

XIX. GORDIENS DU MUSÉE INDIEN

NOUVELLE SERIES.

Par LORENZO CAMERANO, *Professeur à l'Université de Turin.*

Monsieur N. Annandale, Superintendant du Musée d'Histoire Naturelle Indien de Calcutta, a eu l'obigeance de me soumettre la collection de Gordiens appartenant au Musée. L'étude¹ de cette collection permettra d'établir d'une manière plus exacte la distribution géographique de plusieurs espèces et fera connaître aussi quelques espèces nouvelles pour la science.

Chordodes pollonerae, sp. nov.

Assam.

♂ Longueur, m. o. 131. Largeur, m. o. 001.

L'animal est de couleur brun-noirâtre.

La couche cuticulaire extérieure présente:—

1. Aréoles papillaires, dont la forme rappelle le fruit du mûrier (largeur 12, 13, 14 micromillimètres), leur contour est presque rond ou oval. Elles sont de couleur clair et sont très rapprochée entre elles.

2. Aréoles papillaires semblables aux précédentes: mais plus relevées et de couleur plus foncé. Ces aréoles se trouvent isolées ou bien se réunissent, çà et là, par groupes de deux, trois, ou quatre.

3. Aréoles papillaires semblables aux précédentes mais munies d'un petit prolongement réfringent. Ces aréoles sont assez rares.

4. Aréoles papillaires semblables à celles du numéro 2 mais plus relevées et de forme conique qui entourent en nombre de 7, 8 ou peu plus, 1, 2 ou 3 aréoles papillaires de couleur plus foncé, rondes ou ovales, qui portent dans leur partie supérieure des prolongements courts, fins, et réfringents. Je n'ai pas observé des prolongements en forme d'épines.

Parachordodes roccatii, sp. nov.

Majkhali, Almora district, Western Himalayas. (*R. Hodgari*).

♀ Longueur, m. o. 203 (l'extrémité antérieure n'est pas bien conservée).

Largeur maxima, m. o. 0008.

L'animal est de couleur brun.

¹ L. Camerano, "Gordiens du Musée Indien," *Records of the Indian Museum*, vol. II, Part II, pp. 113—117 (1908).

L'extrémité antérieure est assez effilée. L'extrémité postérieure est plus grossie avec l'ouverture cloacale terminale et elle apparaît comme tronquée obliquement.

Les aréoles de la cuticule extérieure (largeur 12 à 20 micromillimètres) sont un peu élevées, leur contour est presque rond. Parmi ces aréoles il y a des nombreuses formations réfringentes (largeur 5 micromillimètres) réunies deux par deux, qui donnent à la cuticule un aspect tout à fait caractéristique. Dans la ligue de séparations, très petite, des deux formations on observe un petit tubercule réfringent.

Parachordodes kaschgaricus, Camer.

Shembaganur, Palni Hills, 6300 ft., Madura district, Madras Presidency. (*Major F. Wall, I.M.S.*).

♂ Longeur, m. 0. 220. Largeur maxima, m. 0. 001.
Couleur noirâtre.

Parachordodes pustulosus, Baird.

Silcuri, Cachar, Assam.

♀ Longeur, m. 0. 440. Largeur maxima m. 0. 0015.

Paragordius stylosus (Linstow).

Delhi, Punjab.

♀ Longeur, m. 0. 142. Largeur maxima, m. 0. 001.
Couleur du corps brun clair. Le collier noir est peu marqué.

Gordius doriae, Camer.

Somaswar, 4700 ft., Almora district, Western Himalayas. (*R. Hodgart*).

♀ Longeur, m. 0. 195. Largeur maxima, m. 0. 001.
Le corps est de couleur brun clair. Le collier noir est bien marqué.

Gordius fulgur, Baird.

“From a tank at Badarpur, Assam (*B. Basu*). Local name *shut shanchar*. Supposed to be very poisonous.”

♀ Longeur, m. 0. 550. Largeur maxima m. 0. 001.

XX PRELIMINARY NOTE ON A NEW TORTOISE FROM SOUTH INDIA.

By J. R. HENDERSON, M.B., F.L.S., Superintendent, Madras Government Museum.

