, Budde-Lund, *A Revision of "Crust. Isop. terr.,"* p. 37.

According to Budde-Lund the first species known to science of this remarkable genus were observed by Pallas in his Russian journey, of which the account was published in 1771. The species there described were named *Oniscus ruderalis* and *Oniscus crenulatus*. The latter may be, in Budde-Lund's opinion, perhaps identical with *Porcellio klugii*, Brandt, 1833. Though Savigny (pl. 13, fig. 4) gave a few figures of the Egyptian species which Audouin named *Porcellio reaumurii*, the first author to deal seriously with illustrations of the structural characters was Uljanin in his Russian treatise of the Crustacea of Turkestan, 1875. He describes and figures *Porcellio fedtschenkoi* and *P. elegans* as new and *P. ornatus* as the species so named by Milne-Edwards in 1840. Budde-Lund refers all three of Uljanin's descriptions to *Hemilepistus*, but leaves *P. ornatus*, Milne-Edwards, under *Porcellio* and makes

P. ornatus, Uljanin, a synonym of that author's *Hemilepistus fedtschenkoi* (see *Isop. terr.*, pp. 113, 158, 305). Certainly the colouring of Uljanin's *ornatus* is very distinct from that described by Milne-Edwards for his like-named species, but the ornamentation of the peraeon is in both confined to the first two segments, not extending to three as in the description or even four as indicated in the figure of the species *fedtschenkoi*. This consideration does not seem to be affected by the circumstance that in this genus the full development of the dentate crests is only gradually attained in the animal's progress to maturity.

In 1885 Budde-Lund made *Hemilepistus* the third of seven subgenera under *Porcellio*, that genus standing first in the Oniscoidea, which was the second section of the family Onisci. In his Revision, 1904, the family Oniscidae contains eight subfamilies, of which the Oniscinae is the seventh, divided into three tribes, with the Oniscoidea standing second and comprising *Armadillidium*, *Porcellio* and *Oniscus*. To *Porcellio* are assigned *Hemilepistus* and eight other names, apparently as subgenera, two being indicated as doubtful, and *Porcellio* itself not being named as a subgenus, but presumably to be taken for granted. Here the term Oniscoidea has suffered a great loss of rank, and must not be confounded with the terms Oniscoidea, Oniscoida and Oniscidea which have been used as group-names, to include all the terrestrial isopods.

Hemilepistus klugii (Brandt).

(Plate xii, B.)

1833. *Porcellio klugii*, Brandt, *Conspectus Crust. Oniscodorum*, p. 17.
1879. *Hemilepistus klugii*, Budde-Lund, *Prospectus Isop. terrestrium*, p. 4.
1885. ,, ,, ,, *Isopoda terrestria*, p. 152.
1908. ,, ,, ,, Voeltzkow's *Reise in Ostafrika*, vol. ii, p. 281.

The description given under the last reference agrees so well with the figures now, I believe, for the first time given of this species that the identification may be accepted with some confidence. *H. crenulatus* (Pallas) would have priority, could its agreement with Brandt's species be satisfactorily shown.

A very striking effect is produced by the prominent pale blunt or rounded teeth forming transverse crests on the front part of the animal, contrasted with the dark grey, smooth or only microscopically setulose remainder of the body. The nearly related *H. reaumurii* (Audouin) is described as occupying deep perpendicular burrows in stony and clayey parts of the Sahara desert. Dollfus was told by M. Eugène Simon that the species named dwelt at the upper part of the hole, using its head as a sort of stopper to the entrance. Noticing the resemblance of the burrows to those of

Cicindela-larvae, M. Simon could not decide whether the isopod borrowed its habitation from some insect, or whether its own excavating activity would account for the extreme rugosity of its anterior segments. This problem awaits solution.

In the specimens here dealt with the head shows at the middle anteriorly a set of four or more unequal warts followed on either side by a widely diverging line of four larger warts or three sets of four subequal warts. The first peraeon segment has fourteen, the second thirteen, large teeth cresting the hind margin, the third segment has twelve or thirteen smaller teeth or warts similarly placed. Laterally above the crests there are groups of four warts on the first, and of three on the second and third segments. The hind margin of the fourth segment has a fringe of very obscure little warts. The telsonic segment is considerably broader than long, with sinuous sides, faintly grooved down the middle to the very narrowly rounded apex.

Eyes small, dark, ocelli about 20.

The second antennae have the first joint of the flagellum a little longer than the second, the latter ending in a little process which, but for its minuteness, might pass for a joint rather than an apical spine.

Upper lip broad, in the dissected specimen showing no marginal hairs.

Mandibles with strongly dentate cutting-plates, adjoining which are a series of setules and several slender spines, to which succeeds the short stalked brush-like process implanted near a strong smooth projection of the trunk.

The first maxillae have the outer plate surmounted by three (or four, see Budde-Lund, 1908) strong and six very slender spines, all apparently smooth-edged. The inner plate has on the inner part of the apex two strong setulose setae of which the inner is the longer. At the apex of the outer margin is a minute spine. In Uljanin's *H. elegans* the margin is itself produced to a sharp point.

The maxillipeds have on or near the distal margin of the masticatory plate three minute spines, and two larger spines below. The short broad first joint of the palp displays one large spine; the conical second joint has on its inner margin one curved spine and a smaller spine between that and the small narrow third joint which carries two apical spines.

The first pleopods of the male have the inner plate ending in a broad pectinate spine, that plate in the second pair having a needle-like apex. The peduncle of the uropods is about as broad as long; the narrow inner rami reach a little beyond the telsonic segment, the conical outer rami reaching beyond the inner, but with a length not equal to the peduncles.

Length of measured specimen 15 mm., with a breadth of about 5 mm. Specimen figured rather larger.

Locality.—The specimens sent by Dr. N. Annandale were labelled as having been obtained at Quetta, under date 6-iv-08; by Mr. J. W. N. Cumming.

[Mr. Cumming tells me that this species is very abundant in the neighbourhood of Quetta and is often seen crawling about in bright sunlight.—N. A.]

Gen. PORCELLIONIDES, Miers.

1877. *Porcellionides*, Miers, *Proc. Zool. Soc. London*, p. 668.
1879. *Metoponorthus*, Budde-Lund, *Prospectus Isop. terrestrium*, p. 4.
1885. ,, ,, *Crustacea Isopoda terrestria*, pp. 76, 161.
1898. ,, Sars, *Crustacea of Norway*, vol. ii, pt. 10, p. 183.
1904. ,, Budde-Lund, *A Revision of "Crust. Isop. terr.,"* p. 37.

Miers speaking of *Porcellio*, Latreille, remarks that de Saussure "based the characters of his primary sections of this genus on the form of the segments of the body." "These," he adds, "appear to me at once so natural and so characteristic, that I adopt them as subgeneric divisions." Miers accordingly distinguishes them as *Porcellio*, with "Postero-lateral angles of all the segments of the body acute, and produced backward," and *Porcellionides*, with "Postero-lateral angles of the first four segments of the body not acute and not produced backward." To the latter subgenus he assigns three new species with the names *jelskii*, *flavo-vittata*, and *hispida*. The second of these is regarded by Budde-Lund as certainly, and the first as doubtfully, synonymous with *Porcellio pruinosus*, Brandt, while the third may be a synonym of *Porcellio orientalis*, Uljanin, both transferred by Budde-Lund to his *Metoponorthus*. This makes it clear that the subgenus *Porcellionides* is the same as the subgenus *Metoponorthus*, over which it has two years' priority. Why this has been uniformly disregarded is probably due in a large measure to Scudder's *Nomenclator Zoologicus*, 1882. That useful work mentions *Porcellionides* of Milne-Edwards, 1840, and *Porcellionides* of Miers, 1877, only indicating by a difference of type that the former was of higher than generic value. It is in fact a French word used by Milne-Edwards for his "Division des Porcellionides." That authors were misled by the "Nomenclator" is made the more likely by the frequent use of *Metoponorthrus* which stands in Scudder's work by mistake for *Metoponorthus*. Miers himself in the "List of the species described" in his paper prints *Porcelloides* twice instead of *Porcellionides*, and as this is on p. 654, it might be argued that *Porcelloides* has page precedence, but practically the list of species described must be regarded as later in date than the descriptions. It is unfortunate that the significant name *Metoponorthus* should have to be withdrawn, but it can scarcely be pleaded either that the date 1877 belongs to a dim antiquity or that the *Proceedings of the Zoological Society* are obscure and inaccessible.

It scarcely needs saying that the distinctive characters borrowed from de Saussure, in which Miers placed confidence, are no longer adequate for modern requirements. But the acknowledged identity of *P. flavo-vittata* with *M. pruinosus* determines the precedence of *Porcellionides*.

Porcellionides pruinosus (Brandt).

1833.	*Porcellio pruinosus*,	Brandt,	*Conspectus Crust. Oniscodorum*, p. 19.
1879.	*Metoponorthus pruinosus*,	Budde-Lund,	*Prospectus Isop. terrestrium*, p. 4.
1885.	,,	,,	Budde-Lund, *Crustacea Isopoda terrestria*, p. 169.
1896.	,,	,,	Dollfus, *Mém. Soc. Zool. de France*, vol. ix, p. 543.
1898.	,,	,,	Sars, *Crustacea of Norway*, vol. ii, pt. 10, p. 184, pl. 80, fig. 2.
1901.		,,	(?) Chilton, *Trans. Linn. Soc.*, vol. viii, pt. 4, p. 141.
1908		,,	Carl, *Nouv. Mém. Soc. Helvétique Sci. Nat.*, vol. xlii, pt. 2, pl. 3, fig. 80 (Racovitza).
1908.	,,	,,	Racovitza, *Arch. Zool. expérimentale*, ser. 4, vol. ix, No. 5, p. 386, figs. xiii—xvii.
1908		,,	Budde-Lund, Voeltzkow's *Reise in Ostafrika*, vol. ii, pp. 281, 285.

The full synonymy of this species contains many specific names and the names of many authors. Recently Racovitza has remarked that, although it is considered cosmopolitan, little attention has been paid to the question of its local variations. He gives some comparative figures to illustrate this point of view and promises a further study.

Specimens sent from the Indian Museum are labelled as having been taken at "Kurseong, 5,000 feet, E. Himalayas, 15-vii-07." Though partial desiccation unfits them for elaborate research, the dissection of a male shows its close agreement with the figures of that sex as drawn by Professor Sars. The fifth and sixth joints of the first gnathopods are crowded with spines and spinules. A slight variation may consist in the fact that the sixth joint is attached close to the outer margin of the fifth, not subcentrally to its apex as in the figure by Sars. The proportions of the second antennae, the upper lip without hairs on the margin, the masculine apparatus of the first and second pleopods, and the shape of the telsonic segment correspond fully with what is shown in the *Crustacea of Norway*.

Porcellionides asiaticus (Uljanin).

1875. *Porcellio asiaticus*, Uljanin, *Crustacea of Turkestan*, p. 15, pl. 3, figs. 11-22.
1879. *Metoponorthus asiaticus*, Budde-Lund, *Prospectus Isopodum terrestrium*, p. 4.
1885. ,, *orientalis* (*partim* ?), Budde-Lund, *Isopoda terrestria*, p. 162.

Uljanin in 1875 describes and figures *Porcellio asiaticus* and *P. orientalis* as two quite distinct species, the largest male of the former measuring 14 × 6·5 mm., of the latter 13 × 8 mm. Budde-Lund, without noticing the difference in breadth, unites the two species as merely colour varieties. In his earlier work he adopts the specific name *asiaticus*, but in 1885 he makes this a synonym of *orientalis*, although the other species has precedence both in Uljanin's text and plates.

The specimens which I refer to *P. asiaticus* were obtained by Dr. Annandale at Lucknow, under date 22-i-08.

Gen. EXALLONISCUS, nov.

Body finely tuberculate, not adapted for conglobation. Eyes wanting. Second antennae short, flagellum three-jointed. Mandibles with four or five stout teeth divided between the cutting edge and its accessory plate; adjacent to the latter is a border fringed with spinules and setules, a feathered seta (at least on one of the mandibles) projecting between this border and the brush of setae on a short peduncle which represents the molar. First maxilla with two short feathered setae occupying the apex of the inner plate, the outer plate being surmounted by smooth spines only seven in number, the distal part of its outer margin setulose. The second maxillae with inner apical lobe much broader than the outer and showing a group of adpressed setae, only the tips of which project from its distal margin. Maxillipeds not very broad, the masticatory plate quadrate, its truncate distal border finely fringed, the palp carrying on the inner margin of its penultimate joint an apically feathered process similar to the somewhat larger terminal joint. The limbs of the peraeon have many spines with multifid apices. The first and second pleopods of the male are in near agreement with those in *Alloniscus*, Dana (judging by *A. pigmentatus*, Budde-Lund); the fifth pair have the gill-cover remarkably acute at the apex. Telsonic segment broad with obtuse apex. Outer ramus of uropods much projecting, longer than the stout peduncle, on the inner border of which the narrow inner ramus is attached, scarcely reaching half the length of the outer ramus.

In 1908 Budde-Lund, in the account of *Alloniscus brevis* (Voeltzkow's *Reise in Ostafrika*, vol. ii, p. 298), incidentally expresses the opinion that *A. coecus*, Dollfus, probably does not belong to the genus *Alloniscus*, at least in his limitation of it. That view is

most likely correct, if all the structural features described above have been rightly observed. Both pairs of maxillae appear to offer distinctive characters, and others may perhaps be drawn from the first antennae and the lower lip, but in regard to these my dissections do not enable me to put forward trustworthy evidence. The name of the genus refers to the removal of its type species from the home in which M. Dollfus had placed it.

Exalloniscus coecus (Dollfus).

(Plate xii, A.)

1898. *Alloniscus coecus*, Dollfus, in Weber's *Zool. Ergebn. einer Reise in Niederl. Ost-Indien*, vol. iv, p. 375, pl. xv, fig. 22, in text 22 *a*, *b*.