The tortoise which forms the subject of this note was obtained in Cochin State, on the Malabar coast, in October 1911, while I was engaged on a collecting tour in the dense State Forests, at a distance of about twenty miles from Chalakudi, the starting point of the forest tramway service. The Kadars, a jungle tribe who brought the first specimen to me, stated that it lived in the forest, inhabiting a short underground burrow and that it did not affect the neighbourhood of water, a fact borne out by the absence of webbed digits. In addition to this specimen, a male apparently mature, which is described below, I subsequently obtained through the kindness of Mr. G. R. Grubb, M.A., M.I.C.E., Chalakudi, a second young example, but a Museum collector dispatched to the forests in March last was unable to find any others, so the species does not appear to be common. *Testudo travancorica*, Boulenger, is common in the same neighbourhood and I obtained a number of specimens. Both examples of the new species have been kept alive for over six months, during which time they have lived entirely on vegetable food. They have not shown any special partiality for water and when handled they do not emit an offensive odour as in the case of *G. trijuga*.

I have followed Stejneger and Siebenrock in substituting the earlier name *Geoemyda* for *Nicoria*, the latter being adopted by Boulenger in the volume on Reptilia in the Fauna of India series. As pointed out by Stejneger (Proc. Biol. Soc. Washington, XV, p. 237, 1902) the type of *Geoemyda* (Gray, 1834) is *G. spengleri*, and the same species was subsequently taken by Gray as the type of his genus *Nicoria* (1855).

GEOEMYDA SILVATICA, n. sp.

Carapace moderately depressed, tricarinate, with the median keel much more prominent than the lateral ones; the greatest height at the level of the posterior margin of the first vertebral shield. Vertebral shields broader than long, except the last in which the length and breadth are almost equal; vertebrals, particularly the first, wider than the costals. Nuchal longer than broad. Plastron of moderate width. Abdominal shields larger than the pectorals. The longest median suture is that between the

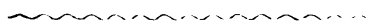
abdominals, but the one between the pectorals is only slightly shorter; the median sutures between the femorals and between the anals are sub-equal. No axillary or inguinal shields. Upper jaw with a median hook. Digits without a distinct web. Claws and limb tubercles well developed.

	mm.
Length of carapace (median line)	119
Greatest width of carapace	83
Length of plastron (median line)	98
Length of hind lobe of plastron	30
Width of hind lobe of plastron	53
Width of bridge	36
Depth of shell	45

The following are the colours in the living male specimen. Carapace, including the keels, uniformly black or almost dark bronze. Plastron dull yellow, with two spots on each bridge. Anterior portion of the head, including the upper and lower jaws, bright yellow with a red spot on the summit of the snout. Posterior portion of the head and also the neck brown. Iris red and a tinge of the same colour on the upper eyelid. Limbs and tail black.

Locality.—Near Kavalai in the Cochin State Forests, inhabiting dense forest, at an elevation of about 1500 feet above sea level.

The new species is most nearly related to *G. tricarinata*, Blyth, a terrestrial tortoise occurring in Bengal and Assam, with which it agrees in the imperfectly webbed digits and yellow plastron, but in the latter the carapace is much more convex, the three keels are yellow, the upper jaw is not hooked and there are other well-marked differences. *G. trijuga* (Schweigger) the only other member of the genus hitherto met with in India, of which I obtained the striking variety described by Anderson as var. *coronata* (Anat. Zool. Researches, Yunnan, p. 729, 1878) at Chalakudi, is an aquatic species with many points of difference. In *G. spengleri* (Gmelin) from Japan, China, Borneo and Sumatra, which agrees with the new species in its depressed carapace and hooked upper jaw, the digits are webbed and the margins of the carapace are strongly serrated.



XXI ON A NEW SPECIES OF BRANCHIO-
DRILUS AND CERTAIN OTHER AQUATIC
OLIGOCHAETA, WITH REMARKS ON
CEPHALIZATION IN THE NAIDIDAE.

By J STEPHENSON, M.B., D.Sc. (Lond.), Major, I.M.S.,
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(Plates xi—xii.)

I received in November 1911 a tube of small aquatic Oligochaeta, sent to the Indian Museum from Madras by Prof. K. Ramunni Menon. The tube contained eight specimens, of which however one was a fragment incomplete at both ends. In one case the animal was in process of dividing asexually; none possessed sexual organs.