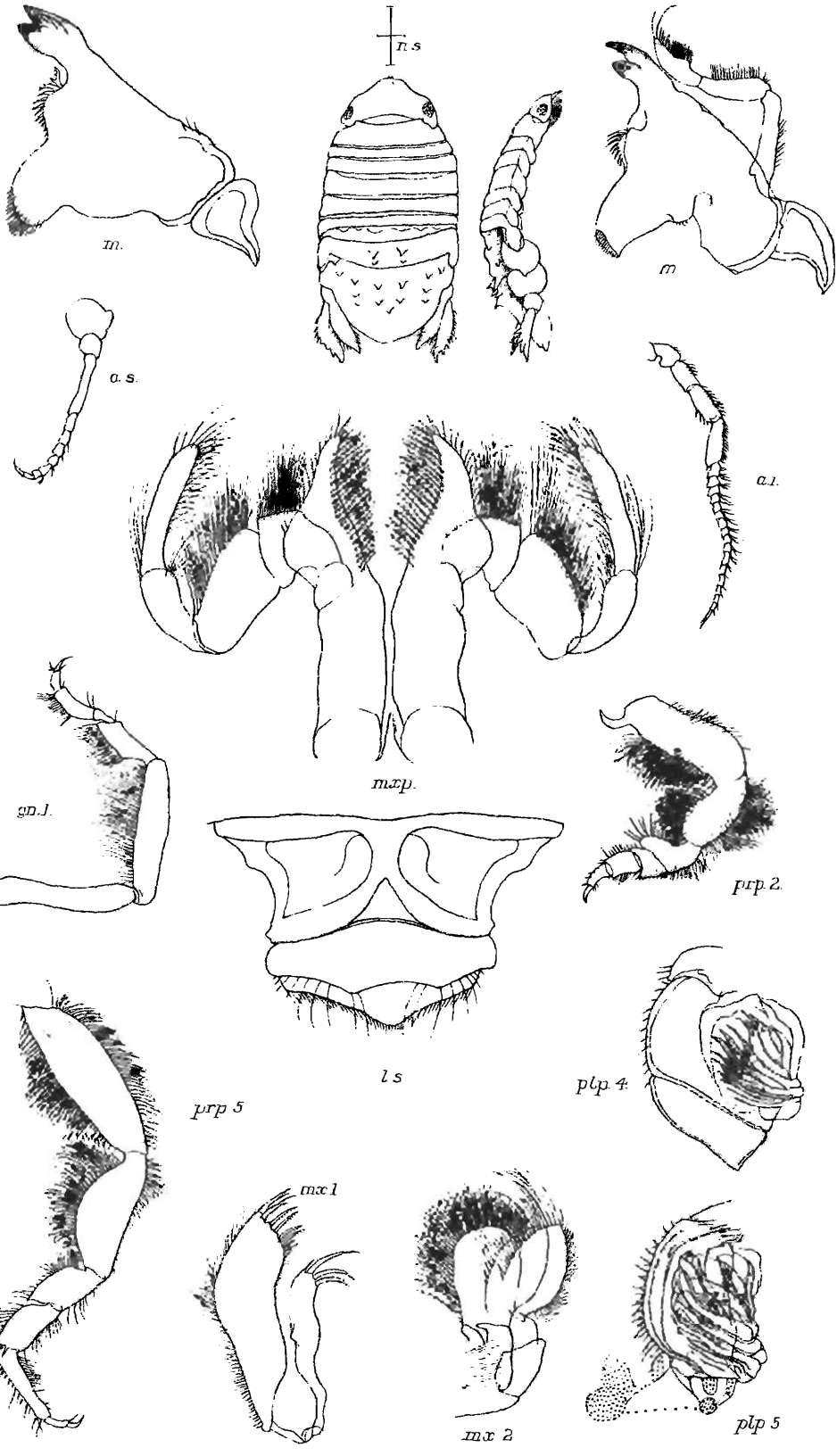
Dollfus gives the following description:—"Body broadly oval, little convex, a little depressed, covered with fine granulations, more accentuated anteriorly. Cephalon: frontal line sinuous, with a feeble median process and very oblique subacute lateral lobes. Prosepistome flat. Eyes none. Second antennae short, flagellum of three subequal joints. Peraeon: first segment with hind margin straight. Pleon, Telson—Lateral processes of the segments 3—5 rather broad, depressed. Pleotelson triangular with subobtuse apex, sides a little sinuous. Uropods: base equalling the length of the pleotelson, inner branches small but reaching beyond the pleotelson. Outer branches? Colour: white." The specimens were taken by Prof. M. Weber at Java and Sumatra. Lines indicating the natural size of specimen figured are 5 × 2 mm., not consistent with the description, body broadly oval. Dr. Annandale's specimens from Maddathorai, Travancore, measured about 5 × 3 mm. Perhaps a true representation lies between my figure a little too broad and that by M. Dollfus rather too narrow. That they are concerned with the same species can scarcely be doubted.

EXPLANATION OF PLATE X.

Sphaeroma annandalei, sp. nov.

n.s. Lines indicating natural size of specimen figured below in dorsal and lateral view.
a.s., a.i. First and second antennae.
l.s. Upper lip with epistome.
m., m., mx. 1., mx. 2., mxp. Mandibles (figure on the left without palp), first and second maxillae, maxillipeds.
gn. 1., prp. 2., prp. 5. First gnathopod, second and fifth peraeopods.
plp. 4., plp. 5. Fourth and fifth pleopods, with further enlargement of the apical bulb in the fifth pleopod.

The mouth-organs and the above-mentioned bulb are more highly magnified than the antennae, limbs and pleopods, the scale being uniform for each of the two sets.



Del T.E.R.Stebbing J.T.Renne Reid Lith Edin.r

SPHÆROMA ANNANDALEI n sp

EXPLANATION OF PLATE XI.

Paraperiscyphis travancorensis, gen. et sp. nov.

n.s. Lines indicating natural size of specimen figured below in dorsal aspect not completely flattened ; the figure above being a lateral view of a rather smaller specimen, of which the uropods are figured on the left in ventral view. All other figures are from the first-mentioned specimen.

Per.s. 1. First peraeon segment with the head, in dorsal view more enlarged.

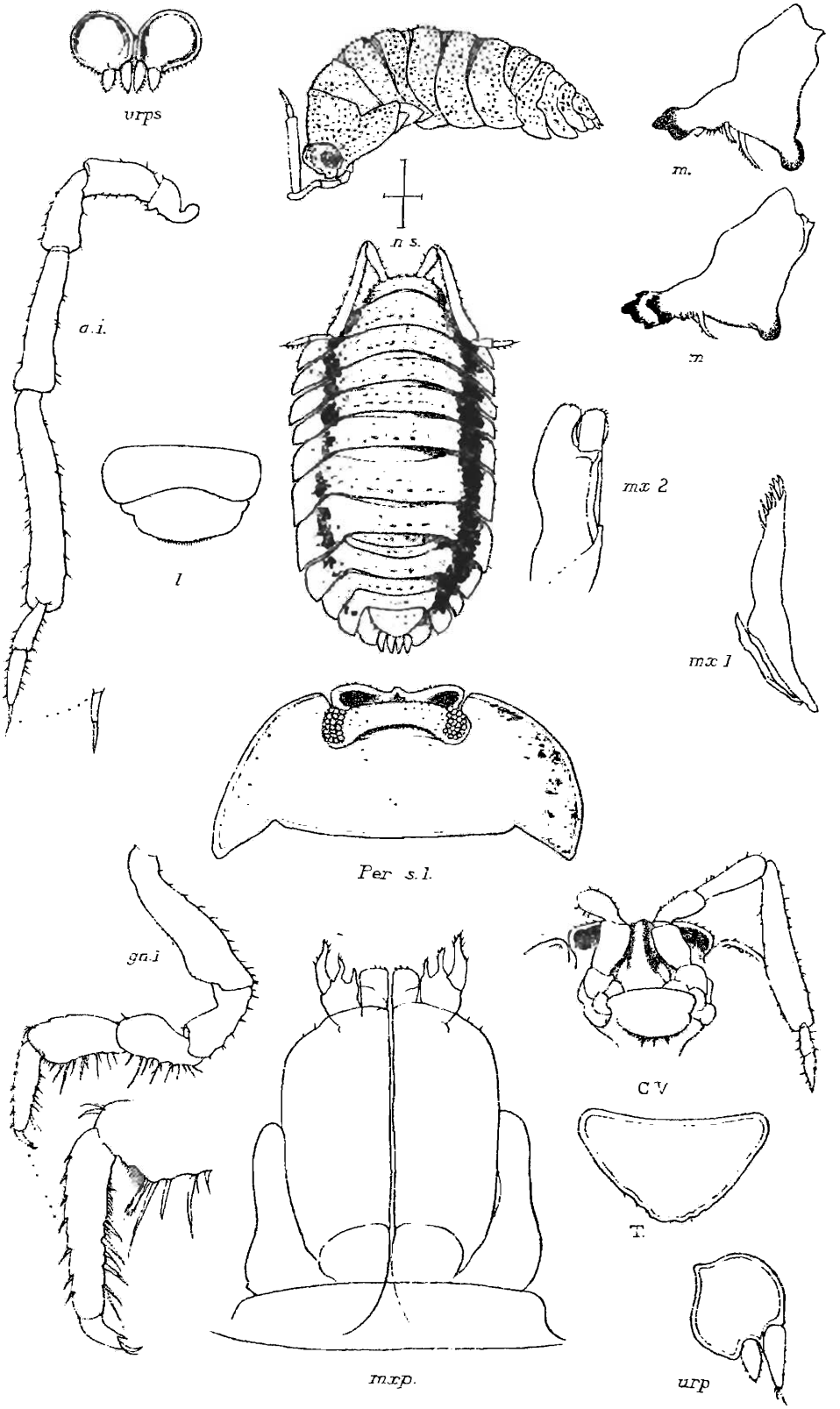
C.V. Ventral view of the head (cephalon).

a.i. Second antenna, with terminal spine more magnified.

l.s., m., m., mx. 1., mx. 2., mxp. Upper lip ; mandibles, the upper from the outer side, the lower figure representing the other mandible from the inner side ; the first maxilla without the inner plate ; the second maxilla ; the maxillipeds. These mouth-organs are figured to a uniform scale.

gn. 1. First gnathopod, with distal part more enlarged.

urp., T. Uropod in dorsal aspect, and telsonic segment, these figures with those of the second antenna and first gnathopod are on a uniform scale, only the extra enlargements of parts agreeing with the scale of the mouth-organs.



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PARAPERISCYPHIS TRAVANCORENSIS n g et. sp

EXPLANATION OF PLATE XII.

A.—*Exalloniscus coecus* (Dollfus).

n.s. Lines indicating natural size of specimen figured below in dorsal view.

l.s., m., m$_1$, mx. 1., mxp. Upper and lower lips; mandibles and first maxilla; and a maxilliped with further enlargement of the distal parts.

m′., mx. 1′., mx. 2. Distal portions of a mandible and a first maxilla, second maxilla with its distal part further enlarged. These figures are drawn from a separate specimen, the distal portions uniformly magnified.

a.i., prp., plp. 1., plp. 2., urp. Second antenna, part of one of the peraeopods, the first male pleopod, inner branch of the second, uropod in attachment to the telsonic segment. These figures are on a lower scale than the mouth-organs. The antenna and terminal joints of a peraeopod are from the separate specimen.

sp. sp′ Terminal spine of second antenna, and spines from the antepenultimate joint of peraeopod, on the same scale as the distal parts of the mouth-organs.

B.—*Hemilepistus klugii* (Brandt).

n.s. Lines indicating natural size of a specimen rather smaller than that from which the drawings were made.

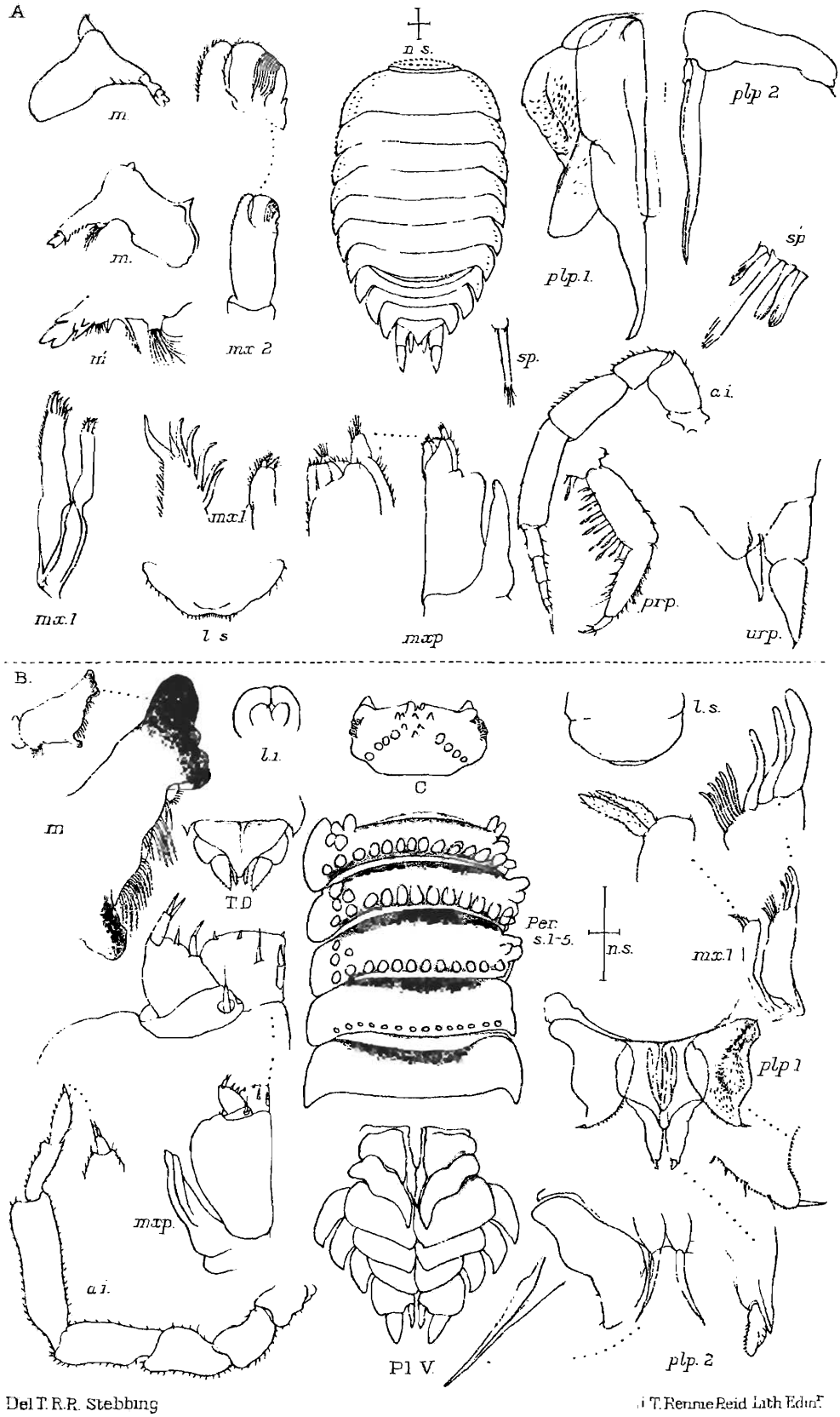
C., Per.s. 1—5, T.D.—Dorsal views of head, peraeon segments to end of the fifth, and telsonic segment with the uropods. The peraeon segments are slightly inclined, with the lateral margins visible on the left, concealed on the right hand.

Pl.V. Ventral view of the pleon. This and the preceding figures are drawn to the same scale, less magnified than the rest, which also are on a uniform scale.

a.i. Second antenna, with apex of flagellum more enlarged.

l.s., l.i., m., mx. 1., mxp. Upper and lower lips; mandible, first maxilla, and a maxilliped, the last three with further enlargements.

plp. 1., plp. 2. First and second pleopods, with further enlargements, the higher magnification being the same for all the figures.



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A. EXALLONISCUS COECUS (Dollfus) B. HEMILEPISTUS KLUGII (Brandt)

XIII SYSTEMATIC NOTES ON THE CTENOSTOMATOUS POLYZOA OF FRESH WATER

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

In preparing an account of the freshwater polyzoa for the "Fauna of British India" I have had occasion to examine specimens of most of the ctenostomatous species as yet known to occur in the rivers, lakes and ponds of different regions. It may therefore prove useful to publish the following supplementary notes. I have received much assistance in the preparation of specimens from Mr. F. H. Gravely, Assistant Superintendent in the Indian Museum, and am indebted for many of these specimens to Dr. K. Kraepelin, Dr. W Michaelsen, Mr. C. Rousselet and Mr. R. Kirkpatrick. Full references to literature on the Indian species will be found in my volume in the "Fauna," only a few of the more important general works being cited in this paper.

Suborder CTENOSTOMATA.

Division *PALUDICELLINA*.

Ctenostomatous polyzoa in which the zoarium increases by a cruciform [1] system of budding, each zooecium giving rise normally to three daughter-zooecia (one on each side and one at its anterior end) and being connected posteriorly with its own mother-zooecium. No zooecium is ever connected by its base with more than four others. In the polypide that part of the alimentary canal which intervenes between the cardia and the main chamber of the stomach is always more or less modified but never forms an organ of compression or is provided with internal teeth.

All the Paludicellina are found in fresh or brackish water. Anatomically they appear to be related to the Alcyonellea rather than the Vesicularina,[2] to which many of them bear a certain superficial resemblance.

Family PALUDICELLIDAE.

Zooecia more or less tubular and at least partially vertical, often adherent by the base only or altogether free. In adverse

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[1] Rousselet (*P.Z.S.*, 1907 (i), p. 252) refers to such forms as "Cruciform Stolonifera" but includes with them certain marine genera that do not exhibit the same regularity in their method of budding.

[2] Waters, *Journ. Linn. Soc. London*—Zool., xxxi, p. 237 (1910).

circumstances resting buds with a hard chitinous coat are produced and lie dormant until the return of favourable conditions.

Key to the genera of the Paludicellidae.

1. No buds produced at the distal end of the zooecium.
   (*a*) Zooecia narrowly flask-shaped, semi-recumbent or at any rate with the dorsal surface clearly distinct from the ventral — *Paludicella.*
   (*b*) Zooecia tubular, upright; the dorsal and ventral surfaces identical — *Pottsiella.*
2. Buds produced at the distal end of the zooecia.
   Zooecia (when adult) tubular, nearly upright, more or less swollen at the base — *Victorella.*

Genus PALUDICELLA, Gervais.

Zooecia narrowly vase-shaped with the dorsal surface distinct from the ventral; the orifice situated on a tubular outgrowth from the former; no distal buds; collar without chitinous chaetae. No part of the alimentary canal of the polypide lined with chitin and only that part which surrounds the pyloric aperture of the stomach ciliated; no defined compressor muscle round the cardiac chamber, although separate fibres can be distinguished. The stomach connected with the zooecial wall by two funiculi, one of which bears the ovary, the other the testis, the former being situated nearer the pyloric orifice than the other. There are 16 tentacles.

Paludicella ehrenbergi, van Beneden.

(Pl. xiii, fig. 1.)

Syn. *Alcyonella articulata*, Ehrenberg; *Paludicella procumbans*, Hancock; *Paludicella elongata*, Leidy.

This is the only species I am able to assign to the genus. Its zoaria as a rule form upright branches consisting of zooecia arising directly one from another. Basal stolon-like tubules are never formed. The lateral basal buds are often suppressed, or only one of them is produced, so that budding is in linear series with only a few lateral branches instead of a cruciform figure. There is a slightly dilated but slender oval chamber between the cardia and the stomach proper. Its walls are glandular and not very thick.

P. ehrenbergi is common in Europe and America but probably does not occur in the Ethiopian and Oriental regions.

Genus POTTSIELLA, Kraepelin.

The zooecia differ from those of *Paludicella* in being entirely vertical and in being separated at the base by stolon-like tubules.

The anatomy of the two genera is very similar, but the whole alimentary canal (pl. xiii, fig. 2*a*) is more slender and elongate in *Pottsiella*, which has only 8 tentacles.

Pottsiella erecta (Potts).

(Pl. xiii, figs. 2, 2*a*.)

Syn. *Paludicella erecta*, Potts.

The zooecia are slender, elongate and somewhat constricted both at the base and at the tip. The orifice is pentagonal in cross-section. The basal tubules are often of considerable length; occasionally extra tubules are produced from the sides of the zooecium, but this is exceptional. Buds may, perhaps, be borne sometimes at the end of these adventitious lateral tubules.

This species is only known from the neighbourhood of Philadelphia, U.S.A. I have been enabled by the kindness of Mr. C. Rousselet to examine specimens from the type locality.

Genus VICTORELLA, Kent.

The adult zooecia are always nearly vertical but as a rule they pass through a stage at which they resemble those of *Paludicella* in form. They are separated by basal tubules resembling those of *Pottsiella*, and daughter-zooecia (distal buds), (with or without similar tubules intervening, are usually borne near the tip of the zooecium (pl. xiii, fig. 3) in addition to the basal buds.

The cardia closes off from the oesophagus proper an oval chamber lined with a thin chitinous coat and surrounded at its base by a stout compressor muscle. This muscle (pl. xiii, figs. 7, 8) serves to close off the chamber from the cardiac part of the stomach, which is produced upwards to meet it in tubular form. The arrangement of cilia in the alimentary canal is the same as that found in *Paludicella*. There is only one funiculus, attached to the base of the stomach, and the gonads are borne on the zooecial wall far from it. There are 8 tentacles.

Four "species" can be distinguished in this genus, but they are so closely allied that it might be better to regard them merely either as varieties or as subspecies (local races). They may be separated as follows:—

1. Parietal muscles present at the tip of the zooecium (pl. xiii, fig. 4). Young zooecium circular in cross-section at the tip, adult zooecium quadrate; distal buds only produced by adult zooecia; lateral basal buds rarely suppressed *V. mülleri*.
2. Parietal muscles absent from the tip of the zooecium (pl. xiii, fig. 5).
   I. Both young and adult zooecia quadrate at the tip; basal tubules

elongate; distal buds produced in profusion by the adult zooecia; lateral basal buds rarely suppressed — *V. pavida.*

II. Young zooecia usually quadrate, adult zooecia quadrate or circular at the tip; basal tubules often short; distal buds produced, often sparingly, by both young and adult zooecia; lateral basal buds present or absent — *V bengalensis.*

III. Zooecia always circular at the tip; basal tubules short; distal buds often absent, never produced in profusion; lateral basal buds usually absent — *V symbiotica.*

Victorella mülleri (Kraepelin).

(Pl. xiii, fig. 4.)

Paludicella mülleri, *Kraepelin, Die deutschen Süsswasser-Bryozoen*, i, p. 159, figs. A, B (1887).

V. mülleri is the most distinct of the four forms and was originally described by Dr. K. Kraepelin as a species of *Paludicella.* I have, however, been enabled by the kindness of Dr. Kraepelin and Dr. W. Michaelsen to examine specimens from the type locality (Greifswald, Germany), in which they occurred together with examples of an undoubted *Victorella.* On a careful examination the latter were found to differ from specimens of *V. pavida* from the type locality in England and also from other German localities in having parietal muscles at the tip of the zooecium (pl. xiii, figs. 4, 5). A further search on the leaves to which the form *mülleri* was attached also revealed intermediate stages between that form and the *Victorella* associated with it. I have therefore no doubt that Kraepelin's types were merely young zoaria of a species of *Victorella* to which the specific name *mülleri* must be applied. In the young zooecium the cross-section of the distal part is almost circular, but in the adult zooecium it becomes quadrate. Apparently young zooecia in this species do not produce distal buds, which are borne in profusion by the zooecia of well-grown colonies.

V. mülleri has only been found in Germany (Ryckflusse at Greifswald) in brackish water.

Victorella pavida, Kent.

(Pl. xiii, fig. 5.)

This species only differs from *V. mülleri* in the following characters:—

(*i*) There are no parietal muscles at the tip of the zooecium (pl. xiii, fig. 5);
(*ii*) both the young and the adult zooecia are quadrate;
(*iii*) *young* zooecia frequently bear stolon-like processes and buds near the distal end;
(*iv*) the growth of the zoarium is perhaps as a general rule somewhat more irregular, particularly as regards the production of lateral basal buds.

Victorella pavida occurs in brackish and occasionally in fresh water in England, Belgium and Germany. It has also been reported from the littoral zone of the sea in Europe and is stated to have been found in Australia.

Victorella bengalensis, Annandale.

(Pl. xiii, figs. 3, 7 and 8.)

This form is distinguished from *V. pavida* mainly by its more luxuriant and irregular growth and by the fact that the distal end of the adult zooecium is usually circular in cross-section. Its zoaria have as a rule the appearance of a thick fur coating the roots and stems of grasses, etc. The swelling at the base of adult zooecia is never very large.

V. bengalensis has been found at various places near the coast of Bengal and Madras, as a rule in brackish but occasionally in fresh water.

Victorella symbiotica, Rousselet.

(Pl. xiii, fig. 6.)

Rousselet, *P.Z.S.*, 1907 (i), p. 255. pl. xv, figs. 7, 8.

V. symbiotica is distinguished by the following characters:—
(*i*) The swelling at the base of the adult zooecium is very small and inconspicuous, the whole of the zooecium being almost cylindrical and practically vertical;
(*ii*) distal buds are produced very sparingly;
(*iii*) the distal end of the zooecium is always nearly circular in cross-section;
(*iv*) the lateral basal buds are very often suppressed.

V. symbiotica was originally described from Lake Tanganyika and has more recently been taken by Mr. C. L. Boulenger and Dr. Cunnington in the salt-lake Birket-el-Qurun in Egypt. I have examined specimens from both localities.

Family HISLOPIIDAE.

This family is easily distinguished by its flattened and adherent zooecia. The structure of the polypide differs considerably from that of any Paludicellid genus, its most characteristic features being the presence (*i*) of a relatively large and practically spherical

chamber lined with smooth chitin and covered externally by circular muscles (pl. xiii, figs. 10, 11), and (*ii*) of strong cilia round the cardiac orifice of the stomach as well as the pyloric. The spherical chamber is separated from the cardia by a cylindrical glandular tract and opens almost directly into the main chamber of the stomach, from which it is only separated by a ring bearing stout and very active cilia.

So far as is known, resting buds are not formed in this family.

The family is only known from Central Africa and Eastern Asia and only two genera can be recognized, namely *Arachnoidea* Moore, and *Hislopia* Carter; they may be distinguished as follows:—

1. Zooecia provided with an upright orificial tubule, separated from one another by stolon-like processes ... *Arachnoidea.*
2. Orifice little raised above the dorsal surface of the zooecia, which arise directly one from another .. *Hislopia.*

Genus ARACHNOIDEA, Moore.

Syn. *Arachnoidia*, Moore; *Arachnidium*, Loppens (*nec* Hincks).

The zoarium consists of flattened zooecia of irregular outline joined together in the typical cruciform manner by slender and elongate basal tubules. Each zooecium is provided on the dorsal surface with a relatively long but slender orificial tubule which projects almost vertically upright. The polypide has 8 tentacles. It possesses in its alimentary canal an almost spherical, strongly muscular chamber lined with chitin and similar in structure to that possessed by *Hislopia* which is described below. The collar is supported by chaetae.

Arachnoidea ray-lankesteri, Moore.

Rousselet, P.Z.S., 1907 (i), p. 255, pl. xiv, figs. 5, 6.

This, the only species, has the character of the genus, but its anatomy is imperfectly known and none of the specimens now in India or Europe appear to be in a sufficiently good state of preservation for its further elucidation.

A. ray-lankesteri is only known from Lake Tanganyika in Central Africa.

Genus HISLOPIA, Carter.

Syn *Norodonia*, Jullien; *Echinella*, Korotneff.

Hislopia differs from *Arachnoidea* mainly in two characters, (*i*) the fact that zooecia arise directly one from another without the intervention of basal tubules, and (*ii*) the absence of an orificial tubule, the orifice being raised above the dorsal surface merely on a slight eminence. The form of the zooecia is also more regular and each is surrounded by a thickened margin. The

number of tentacles is variable but is usually some multiple of four. The collar is unusually ample and is supported by delicate chitinous chaetae. Immediately below the cardia there is a short glandular portion of the alimentary canal, tubular in form, which lies at right angles to the main axis of the zooecium when the polypide is retracted. This opens into the spherical chamber, which is relatively large and bears a thick chitinous lining that has the appearance in optical section of a couple of vertical ridges. The compressor muscle (pl. xiii, figs. 10, 11) covers the whole of the chamber but only extends over the glandular region above it in the form of isolated fibres. In preserved specimens the chamber appears to open directly into the stomach but in living specimens the ring separating the two and bearing the cardiac cilia can be extended in a vertical direction to some length. The parietal muscles are reduced to three or four stout strands on either side of the zooecium and there is not a definite funiculus. The gonads are borne on the zooecial wall at each side of the polypide.