The worm belongs to the group of gilled Oligochaetes, and is closely related to the two Naids described, one by Bourne (4) under the name of *Chaetobranchus semperi* from Madras, and one by myself (15) as *Lahoria hortensis* from Lahore. Since gilled Oligochaeta are interesting on account of their rarity, and since the present form gives occasion for some remarks on the "cephalization" of the Naididae, I describe it here as far as possible in detail. My remarks go under four heads:—(1) Anatomy, (2) Asexual reproduction, (3) Systematic position, (4) Cephalization in the Naididae. It is to be remembered that I have only had the opportunity of examining preserved specimens.

(1) *Anatomy.*

In length the worms were from 8 to 15 mm.; they were brownish in colour; the two longest consisted each of 130 segments, plus a number of minute and scarcely differentiated segments in process of formation at the posterior end; another specimen had 77 segments with again a similar region of newly forming segments posteriorly. The gills were in most specimens just visible to the naked eye as processes on the anterior portion of the body. The prostomium was short and rounded. Succeeding the mouth was a short prebranchial region, which will be considered more fully below.

Gills.—The gills are elongated hollow evaginations of the body-wall; as in the related forms mentioned above, they contain a vascular loop, and, in the anterior portion of the body, the capillary dorsal setae also. Since they correspond in position with the dorsal setal bundles, they form a dorso-lateral series on each side. They diminish in size posteriorly, and the long dorsal setae are then no longer enclosed in them.

In the specimens in which the gills were best developed they were, in the most anterior segments, about .54 mm. in length; but exact measurements are difficult, owing to their being somewhat curled and twisted; in the next succeeding segments, where they are longest, they were .72 mm. long, or about 2—2½ times the diameter of the body in this region. In other specimens they were frequently not so long,—about .27 mm., or equal to the diameter of the body.

Some idea of the progressive diminution in size may be obtained from the following data:—in an animal of 130 segments, the gills at the 40th segment were small finger-like lobes, at the 50th large tubercles, at the 60th small tubercles, and beyond this absent. In another specimen of 130 segments, they disappeared at the 76th segment; in one of 87 segments, at the 67th; they were present, as tubercles only, on the 73rd and 56th segments of two animals whose posterior ends had been destroyed at these levels respectively; and in another specimen they were quite small finger-like lobes on the 17th, and disappeared altogether beyond the 24th segment. Behind the region of the gills, in these preserved specimens, the series is continued as a pushing out of the body-wall, which is raised round the base of the dorsal setal bundles into small pointed conical elevations; but these are merely such as would be produced by a contraction of the muscles of the setal sac pushing out the bundles of setae, and indeed may have been so produced at the moment of fixation.

Pigmentation.—As in the related forms the anterior end of the body is markedly pigmented (pl. xi, figs. 1, 2, 3). The pigment occurs as irregular blotches on the prostomium and pre-branchial region; behind this it has a fairly definite segmental arrangement, as irregular bands extending over the dorsal and lateral surfaces, but leaving the ventral surface free; the bands are formed of a number of irregular spots or blotches, which may or may not be confluent. The pigment may be very slight in amount and scattered in its distribution; in any case it fades away after the first few segments, e.g., beyond the 8th, 12th, or 13th.

Pigment also usually, but not always, occurs on the gills,—not all over them, but in streaks along their lateral aspects (pl. xi, fig. 1). The pigmentation of the gills corresponds roughly, as regards number of segments, to that of the body.

The pigment appears to be located in peritoneal cells lining the body-wall, and to be of the same nature as that of the chloragogen cells; similar cells invest the dorsal vessel as far forward as the second gill, and sometimes some of the lateral loops also [v. *inf.*, and cf. Bourne (4), and his fig. 3].

Setae.—The dorsal setal bundles begin with the gills; the setae are of two kinds, long and short. The long ('capillary') are straight, smooth, tapering gradually to a very fine point, and, where they are free from the gills and can be measured, in length commonly about 330 μ . The shorter ('needle') setae have typically the form shown in fig. 1; the distal curve and the

extremely slender extremity are (in preserved specimens) with difficulty visible with the ordinary high power, and an immersion lens is necessary to appreciate them. These setae are about 100μ long, and are closely applied to the proximal part of the shaft of the longer seta, the distal curved end of the short seta appearing to fit round the shaft of the longer. The point of the short seta may project slightly above the surface of the body in the middle and posterior regions of the animal's length.