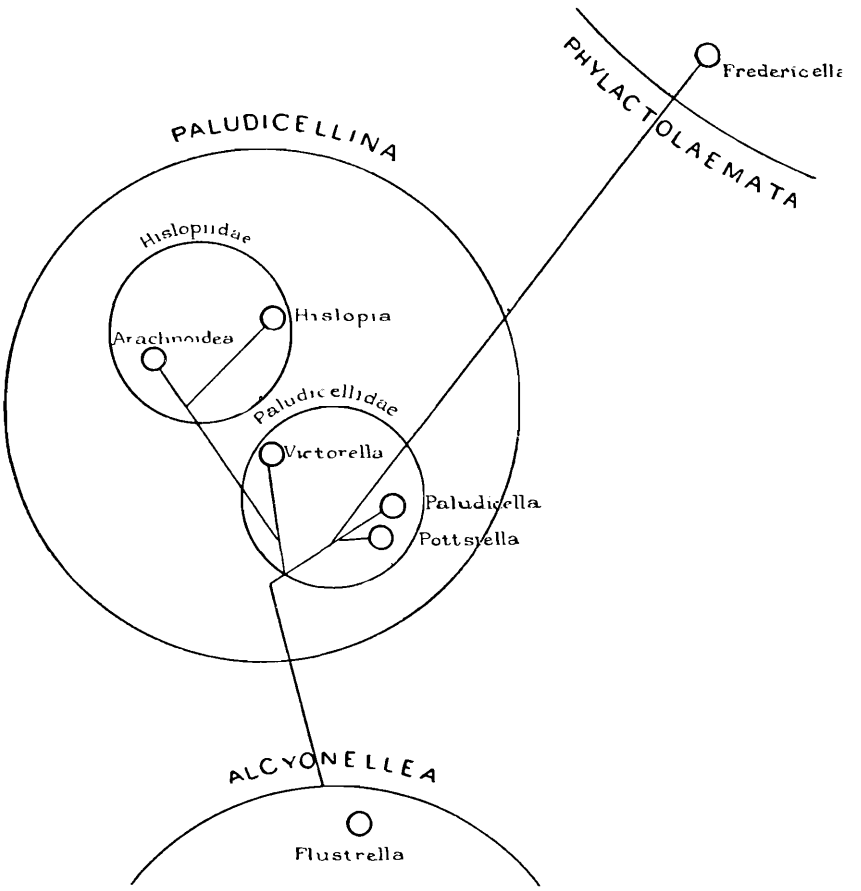
Hislopia lacustris, Carter.

(Pl. xiii, figs. 9, 10, 11.)

Owing to rapid lateral and terminal budding at the base of the zooecia and to the absence of intervening tubules, well-developed zoaria constitute, in the typical form of the species, an almost uniform flat layer which has much the same appearance as that of many Cheilostomata (*e.g* *Membranipora*) and also of certain Ctenostomata of the division Alcyonellea (*e.g.*, *Flustrella*). A careful analysis of the method of budding, however, shows that it is always of the cruciform type, whereas in *Membranipora* more than one lateral bud is produced at each side of the zooecium and in *Flustrella* the method of budding is radiate, numerous linear series of zooecia radiating out from a single parent-zooecium but pressed so closely together as to be practically parallel to one another. The form of the zooecium, especially in luxuriant zoaria, is very variable; it is typically oblong but may be oval, triangular or almost circular or even square. The dorsal surface is usually flat and always has a hyaline transparency, but if the zooecia are closely crowded together on a narrow support such as the stem of a slender water-plant they are often arched above and of a considerably greater depth (pl. xiii, fig. 9) than if they have plenty of room for expansion. In such cases the thickened margin is often practically obsolete. The orifice is surrounded by a thick chitinous rim which usually has a quadrate form and bears a spine at each corner; but sometimes it is circular, and the spines not only vary in length but are often reduced in number or altogether absent. The tentacles vary in number from 12 to 20.

The structure of the cardiac region of the alimentary canal has a certain resemblance to that found in *Bowerbankia* (Vesicularina), the spherical chamber having the same position as and

a certain similarity in structure to the gizzard of that genus (pl. xiii, figs. 12, 13). Its function is however totally different, and it differs structurally in not possessing horny internal teeth. Moreover, the walls do not contract automatically with the retraction of the polypide as they do in the gizzard of *Bowerbankia*.



The spherical chamber in the alimentary canal of *Hislopia* is not a crushing organ but serves as an antechamber in which food may be stored until it is wanted for digestion. In it also the flagellate organisms that seem to form the greater part of the food undergo a process of encystment in the course of which food-material is pressed out from their bodies and apparently absorbed by the polyzoon. Further details as regards this process are given on pp. 200—202 of my volume in the "Fauna of British India."

Two forms which I believe to be merely varieties or at most local races (subspecies) of *H. lacustris* have been described as distinct species. They are—

Norodonia sinensis, Jullien, from China;
Norodonia cambodgiensis, Jullien, from China, Cambodia and Siam.

Echinella placoides,[1] Korotneff, from Lake Baikal in Siberia also appears to belong to the genus.

I have not seen any of these forms, but apparently *N. sinensis* is distinguished by having narrow zooecia with circular orifices, while in *N. cambodgiensis* the zooecia are nearly circular but constricted posteriorly. In both these forms the growth is less luxuriant than in the typical form of the species. *E. placoides*, which may be a distinct species, is distinguished by the great length of the spines at the four corners of the orificial rim.

A fourth form, for which the name subspecies *moniliformis* is proposed, occurs in Calcutta and is distinguished by the shape of the zooecia and the method of growth. The former are practically circular but truncated, not constricted posteriorly and surrounded by a flat membranous fringe. The lateral basal buds are very often suppressed and both are rarely produced, so that a linear zoarium with occasional side-branches is formed.

The diagram on p. 200 represents the relationships of the Paludicellina, as they appear to me.

LITERATURE.

1856. Allman, *A Monograph of the Fresh Water Polyzoa* (London).
1880. Hincks, *A History of the British Marine Polyzoa.*
1885. Jullien, "Monographie des Bryozoaires d'Eau Douce," *Bull. Soc. zool. France*, x, p. 91.
1887 and 1892. Kraepelin, "Die deutschen Süsswasserbryozoen," *Abhandl. Nat. Vereins Hamburg*, x and xii.
1907. Rousselet, "Zoological Results of the Third Tanganyika Expedition, conducted by Dr. W. A. Cunnington, 1904-1905—Report on the Polyzoa," *Proc. Zool. Soc. London*, i, p. 250.
1910. Loppens, "Catalogue des Bryozoaires d'Eau Douce avec une Note sur *Victorella pavida*," *Ann. Soc. zool. et malacol. Belgique*, xliv, p. 97.
1911. Annandale, "Freshwater Sponges, Polyps and Polyzoa," *Faun. Brit. Ind.*

[1] *Biol. Centralb.*, xxi, p. 311, fig. (1901).

EXPLANATION OF PLATE XIII.

FIG. 1.—Young zooecium of *Paludicella ehrenbergi*, × 30.

,, 2.—Two zooecia of *Pottsiella erecta*, in one of which the polypide is undergoing regeneration, × 30; 2*a*, alimentary canal, funiculi and immature gonads of the other polypide, × 75 (only the upper part of the testis is shown).

,, 3.—Young adult zooecium of *Victorella bengalensis* with a single distal bud commencing to develop, × 30.

,, 4.—Tip of an adult zooecium of *Victorella müllcri*, × 75.

,, 5.—Tip of an adult zooecium of *Victorella pavida*, × 75.

,, 6.—Lateral view of the upper part of the stomach and the adjacent parts of the alimentary canal in *Victorella symbiotica*, with the cardiac compressor muscle relaxed, × 240. (The polypide is slightly macerated and the chitinous lining of the oval chamber shows very clearly.)

,, 7.—Dorsal view of cardiac part of the stomach, etc., in *V. bengalensis*, with the cardiac compressor contracted, × 240.

,, 8.—Distal part of a zooecium of *V. bengalensis* containing a recently regenerated polypide, × 75; to show the simple structure of the alimentary canal at this stage.

,, 9.—Lateral view of a zooecium of *Hislopia lacustris* growing in a confined space, × 75. The zooecium is much higher and narrower than usual.

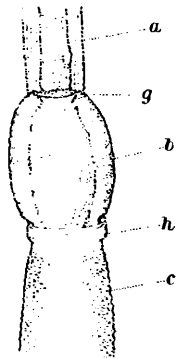
,, 10.—Alimentary canal of *Hislopia lacustris* from the dorsal surface, × 75.

,, 11.—Wall of the crop of *Hislopia* as seen in optical section from above, with green cysts, × 240; to show the two cellular layers and the inner chitinous coat.

,, 12.—Dorsal view of the gizzard of *Bowerbankia caudata* and the adjacent parts of the alimentary canal, × 75.

,, 13.—Gizzard of the same polypide in optical section, × 240. (In both figures a diatom grasped by the teeth of the gizzard is shown.)

a = oesophagus; *b* = chamber lined with chitin; *c* = cardiac chamber of the stomach; *d* = pylorus; *e* = intestine; *f* = rectum; *g* = cardia or cardiac valve; *h* = cardiac compressor muscle; *m* = green cysts; *n* = orifice of the zooecium; *o* = retractor muscles; *r* = parietal muscles; *x* = base of lateral bud; *z* = *distal* bud.



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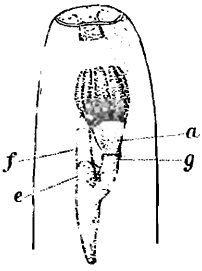

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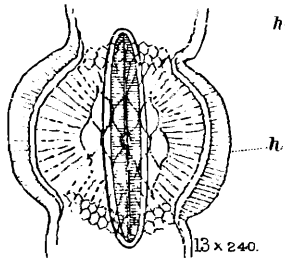

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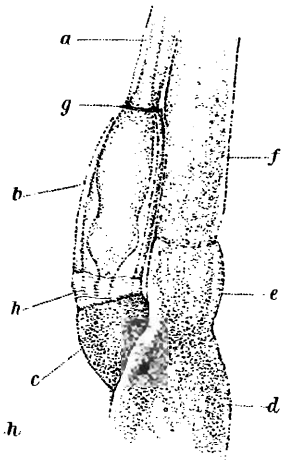

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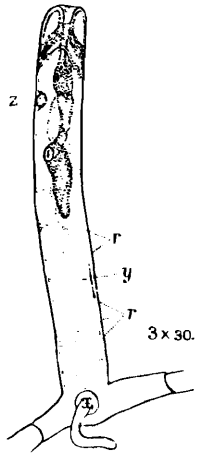

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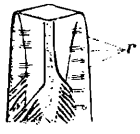

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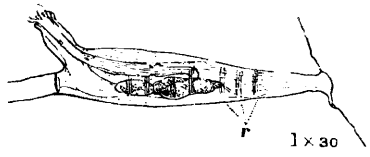

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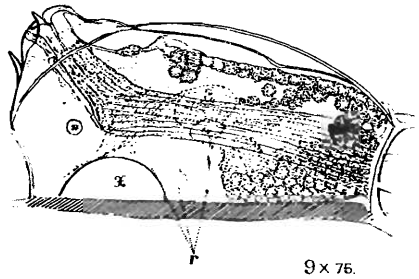

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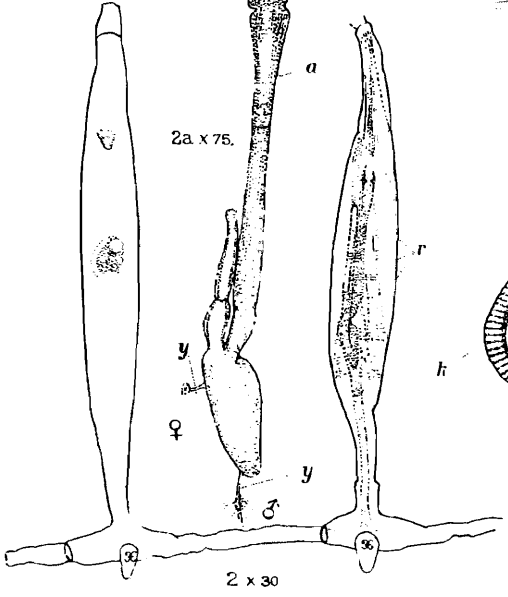

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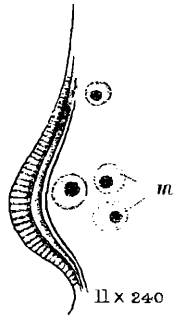

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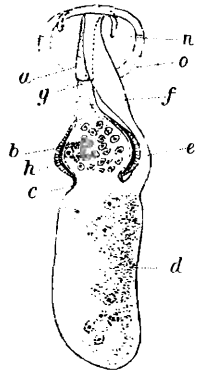

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A C Chowdhary, del. Bemrose Ltd, Derby.

FRESHWATER CTENOSTOMATA.

XIV ON SOME AQUATIC OLIGOCHAETA IN THE COLLECTION OF THE INDIAN MUSEUM

By J. STEPHENSON, *M.B., D.Sc. (Lond.), Government College, Lahore.*

During the past year I have, through the kindness of the authorities of the Indian Museum, received at various times specimens of small aquatic Oligochaeta for examination. An account of these is given in the present communication.

Our knowledge of the Oligochaeta fauna of the Indian region has of late years been very considerably increased through the researches of Michaelsen (*Mem. Ind. Mus.*, vol. i, No. 3, and *Abh. aus dem Gebiete der Naturwissenschaften*. Naturw. Verein, Hamburg, xix Band, 5 Heft) on the collections made by the Indian Museum. This increase in our knowledge however relates more especially to the terrestrial forms, and the number of aquatic Oligochaeta known from the Indian region is still very small. Especially is this the case with the large families of the Enchytraeidae and Tubificidae, so common in Europe; only one Tubificid, and one Enchytraeid, of which latter the genus is doubtful, having so far been recorded.

This may perhaps receive a partial explanation in the small size of these worms, and the fact that they consequently elude the collector, unless he happens to be specially interested in them or specially looking for them. Still, seeing that the Naididae, comprising the smallest or almost the smallest forms in the whole Order, are represented in the Indian fauna by about twenty species, it may not improbably be the case that Enchytraeids and Tubificids are actually somewhat rare.

Another hindrance to our knowledge of these small and delicate forms is the difficulty of adequately describing them—or even, it may be, of identifying them—from preserved specimens only. Most of those I have received from Calcutta have been preserved, since it is difficult to transport the living worms safely for 1,300 miles in this climate; of the species mentioned below, examples of *Aulophorus tonkinensis* however reached me alive. I am therefore conscious that the notes are not so full as is desirable, but considering the small amount that is known, it seems better to give the following descriptions, though incomplete in many ways, rather than to allow the material to be wasted.

Acolosoma bengalense, sp. nov.

Found in the Museum tank, Calcutta, Nov. 10th 1910, C. Paiva. Mr. Gravely's accompanying note stated that the oil-globules were of the colour of blue-green algae, the stomach deep orange.

In the preserved condition the specimens were white in colour, 1—1½ mm. long, and ·2—·3 mm. broad. The prostomium was semicircular in shape, and no broader than the succeeding segments; conspicuous cilia clothe its ventral surface.

The largest number of segments noted in an animal which did not show any signs of approaching fission was fourteen. Other specimens of fourteen segments showed the beginning of an approaching division after the eleventh, or perhaps after the tenth segment; specimens with larger numbers of segments also showed a line of division after the eleventh segment. I cannot state what number of segments, if any, are intercalated at this point before division takes place, since in none of the specimens examined were there any newly forming groups of setae in this region.

The setae are all of the capillary type; dorsal and ventral series both begin in the same segment (ii). The setae are quite straight, long and thin, tapering gradually to a very fine point. In each bundle there is as a rule one, or sometimes two, long setae together with a few shorter ones; this difference in length is a real difference of type, since no setae of intermediate lengths occur; all the shorter setae are of approximately the same length, while the long seta of the bundle is very considerably longer, and it may be added considerably thicker also. This may be illustrated by the following figures, which give the lengths of the setae in μ in nine bundles; the figures in heavy type represent the lengths of the long, the other figures those of the short setae. (1) **234**, 122, 112, 112, 108. (2) **187**, 122, 122, 112. (3) **234**, 112, 103. (4) **244**, 141, 108. (5) **206**, 122, 122, 112, 94. (6) **178**, 112, 112. (7) **169**, 141, 103, 94. (8) **234**, 103, 103. (9) **225**, 103.

The average length of the long setae is thus nearly twice that of the short ones; and since the above measurements are taken from the bottom of the setal sac, the disparity in length between those portions which project beyond the body-wall is still greater.

Bundles of setae were sometimes seen without any long setae; usually there was one, occasionally two; it is possible that in those cases where none was seen, one may have dropped out. The shorter setae were usually two, three or four per bundle.

The buccal cavity is large, in the shape of a narrow bell, placed vertically in segment i; it is lined by a tall epithelium. The oesophagus, beginning at the dorsal end of the buccal cavity, occupies segments ii and iii, and is somewhat sinuous. The stomach extends from iv to viii, and is the widest part of the alimentary tube; the intestine begins in ix and extends to the posterior end.

The dorsal vessel is very distinct in stained preparations, extending along the whole length of intestine and stomach; it dilates on the dorsal surface of the oesophagus to form a 'heart,' coextensive with the oesophagus and in diameter equal to it; the dorsal vessel can again be followed forwards from the anterior end of the heart, over the buccal cavity, to which it is attached as far as the anterior border of the mouth.

The cerebral ganglion is conspicuous, fused with the epithelium of the dorsal surface of the prostomium. Thin strands cross the cavity of the prostomium vertically, each with a nucleus in the middle of its course; strands attach the lower surface of the cerebral ganglion to the epithelium of the ventral surface where the latter turns inwards to become continuous with the lining of the buccal cavity.

The only species of *Aeolosoma* in which the oil-globules are all of a green or blue-green colour are *A. headleyi*, Bedd., and *A. viride*, Stephenson. From the former the present species is distinguished by the setae being quite straight, and divisible into two kinds, long and short; from the latter by the deep orange colour of the stomach, the division of the setae into long and short, and apparently in the details of asexual multiplication (here $n = 11$, in *A. viride* $n = 8$). I therefore propose the following diagnosis:—

Length (preserved) 1—1·5 mm., breadth ·2—·3 mm. Segments up to 16 (or? more); n = 11. Setae all capillary; bundles consist as a rule of one long and several shorter, the long (210 μ) averaging twice the length of the shorter (110 μ). Oil drops blue-green. Oesophagus ii—iii, sinuous; stomach iv—viii, deep orange. Prostomium not broader than succeeding segments.

Chaetogaster spongillae, Annand.

1906. *Chaetogaster spongillae*, Annandale, *Journ. As. Soc. Bengal* (N.S.), vol. ii, No. 5.

Through the kindness of Dr. Annandale I received a few specimens of the above species, discovered and described by him a few years ago. The original account, however, deals largely with the bionomics of the animal; and a few additional notes on its anatomy may therefore not be superfluous.

The specimens which I received were all preparing to divide, and it will be convenient to distinguish the anterior portion, in front of the line of future fission, as A, the posterior, behind it, as B. The whole animal, A+B, measured about ·6 mm.; in one case A measured ·41, B ·18 mm.; in another A was ·39, B ·22 mm.; in each case the pharyngeal region (as far as the beginning of the oesophagus) was ·12 mm. Even allowing for contraction therefore, this appears to be the smallest species of

Chaetogaster known (Annandale gives the length of an individual which is not budding as about 1 mm.).

The margin of the mouth does not reach quite to the anterior tip of the body; there is hence a small prostomium. The mouth is large, and leads directly into the pharynx, as in other species.

The setae (fig. 1) are slender, with a slight $\int$-shaped curve, double-pronged; the distal prong is half as long again as the proximal, but only two-thirds as thick at its base; the nodulus is proximal to the middle of the shaft, the proportions being:—proximal to nodulus: distal to nodulus:: 2: 3. There is no difference in type between the setae of the most anterior bundles and those situated more posteriorly, but there is a considerable difference in length; those of segment ii average about ·09 mm., those of the other segments about ·06, or two-thirds the former. There are on the average four setae per bundle.

In the specimens which I received, A possessed eight fully formed segments, and B three or four; between the two was a budding zone, in which young setal bundles—the anterior destined to belong to the posterior end of A, the posterior to the anterior end of B after separation—were occasionally seen.

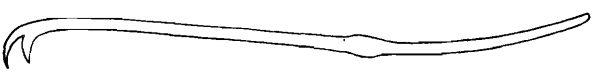

FIG. 1.—*Chaetogaster spongillae*: seta belonging to segment ii; × 890.

The animals therefore begin to divide when they possess eleven or twelve segments: the budding zone forms posterior to viii ($n = 8$), and in the budding zone presumably eight or nine new segments are formed,—three or four to complete A, and five to form the anterior end of B (of these five only the second bears setae): the ninth segment of the original undivided animal ultimately becomes the sixth of B.

Annandale mentions "longitudinal rows of minute, irregular tubercles on the head" I have described similar elevations in *C. orientalis* (= *C. pellucidus*; *Rec. Ind. Mus.*, vol. i, part 3, and *cf.* pl. ix, fig. 1). I have however more recently convinced myself that these appearances are due merely to the muscular fibres which pass between the pharynx and the body-wall, and represent in fact the outer ends of these fibres; the same may not improbably be the case in *C. spongillae*.

The pharynx is a simple wide tube; it is followed by a very short oesophagus, to which succeeds the dilated part of the alimentary tract that I have previously (*loc. cit.*) called the crop; a slight constriction separates this from another dilatation, the stomach, which is followed by the intestine. Of these sections of the tract, the pharynx occupies segments i—iii, as far as the first dissepiment ($\frac{3}{4}$, *v. inf.*); the oesophagus is restricted

to iv, its posterior limit coinciding with the second dissepiment ($\frac{1}{5}$); the crop occupies v—vi, the stomach vii—viii, but since septa are not to be made out behind the oesophagus, these limits are approximate only, and have been fixed by reference to the setal bundles

In longitudinal sections the pharynx is seen to be lined by a thin layer of cuticle; its epithelium, like that of the oesophagus, is approximately cubical. The cells lining the crop however are very much larger, of irregular shape and varying height; so that the epithelium of this portion of the tract has an uneven outline, reminding the observer somewhat of the inner layer of *Hydra*, and suggesting the possibility of intracellular digestion. Chloragogen cells are scanty or absent on the crop, abundant on the stomach.

The circulatory system could not be made out.

Annandale has noted the presence of an otocyst in the brain in this species,—a relatively large, globular, transparent cyst. I have not found any trace of such a cyst in the preserved specimens which I have examined, either mounted whole, or in longitudinal sections: the brain is large, and consists of two parts, an outer cellular surrounding a spherical granular looking mass. There are however a number of enigmatical appearances in connection with the brain of various species of *Chaetogaster*; thus, besides that which led in the present case to the suspicion of an otocyst, there is the structure described by Vejdovsky (*System und Morphologie der Oligochaeten*, p. 38) in *C. diastrophus* ("in dem Einschnitte zwischen den Gehirnlappen befindet sich eine glänzende, scharf contourirte braune Chitinplatte") and figured in his pl. vi, fig. 12; there is the densely pigmented body, possibly functioning as an eye, described by Annandale (*Journ. As. Soc. Bengal* (N. S.), vol. ii, No. 5, p. 189) in a species not named, as well as the sense-organ in the brain of *C. bengalensis* (Annandale, *ibid.*, vol. i, No. 4, p. 117); there is the bright, refractile body, in the same situation as the brown chitinous plate of *C. diastrophus*, described by me in *C. punjabensis* (*Rec. Ind. Mus.*, vol. i, pt. 2; and *cf.* pl. v, fig. 7); and the opaque granular mass, again in a similar situation, in *C. orientalis* (= *C. pellucidus*, *Rec. Ind. Mus.*, vol. i, pt. 3; and *cf.* text-figs. 4, 5).

The anterior part of the ventral nerve cord is, in a number of species of the genus, covered by nerve cells which have no segmental arrangement. In the present species the cord is interesting as showing a fairly distinct aggregation of the nerve cells into separate ganglia. There are no intervals, in the anterior part, where the cord is bare of cells; the cells invest the whole length of the cord as far back as the second setal bundle (segment vi), so that their aggregation into ganglia, though distinctly indicated, is still incomplete. There are two such aggregations in the pharyngeal region, the first of the two being at the level of the first setal bundle (segment ii); and three behind the pharynx, the last of these being opposite the second setal bundle

(segment vi). The arrangement therefore corresponds to the accepted numbering of the segments in *Chaetogaster*, according to which the second setal bundle is assigned to the sixth segment. Behind this the ganglia have the usual discrete arrangement.

On the clitellum, *cf.* my remarks in *Rec. Ind. Mus.*, vol. i, pt. 3, pp. 249—51.

Nais pectinata, Stephenson, var. *inaequalis*, var. nov.

In *Rec. Ind. Mus.*, vol. v, part 4, I recorded a new species of *Nais*, the peculiarity of which consisted in the possession of ctenate needle-setae in the dorsal bundles. The same material from which this species was obtained was shortly afterwards returned to me, in order that I might pick out a number of specimens for separate preservation in the museum. During this re-examination I came across a single specimen of a *Nais* in which the dorsal needles, though ctenate, differed considerably from those found in the ordinary *N. pectinata*; as however in other respects the specimen closely resembled the latter, I describe it here as a variety.

FIG. 2.—*Nais pectinata* var. *inaequalis*: a needle-seta belonging to a dorsal bundle; distal portion only.

Segments 50, plus an undifferentiated growing region at the posterior end. No *eyes*.

The *dorsal setal bundles*, beginning in segment vi, consist usually of one hair-seta and one needle; occasionally of one hair and two needles, or of two setae of each type: in the last case one of the hair-setae is much shorter than the other. The hair-setae are usually about 250 μ long, the shorter ones however about 100 μ; both are quite smooth. The needle-setae are 67—75 μ long, with a slight sickle-shaped curve which includes the distal third of the shaft; there is no nodulus The end is ctenate; but the tooth of the comb which lies towards the inside of the curve of the shaft is very much stronger, and considerably longer than the others (fig. 2); the outer tooth is also slightly larger than the intermediate ones. There may be two, three, or four small intermediate teeth; in one case there were none, the seta being thus merely bifid at its end.

The *ventral setae* begin in segment ii, and are in bundles of three or four; the length is 60—65 μ throughout the body. These bundles may be divided into two groups, an anterior, comprising those of segments ii—v, and a posterior, from segment vi onwards. In the anterior bundles the setae are slighter in form, and less strongly curved, the distal prong of the forked end

being $1\frac{1}{2}$ times as long, but only $\frac{2}{3}$ as thick as the proximal; the nodulus is slightly proximal to the middle of the shaft (proximal to nodulus: distal to nodulus:: 30 μ: 35 μ). In the posterior bundles the setae are stouter, the proximal part of the shaft is more strongly curved, the prongs of the forked end are equal in length, but the distal is only half as thick as the proximal; the nodulus is slightly distal to the middle of the shaft, the former proportions being reversed (proximal portion: distal portion :: 35 μ : 30 μ).

On comparison with the original description of *N. pectinata*, the present specimen is seen to differ not only in the shape of the ends of the dorsal needle-setae, but in the considerably greater number of body-segments, the position of the nodulus, and the relative sizes of the prongs of the ventral setae; slighter differences are seen in the lengths of the dorsal needles and of the ventral setae, and in the respective numbers of ventral setae per bundle in the two forms. It seems advisable therefore to separate this specimen as a distinct variety; the name *inaequalis* is meant to refer to the great disparity in size of the teeth of the comb formed by the end of the dorsal needles.

It may be mentioned in passing that I again found a specimen of *Pristina longiseta*, Ehrbg., during this examination of the material (*cf.* the former paper, referred to above).

Stylaria lacustris, L.

The present species is one of the best known and most easily recognized of all the Naididae: so far, however, the only record of its occurrence in the Indian region is from Lahore (*Mem. Ind. Mus.*, vol. i, No. 3, p. 276), where I obtained a single specimen.

I received the present specimens in January of this year from Mr. Gravely, who obtained them from a pond in the Zoological Gardens at Calcutta. The first consignment was sent alive; but when the tube was opened, after three days, only one specimen was alive, and that was merely a mutilated fragment of fourteen segments, without either anterior or posterior end of the body complete. It was however interesting as embracing at its anterior end a part of the genital region, including some of the clitellum and a portion of the ovisac. Some individuals would therefore seem to become sexual in Calcutta in January.

Mr. Gravely next sent me some preserved specimens; unfortunately none of these had the sexual organs developed, but all were dividing asexually. The *length* of the chains was about 8 mm.—longer, presumably, during extension in life. The triangular *prostomium* ended in a very long narrow proboscis, and eyes were present, as usual. The total number of *segments* varied; from 36 to 54 could be counted bearing setae, and behind this was a growing zone, in which distinct segments were not yet differentiated. The body was covered with a very distinct *cuticle*, much thicker, I think, than is usual in the Naididae and especially

obvious as a clear glassy layer over proboscis, prostomium, and anterior segments, where it was 5—6 μ in thickness.