In the most anterior part of the body, where the gills are longest, the setae are entirely enclosed in the gill processes. Here each bundle consists of two hair setae, or sometimes of only one; if there are two, one is much longer than the other. The hair setae are here much slenderer than they are posteriorly. This is the condition in the first 12, 13, 18, 26 or 27 gilled segments.

In the next succeeding region of the body the gills are becoming shorter, and the hair setae project freely and are no



FIG. 1.—*Branchiodrilus menoni*; dorsal needle-seta; $\times$ about 375.

longer contained in the gills. The bundles are composed of one hair and one needle. The transition from a thin to a thick type of hair seta is marked, and quite sudden. The needle has apparently not the typical shape described above; it is straighter, almost or quite without the distal curve, but it narrows rapidly to a fine point, like the curved form.

In the middle and posterior regions of the body the dorsal bundles consist of one hair and one needle, of the typical forms described above. Occasionally two needles occur in a bundle.

The ventral setae of the branchial and posterior regions of the body may be separated into two forms, though the distinction is not a hard and fast one, since intermediate shapes occur; neither is the distribution of the two forms fixed.

The one form, the more numerous, which may be designated the 'posterior', is distinguished by a comparatively stout shaft, often a somewhat greater length, a nodule distal to the middle of the shaft, and by having the prongs of the fork equal in length or the distal prong slightly longer (fig. 2). In length they measure

110 to 139 μ (proximal to nodulus : distal to nodulus : : 61 : 49. or 82 : 57). The other or 'anterior' type is slenderer throughout, the prongs, especially the distal prong, also longer and slenderer; the distal prong is $1\frac{1}{2}$ times as long as the proximal, while the

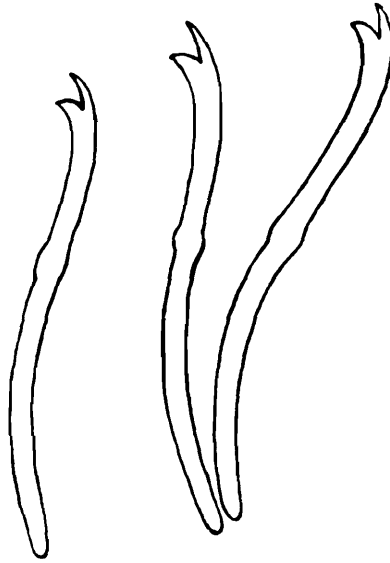


FIG. 2.—*Branchiodrilus menoni*; setae of the posterior ventral type; $\times 375$.

nodulus is at the middle of the shaft or somewhat proximal (fig. 3). In length they measure 100 to 116 μ (proximal to nodulus : distal to nodulus : : 57 : 57, or 55 : 61). In both types the distal prong is only about half as thick at its base as the proximal.

The 'anterior' type occurs on a comparatively small number



FIG. 3.—*Branchiodrilus menoni*; setae of the anterior ventral type; $\times 375$.

of the anterior segments of the body, the posterior type on the remainder; but there is no defined limit to their distribution. Thus well-marked 'anterior' setae may be found on segment xiv, and even behind this; or nearly all the ventral setae in the body may be of the 'posterior' type. The change from 'anterior' to 'posterior' is in any case not a sudden one, and may apparently

take place at a different level on the two sides of the same animal.

As to the number of ventral setae per bundle, this is usually three, and I have never seen more except in the one instance shown in pl. xi fig. 4, where one of the bundles has four. Posteriorly there may be only two; and in some of the anterior segments also there may only be two. Very commonly in the anterior segments there were two fully formed setae, along with a half-formed seta, of which the proximal end was wanting,—as if it were still in process of formation, or perhaps rather as if its formation had been permanently arrested at this stage (cf. pl. xi, fig. 4).

Prebranchial region.—The region between the first gill and the mouth is in this species peculiar in several respects, and seems to merit special description. It may be recalled that in Bourne's worm dorsal and ventral setae begin at the same level (segment ii), the interval between mouth and first setae being equal, according to his figure, to about a single body segment; cephalization is therefore limited to the first segment. In the allied worm previously described by me there is a considerable interval between mouth and first gills; in this interval are situated the four first ventral setal bundles (exceptionally only three) but no dorsal setae; the gills and dorsal setae, therefore, begin on the sixth segment, and the first five segments are cephalized.