The *dorsal setae*, beginning in segment vi, were usually two per bundle, both hair-setae, but of unequal length. The longer of the two was about 530 μ in length, or double the diameter of the body; the shorter was about half the length of the longer. In addition, contained within the setal sacs, and reaching only to the level of the surface of the body, there were one or two fine pointed hair-like setae, 50 μ long, probably of the nature of replacing setae.'[1]

The *ventral setae*, mostly six or seven in a bundle, but sometimes as many as nine, were in length about 130 μ. Of the two prongs at the outer end, the distal was very much longer and thicker than the proximal, so that on a superficial examination the setae sometimes appear to end in a single somewhat sharply curved hook; the nodulus was slightly proximal to the middle; and the proximal portion of the shaft was bent at a well-marked angle, instead of showing the usual even curve. These setae therefore resembled those of the specimen recorded from Lahore, as illustrated in *Mem. Ind. Mus.*, vol. i, No. 3, pl. xix, fig. 47.

The *alimentary tract* begins to be covered by chloragogen cells in segment vi. The stomach is a well-marked dilatation beginning in vii, either at the level of the setae, or close behind dissepiment $\frac{6}{7}$; it extends as far as the setae of viii; its wall is composed of large granular cells. The alimentary tube is again narrowed behind the stomach, dilating finally in x to become the intestine.

Body-cavity corpuscles were noted in the first (the mutilated living) specimen, as small clear homogeneous spindle-shaped bodies without visible nucleus; they were not visible in the preserved specimens.

The position of the first *nephridium* varied; in some specimens it was in vii, in about an equal number in viii, and once in ix. In cases where A (the first animal of the chain) had the first nephridium in viii, it was in viii in B also. Since B receives five segments from the budding zone (v. *post.*), segments vi and vii of B belonged originally to the middle part of the body of the parent or undivided animal, and hence presumably contained nephridia; the nephridia of these segments must therefore have degenerated, in these cases, at the onset of asexual division. My previous specimen from Lahore had the first nephridium in ix (*loc. cit.*).

The shape of the *cerebral ganglion* in the preserved specimens is shown in text-fig. 3; it is indented anteriorly and posteriorly, and is remarkable in possessing a pair of large antero-lateral lobes. It thus differs markedly from the Lahore specimen (*loc. cit.*, pl. xix, fig. 48).

[1] But see, on the subject of such supposed 'replacing setae', Piguet, *Rev. Suisse de Zool.*, T. 141, p. 290; and, in regard to another species, Michaelsen, *Mem. Ind Mus*, vol. i, No. 3, p. 134.

The process of *asexual division* could be fairly well followed from the preserved specimens. The value of *n* varies; 15, 17, 18, 20 and 21 were noted; in the budding zone are produced five segments which will form the anterior end of B, and an indefinite number forming the posterior part of A; the proboscis of B points backwards. The peculiarity of the process in these specimens is the situation of the second and third budding zones: the second zone of budding is established one original segment in front of the first, *i.e.*, behind segment *n*—1; and the third appears again one segment in front of the second, behind segment *n*—2. The fourth appears in B, *e.g.*, it may be behind original segment xxxvi. (*Cf.* Piguet, "Observations sur les Naididées," *Rev. Suisse de Zool.*, T. 14, 1906, p. 289.)

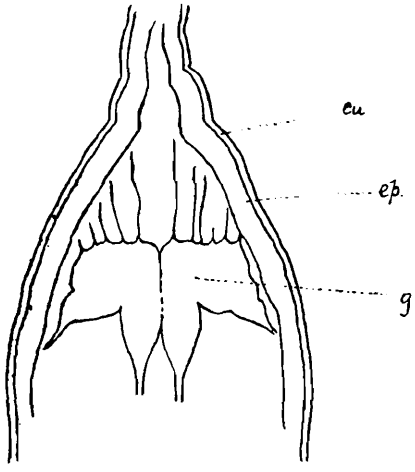

FIG. 3.—*Stylaria lacustris*: a small part of the anterior region of the body, including the base of the proboscis; to show the shape of the cerebral ganglion: × 210. *Cu.*, cuticle; *ep.*, epithelium; *g.*, ganglion.

Pristina proboscidea, Bedd., f. *typica.*

With the preserved specimens of *Stylaria lacustris*, just described, there occurred a single individual of the species discussed by Michaelsen, *Mem. Ind. Mus.*, vol. i, No. 3, p. 133, under the above designation. The specimens submitted to Michaelsen were found living in *Spongilla crassissima* and *S. carteri*, by Annandale in Calcutta; the individual which I examined was taken with the *Stylaria* from a pond in the Zoological Gardens and was therefore living freely at the time of its capture. The specimen agrees in most respects with what Michaelsen says; a short note will therefore be sufficient.

The specimen was considerably curled; its *length* was estimated at 5 mm. The '*proboscis*' was much shorter than in the case of the specimens of *Stylaria* amongst which it was found,

and was much less sharply marked off from the basal portion of the prostomium, of which it is an extension. There were no *eyes*. The *segments* numbered 36, plus an undifferentiated posterior region.

The *dorsal setae*, 2—5 per bundle, begin in segment ii; they are all hair-setae, and are not specially elongated in any particular segment. When, as often, they are 3 or 4 per bundle, all are of approximately equal length; in a bundle of 5 setae, three were longer than the rest (540 μ—between two and three times the diameter of the body), one was somewhat shorter (360 μ), and one much shorter still (less than 180 μ). These setae show the fine serrations noticed by previous observers; on the longer hairs the serrations are about 5 μ apart, or 6 μ towards the base; on a smaller hair they are rather closer—about 4 μ apart; they fade away altogether near the insertion of the setae into the body-wall; they are present on the setae of segments ii and iii as well as in all the other segments.

The *ventral setae* were 3 per bundle in segment ii, 4 and 5 on each side respectively in iii, 4 and 6 in iv, 6 in v; while in the middle part of the body 9 setae per bundle was not uncommon; the number per bundle increases therefore on passing from the anterior end towards the middle region of the body. The variations in the thickness of the shaft of the setae in the anterior segments were similar to those recorded by Michaelsen (*loc. cit.*); in segment ii the thickness was 3 μ, in iii 2·5 μ and in iv less than 2 μ.

Septal glands were present in segments iii, iv and v; the round *stomach* occupies viii; the alimentary canal narrows again behind the stomach, and dilates finally to become the *intestine* in x. The first *nephridium* was in ix.

As to the process of *asexual reproduction*, $n = 16$; of the segments produced in the zone of budding, the seven posterior ones are placed behind the plane where division will take place, and go to form the anterior end of B. The next zone of budding to be produced appears behind segment xv, *i.e.*, one original segment in front of the first; so that the animal which will ultimately be separated from this region contains only one of the original segments of the parent. The third zone of budding was being established after segment xxix of the original animal; thus, in B, $n = 29$ minus 16 (segments in front of the first zone of budding) plus 7 (segments added to form the head of B) = 20.

Aulophorus tonkinensis (Vejd.).

This interesting form, first described by Vejdovsky from a single incomplete specimen, has since been more thoroughly investigated by Michaelsen. The latter author's last reference to it (*Mem. Ind. Mus.*, vol. i, No. 3, p. 132, where the previous literature is given) records that it was collected by Annandale in several localities in India, and gives a note by Annandale on the habits of the living worm.

In December of last year (1910), I received, through the kindness of Dr. Annandale, a tube containing specimens of this worm, sent off alive from Calcutta. On their arrival in Lahore, about half the specimens were dead and disintegrating; a number were alive but motionless; and a few were still active, protruding themselves from their tubes. A subsequent consignment received in January of this year were unfortunately all dead.

Observations on the tubes, and on the mode of progression of the animal, confirmed Annandale's statements. The tubes were composed of bits of leaves, small fragments of wood, and black granular matter; they were always found floating on the surface. In the second batch of specimens the animals were all dead, as has been said, and the tubes were empty; here in all cases there was seen to be a thin and delicate transparent tube within the rough outer one: this was probably the case, though it was not observed, in the first batch also.

The mechanism of progression was much the same as noted by Annandale, modified by the fact that the tubes were floating on the surface. Thus, in a watch-glass, the animal protruded the anterior part of its body downwards and forwards till it touched the bottom, where it attached itself by means of its circular pharynx, using this latter as a sucker; it might then crawl slowly along, the tube still floating on the surface, without ever letting go its hold. Or it would contract its body, thus pulling the tube forward; then it would let go, and extending itself regain its hold on the substratum by means of its pharynx a little in advance of the former place.

The most distinctive characters of the species are to be found in the setae, gills and palps. These features have however been previously described: and I will therefore only add a few particulars concerning the internal anatomy, observed during the examination of the living worms.

The *pharynx* is large and wide, and extends backwards to dissepiment $\frac{3}{4}$; the *oesophagus*, which succeeds, reaches as far as $\frac{8}{9}$; chloragogen cells begin in segment vi; the *stomach* occupies ix; the alimentary tract narrows again in x, to dilate finally in xi, where it becomes the *intestine*.

Body-cavity corpuscles are present, as small circular or irregular homogeneous and refractile bodies.

The *blood* is a very pale red. The *dorsal vessel* is dorsal only in name throughout most of its length, as in related forms; it appears as a clear streak in the chloragogen covering of the intestine and stomach, being thus embedded in the alimentary wall; in segment ix it becomes lateral in position, having thus far been ventral; in viii it separates itself as a distinct vessel with walls of its own; and shortly after this takes up a dorsal position above the oesophagus. The *ventral vessel* is distinct from the alimentary canal throughout the body. *Contractile loops* are present in the hinder part of segments vii and viii respectively, lying on the septum.

The first *nephridium* occurs in segment vii.

In the asexual reproductive process, by fission, $n = 17$; of the segments produced in the budding zone, the posterior five (*i.e.*, four seta-bearing segments plus one without setae) go to form the anterior end of the posterior animal.

XV CONTRIBUTIONS TO THE FAUNA OF YUNNAN BASED ON COLLECTIONS MADE BY J. COGGIN BROWN B.Sc. 1909—1910.

PART VI.—BATRACHIA AND REPTILES.

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

Mr. Coggin Brown's collection of Batrachia and Reptiles is not a large one and the specimens have suffered much through leakage of spirit *en route*. Some interesting forms are, however, represented and I trust that the following records will prove interesting from a geographical point of view.

BATRACHIA.

1. *Tylototriton verrucosus*, Anderson.

Specimens from Tengyueh (5,600 feet) and Yang-pi (5,200 feet).

This newt was originally described from Yunnan and occurs also in Upper Burma and the Eastern Himalayas. It is very abundant at Kurseong (alt. 4,500—5,000 feet) in the Darjiling district, breeding there in small pools of rain-water in June and July. Larvae evidently just about to undergo their final metamorphosis are common in August, but I have seen quite young larvae also in April and it seems possible that the early spring showers induce a few individuals to breed, although the majority do not do so until the real break of the rains.

2. *Megalophrys carinensis* (Boulenger).

Leptobrachium carinense, *Boulenger*, *Faun. Brit. Ind.*—Rept., p. 511.
Megalophrys carinensis, *id.*, *P.Z.S.*, 1908 (i), p. 427.

A large specimen from Hsia-kuan (6,700 feet). Originally described from the Karin Hills; this frog also occurs in Tenasserim.

3. *Megalophrys major*, Boulenger.

? Ixalus lateralis, *Anderson*, *Anat. Zool Res. Yunnan Exp.*, p. 844, pl. lxxviii, fig. 5 (1879).
Megalophrys major, *Boulenger*, *P.Z.S.*, 1908 (i), p. 416, pl. xxiii.

No specimens of this species were taken by Mr. Brown in Yunnan, but he has recently sent me what may be its larva from the Hse-gna-Sang River, Panzi, Hsipaw, N. Shan States. The tadpoles from Hsipaw closely resemble those of *M. montana* and *M. parva* in structure but differ from the former in having the ventral surface pale and from the latter in not being mottled or spotted on the dorsal surface, which is of a uniform dark brown.

I take this opportunity to put on record the occurrence of tadpoles apparently identical with those of *M. parva* in a small spring on the road to the plains from Naini Tal at an altitude of about 5,000 feet. This record extends the known range of the family Pelobatidae, which does not appear to have been taken hitherto in the Western Himalayas. The specimens were taken by myself in October, 1906.

4. *Bufo melanostictus*, Schneider.

Specimens from Tengyueh. The common toad of the greater part of tropical Asia.

5. *Hyla chinensis*, Günther.

Mr. Brown has given me the following note on the species :—

"*Hyla chinensis* is very widely distributed in China, and has been obtained from Southern China and the island of Formosa by Swinhoe,[1] from Shanghai by the Szechenyi expedition,[2] from Lung-tan-ssi in southern Shensi by Blackwelder,[3] from Tengyueh in Western Yunnan by Anderson[4] and from Tengyueh and Pu-piao in the same province by myself. Günther has pointed out that this frog (which is extremely similar to the common European tree frog) appears to be peculiar to China. Anderson's specimens were found covering a few bushes around Momien (Tengyueh) in the month of July; whilst Blackwelder found a small company in a shallow temporary pool of water on the grassy side of a mountain ridge, 6,000 feet in elevation, in the month of April. The chorus made by them was so loud as to be plainly audible at a distance of 2,000 feet.

The frog is common around Tengyueh and appears to spend the cold months of the year on the ground, in secluded positions under old tree-trunks, etc. I have found them, usually in small groups of four or five, under stones in damp fields in December and January. As the weather gets warmer they appear to become more arboreal in their habits, taking then to bushes, trees and tall

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[1] *Catalogue of Batrachia Salientia in British Museum*, p. 108, 1858.

[2] "Verzeichniss der Reptilien, Amphibien, und Fische," by Dr. Franz Steindachner in *Die wissenschaftlichen Ergebnisse der Reise des Grafen Bela Szechenyi in Ost-Asien*, 1877-1880, Band ii, p. 507.

[3] "Report on Zoology," by Eliot Blackwelder in *Research in China*, part 2, p. 481. Washington, 1907.

[4] *Anatomical and Zoological Researches of Yunnan Expeditions*, by Anderson, 1878, vol. i, p. 847

plants. They are apparently nocturnal, for a group which were under observation in a garden for three months in the autumn of 1909, used to lie snugly together in the open end of a bamboo during the day, wriggling closer together if approached. At dusk they emerged one by one, remaining at the mouth of the bamboo for a few minutes before taking a leap on to the spray of an adjacent rose bush which was their favourite and apparently only hunting-ground. When approached with a light they showed great alarm, jumping rapidly and far, and apparently at random, their adhesive feet taking firm hold at the instant of contact with a twig or leaf. They seemed to like water, for a small quantity was always lying collected at the bottom of the bamboo in which they lived, and during rain or when water was poured in on them they invariably came up half way to meet it. During the three months of observation they made no sound; this was perhaps owing to it not being the time of the breeding season.

The specimens from Pu-piao were obtained at an elevation of 4,500 feet, living on the top of a thick high hedge. Tengyueh itself has an elevation of 5,365 feet."

The collection also includes specimens of several species of *Rana*, but their condition forbids a precise identification.

REPTILES.

6. *Japalura yunnanensis*, Anderson.

Anderson, Anat. Zool. Res. Yunnan Exp., p. 803, pl. lxxvi, fig. 2 (1878).

A specimen from Yang-pi.

7. *Acanthosaura dymondi*, Boulenger.

Boulenger, Ann. Mag. Nat. Hist. (7), xvii, p. 567 (1906).

A specimen from Ta-lu, Yung-pe Ting district (alt. 7,800 feet). I have compared it with one of the types from Yunnan Fu (alt. 6,400 feet).

8. *Ablabes porphyraceus* (Cantor).

A young specimen from Mong Wan (alt. 3,100 feet).

9. *Zaocys nigromarginatus* (Blyth).

A specimen from Lu-shui-ho in the province of Ssu-chuan.

10. *Coluber taeniurus*, Cope.

Specimens from Tengyueh and Ma-chan-kai (6,000 feet) in the Tengyueh district.

11. *Colubcr prasinus*, Blyth.

A specimen from Pu-piao (alt. 4,600 feet) in the Yung-chang Fu district.

12. *Helicops schistosus* subsp. *yunnanensis* (Anderson).

Atretium schistosum, *Daud.*, *var.* yunnanensis, *Anderson*, *Anat. Zool. Res. Yunnan Exp.*, p. 822 (1878).

Helicops schistosus *var.* andersoni, *Wall*, *Rec. Ind. Mus.*, iii, p. 146 (1909).

A specimen from Mong Wan must be attributed to this race, the internasal being divided into three shields as in two of the three original specimens, which are the types of Wall's variety as well as of Anderson's. So far as I am aware this form has only been found in Yunnan. It is distinguished from the typical form of the species by the splitting of the internasal into either two or three shields.

13. *Tropidonotus stolatus* (Linn.).

A specimen from Lo-po-ssu-chuang (Mong Hum) (alt. *ca.* 5,000 feet). The markings are unusually conspicuous owing to the pale ground-colour of the dorsal surface, but I am not sure how far this is due to partial maceration of the specimen.

14. *Tropidonotus nuchalis*, Boulenger.

Boulenger, Cat. Snakes Brit. Mus., i, p. 218, pl. xiii, fig. 1.

I attribute to this species, which was originally described from the upper basin of the Yang-tse-kiang, two small specimens, one (total length 31 cm.) from Tengyueh, the other (total length 43 cm.) from Pe-lien (alt. 5,800 feet) in the same district. They agree fairly well with Boulenger's description and have the mid-dorsal groove on the neck (which doubtless suggested the specific name) conspicuously present; but in one the suture between the internasals is distinctly and in the other slightly shorter than that between the fronto-parietals. The smaller specimen is dark with a pale transverse bar running across the neck and interrupted by the nuchal groove, and with a minute white spot on each side of a large number of the dorsal and lateral scales. In the larger specimen these minute spots have disappeared and the nuchal cross-bar is represented by a brownish spot on either side. The dark lines on the sides of the head were apparently faint or absent in both specimens, but their state of preservation is too bad to justify an exact statement on this point.

15. *Bungarus fasciatus* (Schneider).

A young specimen from Chu-tung (alt. 5,500 feet) in the Yung-ping Hsien district.

XVI NOTES ON ASIATIC SPECIES OF CRUSTACEA ANOSTRACA IN THE INDIAN MUSEUM.

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

The publication of Prof. E. von Daday's valuable monograph on the Branchiopoda Anostraca[1] has enabled me to determine the unnamed specimens of this group in the Indian Museum without difficulty. Prof. von Daday was kind enough to examine the majority of species in the collection at the time when he was working at the group and the number of specimens which have since accumulated is not large.

No additions to the comparatively small number of species found in India were included in the material awaiting identification; but an enumeration of the forms at present known from India and the countries adjacent to it, with such details of their occurrence as are known, will perhaps be of some assistance to those interested in the freshwater crustacea of this region.

Owing to an unfortunate mistake the real types of Alcock's *Branchipus bobrinskii* were not sent to von Daday when he was preparing his monograph. The species is here identified with *Chirocephalus altaicus*, von Daday.

Six species of Anostraca, belonging to five genera, are now known from India, from the countries abutting on its northern frontier and from Ceylon.

Branchinecta orientalis, G. O. Sars.

1910. *Branchinecta orientalis*, E. v. Daday, *Ann. Sci. Nat. Zool.* (9), xi, p. 156, fig. 12, a-o.

This species is known from Hungary and Russia and extends eastwards as far as the Pamirs, Tibet and Mongolia. The Tibetan specimens, which are preserved in the Indian Museum, were presented by Capt. R. E. Lloyd who obtained them in August, 1904. They were taken in a large muddy pond, evidently not permanent in nature, at the foot of Gyantse fort at an elevation of about 13,000 feet. Though they were found in August von Daday refers these specimens to the seasonal phase called 'forma *vernalis*' which differs from the 'forma *aestivalis* only in its larger size.

[1] Von Daday, "Monographie systématique des Phyllopodes Anostracés," *Ann. Sci. Nat. Zool.* (9), xi, 1910, pp. 91—492.

It seems probable that *B. orientalis* only occurs at great altitudes in the eastern part of its distributional range; the Pamir specimens were found at an elevation of about 13,000 ft.

Pristicephalus priscus, von Daday.

1910. *Pristicephalus priscus*, von Daday, *Ann. Sci. Nat. Zool.* (9), xi, p. 224, fig. 29, a-k.

This species is known only from the Western Himalayas. It has been found on the following occasions:—

1. Suka Tal,[1] Kumaon, *ca.* 7,000 ft., Oct. 3rd. 1906, and May, 1909. N. Annandale, R. E. Lloyd.
2. Bhowali Bazar, Kumaon, *ca.* 5,500 ft., May, 1909. A. D. Imms, R. E. Lloyd.
3. Phagu, Simla Hills, *ca.* 9,000 ft., May 3rd, 1907. N. Annandale.
4. Theog, Simla Hills, *ca.* 8,000 ft., April 27th and May 3rd, 1907. N. Annandale.

Suka Tal and the ponds at Phagu and Theog were found quite dry on subsequent occasions.

The Phagu specimens, living in a pool of rain-water at a height of 9,000 ft. were considerably smaller than those obtained 1,000 ft. below in the village pond at Theog. At the latter place on the 27th of May, Dr. Annandale found both males and females in abundance; but five days later, although males were still numerous, not a single female could be discovered.

In May of the present year *P. priscus* appeared to be wholly absent from small pools in the neighbourhood of the Kumaon lakes.

Chirocephalus bobrinskii, Alcock.

1898. *Branchipus* (*Chirocephalus*) *bobrinskii*, Alcock, *Rep. Nat. Hist. Results Pamir Boundary Comm.*, p. 17, pl. iii, figs. 1, 1a.

1910. *Chirocephalus altaicus*, von Daday, *Ann. Sci. Nat. Zool.* (9), xi, p. 191, fig. 22, a-i.

1910. *Chirocephalus bobrinskii*, von Daday, *ibid.*, p. 212.

It seems that two species of Anostraca were found by Alcock in the Chakmaktin Lake, Little Pamir, and were separated into two bottles; but by an unfortunate mistake both were labelled *Branchipus bobrinskii*. One bottle labelled 'types' is in the Indian Museum; the other was sent to von Daday who remarks that "par un hasard inexplicable au lieu de *Chirocephalus*, j'ai reçu *Branchinecta orientalis*, G. O. Sars."

An examination of the types shows that Alcock's species is unquestionably the same as that which von Daday has recently described under the name of *C. altaicus* from two males found in a

[1] The specimens which von Daday records from Naini Tal were in reality found in this temporary sheet of water.

valley of the Altai Mountains and from the vicinity of Sinjucha in the same range.

The only differences that I am able to detect between male *C. bobrinskii* and the figures and description which von Daday has given of *C. altaicus* are as follows:--

The large spine-like process on the under surface of the proximal segment of the second antennae, near its base, is longer, considerably more than half the length of the segment. In the trilobate process at the base of the second antennae the edge of the triangular emargination between the two basal laminae is entire—not denticulate as shown in von Daday's fig. 22 c. Von Daday states that the apex of the ultimate antennal segment is truncate or bilobate: in the types of *C. bobrinskii* it is truncate. The penis, when everted, has the same form as in *C. altaicus*, but the spinulose process at the base is distinctly broader.

Apart from the details mentioned above the second antenna with its curious pedicled digitate process at the base of the ultimate segment agrees precisely with von Daday's account; the trunk-limbs correspond closely with his figures and the characters which distinguish *C. altaicus* from its near allies *C. turkestanicus* and *C. sinensis* are well shown.

Von Daday was unable to examine any females of this species and the single female specimen from the Chakmaktin Lake is unfortunately in very poor condition. It is, however, clear that this sex shows much affinity with Thiele's *C. sinensis*. On each of the first two abdominal somites there is a stout outstanding spine on either side and on each of the succeeding somites except the last there is a pair of spines on the hinder margin, directed posteriorly and diminishing in size from before backwards. The egg-sac is as long as the first five abdominal somites combined and its aperture is terminal, transverse and V-shaped in lateral view.

The specimens are so contorted that accurate measurement is an impossibility. It seems, however, that they could not have exceeded 12-13 mm. in length. Von Daday's two specimens measured 12 and 19 mm. respectively.

C. bobrinskii is known only from the Pamir and Little Pamir. Those from the latter region were found at an elevation of about 13,000 ft.

Branchipus stagnalis (Linn.).

1910. *Branchipus stagnalis*, von Daday, *Ann. Sci. Nat. Zool.* (9), xi, p. 312, fig. 54, a-h.

This widely-distributed species occurs in Europe, N. Africa and Asia, extending eastwards as far as Sind. The specimens from Sind, the only locality in the Oriental region from which the species has been recorded, were collected by Mr. A. W. Murray and are preserved in the Indian Museum; the precise date and circumstances of their capture are not available. Gurney in 1907 [1] recorded these examples under the name of *B. pisciformis*, Schaeffer.

[1] Gurney, *Journ. A. S. B.* (n s.), ii, 1907, p. 275.

Streptocephalus dichotomus, Baird.

Chirocephalus stoliczkae, Wood-Mason, MS. (= var. *simplex*, Gurney).

1896. *Branchipus* (*Streptocephalus*) *bengalensis*, Alcock, *Journ. A. S. B.*, lxv, p. 538, pl. x.

1910. *Streptocephalus dichotomus*, E. v. Daday, *Ann. Sci. Nat. Zool.* (9), xi, p. 349, figs. 63, 64.

This species is found only in India. It appears to be the common representative of the Anostraca in the plains; but, in the north-west and south, has been found at considerable elevations.

The precise locality of Baird's type specimen is unknown; it is stated to have been found alive in a pail of milk. The other records are as follows:—

1. Near Bangalore, Mysore, *ca.* 3,000 ft., Oct. 13th, 1910. N. Annandale and M. Travers.
2. Marikuppam, Mysore, *ca.* 2,500 ft., Oct. 21st, 1910. Mus. Collr.
3. Shevaroy Hills, Madras Pres., *ca.* 5,000 ft. J. R. Henderson.
4. Spur Tank, Madras (city), March, 1911. J. R. Henderson.
5. Near Calcutta, in flooded rice-fields, 1896, probably June or July. (Types of *B. bengalensis*, Alcock.) Mus. Collr.
6. Cutch, Sind. (Types of var. *simplex*, Gurney.) F. Stoliczka.
7. Dhurampur Kooa, base of Simla Hills, 2,500–3,000 ft., July 21st, 1911. Mus. Collr.

Gurney's var. *simplex*[1] is distinguishable only in the case of the male: the type specimens from Cutch all belong to this sex. Of twenty-four males from Dhurampur Kooa, ten are typical, while fourteen exhibit the characters of the variety. Forty females were found in the same locality, but it does not seem possible to distinguish two forms among them.

Although the two forms of male certainly occur together, there is a complete absence of intermediates and, in consequence, the retention of the varietal name appears to be justified. In several male examples the process characteristic of the typical form, near the apex of the upper ramus of the second antennae, is shorter than is shown in the figures given by Sars and von Daday; but the distinction in this respect between the typical form and the variety is always clear and is correlated with the number of cirriform appendages at the distal end of the proximal antennal segment (four in the typical form: three in the var. *simplex*).

A single male from the Shevaroy Hills, one of those determined by Sars, accords with the typical form. But von Daday notes that he received an example of the variety from the Norwegian carcinologist and it is probable therefore that both forms

[1] Gurney, *Journ. A. S. B.* (n.s.), ii, 1907, p. 276, pl. v, fig. 11.

occurred together in the Shevaroy Hills, for it does not appear that Sars examined specimens from any other locality. Von Daday records the var. *simplex* from Calcutta, but this is, I believe, due to an error.

The var. *simplex* has been obtained at Cutch unassociated with typical examples, the two forms have occurred together in the Shevaroy Hills and at the base of the W. Himalayas, and the typical form without any admixture of the variety has been found at Bangalore, Marikuppam, Madras and Calcutta.

Streptocephalus spinifer, Gurney.

1906. *Streptocephalus spinifer*, Gurney, *Spolia Zeylanica*, iv, p. 126, pl. i.

1910. *Streptocephalus spinifer*, von Daday, *Ann. Sci. Nat. Zool.* (9), xi, p. 403, fig. 83, a-e.

This species is known only from the original specimens, found by Mr. E. E. Green in a stagnant pool at Maha Ilupalama, Ceylon. There are no examples in the Indian Museum.

XVII NOTES ON FRESHWATER SPONGES.

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

XIII.—SPECIMENS COLLECTED IN THE POONA DISTRICT, BOMBAY PRESIDENCY, BY S. P. AGHARKAR.

The Indian Museum is indebted to Mr. Agharkar for an interesting little collection of sponges from the Bhima River in the Western Ghats (Poona district), among the specimens being the types of a new subspecies.

Genus SPONGILLA.

1. *Spongilla* (*Euspongilla*) *cinerea*, Carter.