In the specimens now under discussion, there is a moderate interval between the mouth and the level of the first gill, equal on the average (cf. pl. xi, figs. 1, 2 and 3) to the diameter of the body at the latter situation. No distinct external annulation could be made out in this interval; and the pigmentation was not segmentally arranged. The most curious point however is the varying distribution of ventral setae in this region.

The setae are always, when present, of a type distinct from those in the rest of the body. In their general proportions they resemble the 'anterior setae, but are considerably shorter (77 to 87 μ), remarkably slender, with delicate prongs, and a nodulus proximal to the middle of the shaft (proximal : distal : : 36 : 41, or 41 : 46).

Their distribution was as follows. In one specimen (pl. xi, fig. 1) there were four bundles of such setae in the prebranchial region; in another three (pl. xi, fig. 2); the condition in these specimens (except for the small size of the prebranchial setae) was therefore the same as in the related species previously described by me. In a third specimen there were on one side two setal bundles, of only one seta each, the anterior of the two being the longer; on the other side there was, near the mouth, a single bundle of two setae; the prostomium in this specimen was fairly well formed, and the prebranchial region of considerable extent; i.e. considering the manner in which asexual division takes place in this form (v. *inf.*), this specimen had probably been leading a free existence for some time. In a fourth there was on one side a single bundle, of one seta only, situated nearer to the first gill than to the

mouth; on the other side there were no setae; the prostomium was very round, and the impression given was that the animal had not been long separated. A fifth specimen had no prebranchial setae on either side; the prostomium was very well marked, the mouth and the structures of the head in general were well formed; moreover this was the specimen in which asexual division was going on at the posterior end (pl. xi, fig. 4); it seems justifiable to suppose that this animal had been leading an independent existence for some time. A sixth specimen had similarly no prebranchial setae on either side; the setae of the first gilled segment were smaller and thinner than those of succeeding segments; the differentiation of the head end of the animal was however incomplete, the shape, and the relations of mouth and pharynx did not appear normal, and the gills ceased, even as tubercles, after the twenty-first segment; it seems not improbable, therefore, that this animal had only recently been separated, and had still to undergo a certain amount of development at this anterior end. The seventh specimen had no prebranchial setae, and setae were also absent on the first gill-bearing segment (pl. xi, fig. 3); the prostomium, mouth, pharynx and cerebral ganglion were well formed, and the animal had probably therefore been separated for a considerable time.

It is perhaps worthy of remark that in the fifth and seventh of the above specimens the prebranchial region seemed to present a somewhat indefinite, thicker or denser appearance of the tissues and a consequent slight opacity, as compared with the segments behind it. Whether this is of any importance or not is perhaps doubtful; but it reminded me of a similar somewhat denser and more opaque appearance of the tissues which is seen at the hinder end, in any of the Naididae, in the region where new segments are forming but not yet differentiated.

It is evident, in any case, that the distribution of setae in the anterior part of the body varies very considerably. So far as I am aware, such marked variations have not been noticed in any other form. Further remarks on the import of this variability will be found below.

Other anatomical features.—In sections through the middle of the body, the sides of the animal are seen, in these specimens, to be somewhat pinched in; and at the level of each septum a distinct band of muscular fibres passes on each side from the lateral line to the gut; it is presumably the contraction of these fibres that causes the constriction referred to.

The pigment cells, as seen in sections, are large irregular cells, containing a large number of brown granules, and indeed appearing to be made up of them (pl. xi, figs. 5, 6). The cells occur in several situations,—(a) round the dorsal vessel and lateral commissures, (b) along the muscular fibres passing through the coelom from gut to parietes, (c) inside the muscular layer of the body-wall, (d) apparently more or less free, as corpuscles inside the body-cavity, attached however to the inner surface of the parietes by processes of the pigment cells themselves, or of other corpuscles.

The buccal cavity is tubular, and is succeeded by the pharynx, a portion of the tube which possesses a strongly ciliated and laterally extended dorsal diverticulum, the cells lining which are markedly columnar; while the ventral wall of the pharynx is composed of flatter and more irregular cells (pl. xi, fig. 5). The pharynx extends backwards to include the first gilled segment; the diverticulum then flattens out and disappears. The oesophagus is strongly ciliated; there is no stomach,—indeed, beyond the pharynx, the tube can scarcely be differentiated into distinct regions.