This rare sponge was found encrusting the bed of the Bhima River at Khed in the Poona district on May 1st. The specimens, which retain a bright green colour in spirit, agree in structure with others obtained at Nasik on the western slopes of the Western Ghats and in Naukuchia Tal (alt 4,200 feet) in the W. Himalayas. They differ from a piece of the type with which I have compared them in having smaller, radiate oscula and rather stouter and more distinctly spinous skeleton-spicules. They possess comparatively few gemmules.

2. *Spongilla* (*Stratospongilla*) *bombayensis*, Carter.

Specimens were found on the bed of the Bhima River at Khed with those of *S. cinerea*. They contained (in May) few gemmules.

Genus CORVOSPONGILLA.

In my volume on the freshwater sponges, etc., in the *Fauna of British India* I have proposed the recognition of a new genus (*Corvospongilla*) to include those species formerly assigned to *Spongilla* which have birotulate flesh-spicules and amphioxous or (more usually) amphistrongylous gemmule-spicules devoid of rotulae.

3. *Corvospongilla burmanica* subsp. *bombayensis*, nov.

Kirkpatrick[1] has described *C. burmanica* with such care that it is unnecessary to characterize the new subspecies here proposed otherwise than by indicating the points in which it differs from the typical form of its species.

[1] *Rec. Ind. Mus.*, ii, p. 97.

1. The sponge is green fresh and nearly black dry.
2. The oscula are almost flush with the external surface and show but slight traces of being elevated above it.
3. The vertical pillars or radiating fibres of the skeleton are rather close together, so that their free extremities are disposed densely on the surface, giving it a more spiny appearance.
4. The skeleton-spicules are slightly stouter.
5. The gemmule-spicules are extremely variable in size; indeed, there is an almost complete gradation between megascleres and microscleres, some of the largest of the latter being nearly smooth.

Habitat.—Bed of the Bhima River at Khed, Poona district; with *Spongilla cinerea* and *S. bombayensis*.

In his account of the gemmule of *C. burmanica* Kirkpatrick distinguishes three layers of spicules, an outer shell of skeleton-spicules, an intermediate layer of microscleres, and an inner layer of the latter in close contact with the gemmule. In many of the gemmules I have examined, however, I can only distinguish two distinct layers, an outer cage of skeleton-spicules mixed with amphistrongylous microscleres of very variable size and form, and an inner layer of much more uniform gemmule-spicules embedded like a mosaic in the outer wall of the gemmule.

Both forms of *C. burmanica* differ from *C. loricata*, Weltner, in the structure of the gemmule-spicule, the spines of which are much stouter in the latter; from *C. lapidosa*, Annandale, their much less stony hardness, spherical gemmules, well-defined radiating skeleton-fibres and conspicuous oscula will at once distinguish them.

MISCELLANEA

INSECTS.

FURTHER NOTES ON SYNONYMY IN CORETHRINAE.—The history of *Corethra* and the allied genera has become somewhat confused of late, mainly due to the placing of the type species of that genus, *culiciformis*, Degeer, in a genus founded by Loew (*Mochlonyx*), for a congeneric species *velutina*, Ruthe; and partly to the discovery quite recently that a genus *Chaoborus*, Lichtenstein, erected in 1800, is synonymous with *Sayomyia*, Coq., which latter (proposed in 1903) has been adopted of late by the workers in Culicidae in place of *Corethra* (as applied to those species other than *culiciformis* and its congeners).

Corethra was established by Meigen in 1803 for *Tipula culiciformis*, Degeer; there can therefore be no argument against this being the type species. Two other species, *pallida*, Fab. (1781), and *plumicornis*, Fab. (1794), were added, and it was twenty years after the creation of the genus that a fourth species appeared. This was *punctipennis*, Say., followed by *flavicans*, Mg., in 1830, others being added subsequently.

Ruthe described *velutina* as a *Corethra*[1] and this species was made the type of *Mochlonyx* by Loew. When Loew set up *Mochlonyx* (in 1844), there were known only four species, *culiciformis*, *plumicornis*, *pallida* and *fusca*, all placed in *Corethra*. In separating those species with a metatarsus distinctly longer than the 2nd joint from those in which it is several times shorter than the 2nd joint, Loew was morphologically correct, but made the mistake of selecting the wrong group of species for his new genus.

Now this seems a strange thing for so sound a dipterologist as Loew to do, but if we premise that Loew *never actually saw culiciformis*, we have an explanation of the whole situation. This is on the assumption that neither Degeer nor any other early writer gave a specification of the relative lengths of the tarsal joints.[2]

In this case Loew would conclude that *culiciformis* as well as *plumicornis*, *pallida* and *fusca* possessed long metatarsi, and that in *velutina*, Ruthe, he had found an isolated case to the contrary, which he was justified in placing in a new genus.

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[1] Isis, 1831, p. 1205. As though to complicate matters still further, even Ruthe contradicts himself, for in the two short preliminary diagnoses in Latin and German he says 1st tarsal joint much *shorter* (the italics are mine) but in the full German description following he says much "longer:" but that this is an error is obvious by the continuation that the fore pair are "shorter still," being only one fourth as long as the 2nd joint, which itself is twice as long as the 3rd.

[2] This is a point I have no means of verifying, Degeer's work not being accessible, but Coquillett (Can. Ent., xxx, 189), in establishing *Sayomyia*, says that the figures are useless for deciding the question.

Moreover, in the light of the definite information of the very short 1st tarsal joint in *culiciformis* as specially supplied me by Mr. Hill after an examination of examples of the species in the British Museum, it seems almost certain that Schiner also never saw the species, as otherwise he would have corrected Loew's error. It was not a case of the point being overlooked, since Schiner accepted the differentiation of the genera on Loew's character,—the relative lengths of the metatarsus and 2nd tarsal joints.

Coquillett, recognizing Loew's error in selecting the wrong group of species for his new genus, proposed *Sayomyia*[1] for those species with long metatarsi, taking as his type *punctipennis*, Say., a North American species,[2] and until recently this generic term has been in general use for those species of "*Corethra*" *sensu lato*, apart from the congeners of *culiciformis*.

The recognition quite recently (1910) by Coquillett himself that *Chaoborus*, Lichtenstein (1900), is synonymous with *Corethra* itself and antedates Meigen's genus by three years, throws all the species lately placed in *Sayomyia* into this ancient genus.

In my previous notes on this subject[3] the identity is explained.

Regarding some other species, *manilensis*, Sch., was described only four years after that author published his "Fauna Austriaca," so that it is evident it must be a *Chaoborus* also.

"*Corethra asiatica*," Giles, has the metatarsus distinctly longer (about $1\frac{1}{3}$ to $1\frac{1}{2}$ times) than the 2nd joint, which latter is a little longer than the 3rd. It is therefore a *Chaoborus*.

"*Sayomyia cornfordi*," Theob., I am informed by Mr. Hill, who has kindly examined the type on my behalf, has the metatarsus $1\frac{1}{2}$ times as long as the 2nd which is $1\frac{3}{4}$ times as long as the 3rd, the remaining joints being subequal, each a little shorter than the 3rd. *Cornfordi* therefore is also a *Chaoborus*.

Although I quite agree with Prof. Kertesz in believing only two sub-families should be allowed (Culicinae and Corethrinae[4]), as has been always customary until the connection between mosquitoes and malaria drew the attention of many students to the subject who were not dipterologists, it is difficult to understand why he places "*Mochlonyx*," Lw. (with the three species *culiciformis*, Deg., *velutinus*, Ruthe, and *effoetus*, Wlk.,[5] which of course are true *Corethrae*), in the sub-family Culicinae, retaining "*Corethra*" in Corethrinae for those species that I have shown have to be relegated to *Chaoborus*.

So far as my information carries me, *Corethra*, Mg., *sensu stricto*, will contain only the two species *culiciformis*, Degeer, and *velutina*, Ruthe, the latter with *effoetus*, Wlk., as a synonym.

[1] Can. Ent., xxxv, 189. [2] Journ. Acad. Sci. Phil., iii, 16 (*Corethra, id.*).
[3] Rec. Ind. Mus., iv, 317 (1911).
[4] In my catalogue of Oriental Culicidae published recently I admitted more than two sub-families merely out of compliment to workers in this family, and I may do so for the same reason in my forthcoming extensive supplement, but I am convinced that from a zoological point of view the two sub-families are quite sufficient.
[5] This is synonymous with *velutina*, Ruthe.

In *Chaoborus*, Lichtenstein, must certainly be placed the following: *plumicornis*, F., *pallida*, F., *fusca*, Staeg., *flavicans*, Mg., *manilensis*, Sch., *punctipennis*, Say., the latter with *trivittata*, Lw., as a synonym.

Prof. Kertesz's catalogue gives the following species under "*Corethra*" and there are no means to hand of testing their true generic position, but the probability is that the majority, perhaps all of them, belong to *Chaoborus*. It may be noted that the above-mentioned catalogue uses the term *Corethra* to embrace the species now certainly referred to *Chaoborus* as well as the following ones of uncertain position: *antarctica*, Huds. (New Zealand), *nyblaei*, Zett. (North Europe), *obscuripes*, Wulp (Central Europe), *pilipes*, Gimm (Eastern Europe), and *rufa*, Zett. (North Europe).

E. Brunetti.

CRUSTACEA.

On the distribution of the different forms of the genus *Ibla*.—Until a few years ago only two forms of the genus *Ibla* (*I. quadrivalvis* (Cuvier) and *I. cummingi*, Darwin) had been described, but in 1907 Hoek described a third under the name *Ibla sibogae* (*Siboga-Exped.*, Mon. xxxia—Cirripedia Pedunculata—p. 48, pl. iv, figs. 20—22, pl. v, figs. 1—8, 1907). The most curious difference between *I. quadrivalvis* and *I. cummingi* is, as Darwin pointed out, the fact that whereas the large individuals of the former are hermaphrodite and possess a well-developed penis, similar individuals of the latter are exclusively female and possess no penis (*Mon. Cirripedia*—Lepadidae, p. 204). The typical form of *I. cummingi* can be readily distinguished on superficial examination by blue markings on its valves which are quite absent from those of *I. quadrivalvis*. All other differences are trivial and, in my opinion, fall well within the limits of individual variation. *I. sibogae* (except for minute structural differences which I also consider of little importance) differs from *I. cummingi*, with which its sexual features are in agreement, in the absence of the blue markings; from *I. quadrivalvis* it can hardly be distinguished unless the animal be dissected out of its shell.

I have recently obtained cotypes or paratypes of *I. sibogae* and have examined considerable numbers of specimens of the genus from the Gulf of Oman, the coast of Burma, the Straits of Malacca, the Gulf of Siam, Port Jackson and New Zealand. With the exception of those from Australia and New Zealand, these specimens agree either with *I. cummingi* or (more commonly) with *I. sibogae*. The series from the coast of Burma is a large one and includes almost every grade in a transition between these two forms, and I have no doubt that the form *sibogae* must therefore be considered merely as a variety of *I. cummingi*, as Hoek himself thought might prove to be the case. Among the specimens that represent this variety in the collection before me are some of those

which Lanchester (*P. Z. S.*, 1902 (i), p. 372) recorded from Pulau Bidan near Penang as *L. quadrivalvis*. The specimens from Port Jackson and New Zealand clearly represent the true *I. quadrivalvis* and are hermaphrodite. This form was not taken in the Malay Archipelago by the "Siboga."

Taking these facts into consideration, I am inclined to believe that *I. quadrivalvis* and *I. cummingi* are merely local races, the one confined to the southern part of the Pacific, Madagascar and the east coast of Africa, the other to the waters of the Oriental Region and the Persian Gulf; and that all records of *I. quadrivalvis* from the Oriental Region refer actually to *I. cummingi* var. *sibogae*, which occurs on the coast of Burma, in the Straits of Malacca, the Gulf of Siam, the Malay Archipelago and also at Muscat in Arabia.

Neither the variety *sibogae* nor the typical form of *I. cummingi* is invariably associated with *Pollicipes* as was the case with Darwin's specimens of the latter from the Philippines—he does not state that it was the case with those he examined from Lower Burma. Capt. F. H. Stewart took numerous specimens of both forms on an island off the coast of Burma (*Mem. Ind. Mus.*, iii, p. 36), but no specimens of *Pollicipes*; while the specimens of the latter genus taken by Dr. W. Mortensen in the Gulf of Siam do not appear to have been found on the same date as those of *Ibla* from the same locality (*Sacr. Vid. Medd. naturh. Foren. Köbenhavn*, 1910, pp. 81, 85). The sexual peculiarities of *I. cummingi* cannot therefore be correlated with a semi-parasitic mode of life, although they may possibly be due to climatic influences. Before theorizing on this point, however, it might be well to check the records of the different forms of the genus, and I would appeal to all students of the Cirripedia who have the opportunity of examining specimens of *Ibla* (or of any other genus) not to trust merely to an external examination of the shell in their determination of the species but to dissect the animal out before recording its name.

N. ANNANDALE.

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of the

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Other Publications edited and sold by the Superintendent of the Indian Museum (also obtainable from Messrs. Friedlander & Sohn) issued by the Director of the Royal Indian Marine.

Illustrations of the Zoology of the R.I.M.S. " Investigator " 1892. Fishes, Plates I to VII. Crustacea, Plates I to V, 1894. Fishes, Plates VII to XIII. Crustacea, Plates VI to VIII. Echinoderma, Plates I to III, 1895. Echinoderma, Plates IV and V. Fishes, Plates XIV to XVI. Crustacea, Plates IX to XV, 1896. Crustacea, Plates XVI to XXVII, 1897. Fishes, Plate XVII. Crustacea, Plates XXVIII to XXXII. Mollusca, Plates I to VI, 1898. Fishes, Plates XVIII to XXIV. Crustacea, Plates XXXIII to XXXV. Mollusca, Plates VII and VIII, 1899. Fishes, Plates XXV and XXVI. Crustacea, Plates XXXVI to XLV, 1900. Fishes, Plates XXVII to XXXV. Crustacea, Plates XLVI to XLVIII. Index, Part I, 1901. Crustacea, Plates XLIX to LV. Mollusca, Plates IX to XIII, 1902. Crustacea, Plates LVI to LXVII. Crustacea, Plates LXVIII to LXXVI. Fishes, Plates XXXVI to XXXVIII, 1905. Crustacea (Malacostraca), Plates LXXVII to LXXIX. Crustacea (Entomostraca), Plates I and II. Mollusca, Plates XIV to XVIII, 1907. Fishes, Plates XXXIX to XLIII. Crustacea (Entomostraca), Plates III to V. Mollusca, Plates XIX and XX, 1908.—Re. 1 per plate. Mollusca, Plates XXI to XXIII, 1909.—As. 8 per plate.