The dorsal vessel is, for by far the greater part of its extent, dorsal in name only; it runs for the most part on the left of the intestine (pl. xi, figs. 2, 6); it is invested by chloragogen cells and pigment cells as far forward as the interval between first and second gills; here it becomes dorsal, and loses its investment.

The present species does not stand alone in the matter of the aberrant course of the dorsal vessel. I have ascertained, from an examination of my specimens, that *B. hortensis* is similar in this respect, though the fact was not noted in my original account of this worm. It is known also to be the case in the various species of the genus *Dero* (Naididae), and in *Branchiura sowerbyi* (Tubificidae) (1, 13); and I have found it also in the Tubificid worm I have described (13) as *Limnodrilus socialis*. One peculiarity common to all these forms is that they possess specialized respiratory arrangements;—*Dero*, *Branchiura*, and *Branchiodrilus* possess branchiae, while *Limnodrilus socialis* has a well-developed integumentary blood plexus in the posterior part of its body, and during life is incessantly waving this posterior end in the water; but as to what connection there is between such specialized respiratory arrangements and a lateral or ventrolateral position of the dorsal vessel I am not clear.

There is a large giant fibre on the dorsal surface of the ventral cord, looking in sections like a large empty tube (pl. xi, fig. 6).

(2) *Asexual Reproduction.*

One specimen only was dividing asexually (pl. xi, fig. 4); and here a fragment only of the posterior animal was present. The whole specimen consists of 87 segments in the anterior animal, and nine segments of the posterior. Though apparently nearly ready for detachment, there is as yet no differentiation of a head in the hinder zooid, no mouth, and no new setae, no newly formed segments, nor any region intervening between the first gilled segment and the anterior end of the body; the gills however have formed, and the characteristic pigmentation of the anterior region is beginning to appear. At the posterior end of the anterior animal there is an appearance suggestive of the approaching rapid formation of a budding zone,—a slight opacity, and an irregular fine transverse streaking, more especially on the ventral half of the body.

The condition is therefore to be compared with what occurs in Bourne's *Chaetobranthus*, where there is no budding zone, and the process of division resembles rather a simple fission of the animal into two. It is to be contrasted in this respect with the species I found at Lahore, where a regular budding zone is formed, as in *Nais*, *Chaetogaster*, etc. Further, the present form agrees with Bourne's in the fact that asexual reproduction is apparently a comparatively rare occurrence; Bourne, out of a large number, found only a few specimens dividing; whereas in many species of Naididae it seems to be rather the exception than the rule to find an animal which is not preparing to divide.

It would appear from the specimen undergoing division (pl. xi, fig. 4),—if I am right in supposing that a separation of the two individuals was here not far off,—that a considerable amount of the development of the head has still to be gone through after fission is completed. This is confirmed by the actual condition of two of the free-living specimens examined (the fourth and sixth; cf. *ant.*, under the description of the prebranchial region).

Can this inference be used to explain the remarkable variations in the distribution of the prebranchial setae? In other words, can we suppose that all specimens which show fewer than four pairs of ventral setal bundles in front of the gills have recently been separated, and have not yet completed the development of the anterior end,—and that the production of the full number of setal bundles will follow in time? Would the specimens described above have developed, in all cases, four bundles of ventral setae in the prebranchial region if they had been left alive?

This seems quite possible with regard to such specimens as the fourth and sixth of the foregoing description; here the other structures of the anterior end—prostomium etc.—were also incomplete, and it is quite possible that the setae might, later, have developed along with these.

It does not seem very probable with regard to some of the other specimens. For example, in that represented in pl. xi, fig. 3, the seventh of the previous description, the prostomium, mouth, and other features of the anterior end are well developed, yet the ventral setae are wanting; had they been going to develop, there would have been at least some signs of them. The same may be said with regard to the fifth. And in the specimen with three well-developed setal bundles in the prebranchial region (pl. xi, fig. 2) there would probably have been some sign of a fourth if a fourth had ever been going to develop. Again, asexual reproduction apparently here, as in Bourne's worm, does not occur with any great frequency; hence the chances are very much against six out of these seven specimens having been very recently separated, as the above explanation would demand.

The matter may therefore be summed up as follows:—In the present form the process of asexual reproduction is accompanied by the formation of only the rudiment of a budding zone; separation of the two resulting individuals takes place early;

and a considerable portion of the process of differentiation of the head is completed after separation. In this differentiation, the formation of the setal bundles sometimes lags behind that of the other structures, and the number of setal bundles formed varies considerably. Not infrequently, it would appear, none are formed; and the maximum number of four is perhaps comparatively seldom produced.

(3) *Systematic Position.*

Though closely related to the worm which I have described as *Lahoria hortensis*, the present species is not identical with it; and the more restricted distribution of the gills in the form under discussion, the details of asexual reproduction, certain differences in the form of the setae, and the smaller number of these in both dorsal and ventral bundles, are sufficient to distinguish it.

With regard to Bourne's *Chaetobranthus semperi* the agreement is in many respects closer. Thus Bourne gives identically the same number of segments (130) which I counted in the best developed specimens of the present batch; the details of pigmentation correspond in the two; the number and distribution of the gills is about the same; the details of asexual reproduction are strikingly similar, and different from what is usual in other Naididae; and finally both were taken in the same locality.

On the other hand there are several points of difference. To begin with the less important, the length of Bourne's worm appears to have been greater, though some of the apparent difference is no doubt due to contraction of the preserved specimens; the setae did not begin to project freely so soon in Bourne's specimens (about the 30th segment), as in mine (13th to 28th); and, to judge from Bourne's figure, the position of the mouth is different in the two, the prostomium being considerably longer, and the prebranchial region somewhat shorter in Bourne's specimens than in those now under discussion. Further and more important differences are found in the characters of the setae; though those of the two forms have a general resemblance, this does not extend to details (compare, for example, the dorsal needles of the present form with the sickle-shaped dorsal setae of *Chaetobranthus semperi*); and a marked distinction is found in the numbers of setae per bundle, both in the dorsal and ventral series. Lastly there is the fact that in the present form there may be as many as four pairs of ventral setal bundles between the first gills and the mouth.

In my present specimens, it is only in a minority that well-formed setal bundles are developed between the first gills and the mouth; and had I received a smaller number of the worms, say two or three only, it is not improbable that such examples would have been wanting altogether; in which case, in view of the many and detailed points of similarity, it is not unlikely that I should have recorded the present find as a rediscovery

of Bourne's worm. It does not seem possible, on the other hand, that Bourne should have overlooked the occasional occurrence of prebranchial ventral setae, since he "secured numerous specimens of *Chaetobranchus*" and (with regard to the mode of asexual reproduction at least) "examined a very large number of individuals."

The two forms are therefore to be regarded as distinct, and I accordingly propose for the one herein described the specific name *menoni*. It seems however impossible, merely on the ground of a (far from constant) difference with regard to the prebranchial setae, to deny a close genetic relationship between the two. They must undoubtedly be regarded as belonging to the same genus.

For the generic name *Chaetobranchus*, which, since it is the name which Bourne used, has been employed above in referring to the worm described by him, Michaelsen (8) substituted *Branchiodrilus*, *Chaetobranchus* having been previously used for a fish. The new worm thus becomes *Branchiodrilus menoni*.

If however these two species are ranked under the same genus, so must be the form from Lahore described by me as *Lahoria hortensis* (15); since the reason for separating this latter as a distinct genus from Bourne's worm was the same difference with regard to the prebranchial setae which occurs or may occur in *B. menoni*; i.e. the fact that four (or three) pairs of ventral setal bundles may occur in front of the first gills, or rather (which comes to the same thing) in front of the first dorsal setae.

The genus therefore now comprises three species, and genus and species will be defined as follows:—

BRACHIODRILUS Mchlsn. (= *Chaetobranchus*—Bourne):

Prostomium rounded. A pair of dorso-laterally placed branchial processes on many or most of the body-segments, beginning immediately or a short distance behind the mouth. Ventral setae crotchet shaped, forked distally. Dorsal setae beginning in the same segment as the gills, of two kinds, capillary and needles; the former, in a number of the anterior segments, enclosed in the gills.

I. *B. semperi* (Bourne).

Length 38-50 mm., diam. .5 mm., segments 130. Branchial processes begin in the segment behind the mouth; at first are about four times as long as the diameter of the body, then decreasing in length and disappearing at the 60th—70th segment. Dorsal setal bundles consist of two or three capillary setae, longer in the anterior, shorter in the posterior segments, and two or three short sickle-shaped setae, the latter wanting in the anterior segments. Capillary setae of dorsal bundles all enclosed in the branchial processes in about the first 30 segments, some so enclosed in about the next 30, thenceforward all free. Ventral

bundles of 4-6 setae, the distal prong of which is the longer in the most anterior segments, the proximal being the longer in the remaining segments. No stomach. Lymph corpuscles rounded, with numerous olive-green granules. Asexual reproduction without the previous formation of a budding zone.

2. **B. menoni** sp. nov.

Length (preserved) 8-15 mm., segments up to 130. A short prebranchial region between first gills and mouth, which may or may not possess a series of pairs of ventral setal bundles (up to 4 pairs). Gills diminishing in size posteriorly, and ending some distance in front of hinder end; longest gills $2\frac{1}{2}$ times as long as diameter of body. Dorsal setal bundles anteriorly of one or two hair setae; in the middle and posterior parts of the body of one hair and one needle seta, the latter somewhat bayonet-shaped, tapering to a fine point. The hair setae of the anterior bundles enclosed in the gills; becoming free before the 30th segment. Ventral bundles usually of 3, sometimes of 2, setae; anteriorly slenderer, distal prong longer, nodulus proximal to middle of shaft or about its centre; further back the setae are stouter, distal prong approximately equal to or a little longer than proximal, nodulus distal to middle. No stomach. Asexual reproduction without or almost without previous formation of a budding zone.

3. **B. hortensis** (Stephenson) (= *Lahoria hortensis*).

Length 16-25 mm., diam. .5-.75 mm., segments 90-120. Gills and dorsal setae begin on sixth (occasionally fifth) segment. Gills diminishing in size posteriorly, ending just in front of hinder end of animal; longest gills 3-4 times as long as diameter of body. Dorsal setal bundles of capillary and needle setae, not more than two of each per bundle; contained within the gills for the first 40-50 segments, then one hair seta of each bundle free; needle setae straight, pointed. Ventral bundles of 4-5 setae, distal prong slightly longer than proximal, and much thinner at its base. No stomach. A budding zone formed during asexual division.

4. *On Cephalization in the Naididae.*

Cephalization means the formation of a head; to quote from Beddard (2), "Lankester has applied this expression to the specialization of the anterior region of the body so frequently seen among the Oligochaeta." This specialization shows itself perhaps most prominently in the distribution of the setae;—"all Oligochaeta show cephalization as regards the first segment of the body, which never possesses setae." The Naididae which (except *Chaetogaster*) have regularly ventral setae in all segments from the second onwards, frequently lack dorsal setae in a number of the anterior segments, and there are thus in these cases

a number (usually four, i.e. segments ii—v) of segments which have ventral but no dorsal setae. It is frequently found moreover, e.g. in the genus *Nais*, that the ventral setae of these 'cephalized' segments are different in type from the succeeding ones; thus the distal of the two prongs of the forked end may be relatively longer, and the nodulus situated proximal, instead of distal, to the middle of the shaft.

Other systems or organs are concerned. Beddard instances septa and nephridia, which may be absent from the anterior segments. In addition I may adduce pigmentation; the cephalized segments may be lighter in colour, or the pigment may be differently arranged, as compared with the following segments. Chloragogen cells are absent from the alimentary tract in the cephalized segments. The gills of *Branchiodrilus hortensis* are similarly absent from this region.

The next point which I wish to bring forward is that this cephalization is related in the Naididae to the manner of asexual division, and to the production, between two separating individuals, of a budding zone. When one of the Naididae divides asexually, the usual procedure is that at some spot near the middle of the length of the animal a rapid production of new segments takes place; of these segments the larger number go to form the tail end of the anterior, the smaller number to form the head of the posterior, of the two resulting animals. This head commonly consists of five segments, with a prostomium, all newly formed; i.e., it corresponds to the number of cephalized segments as determined by the examination of free-living specimens. In other words these segments, produced in the budding zone, and representing the head of the (subsequently to be detached) animal, want the dorsal setae, and frequently have the ventral setae modified; they are commonly, at first at least, less pigmented (as are also the newly formed segments at the posterior end of the anterior animal); they contain no chloragogen cells, have no nephridia, and in *Branchiodrilus hortensis* are without gills.

Since the predominant mode of reproduction in the Naididae is the asexual, by fission,—sexual reproduction being a comparatively, or absolutely, rare occurrence,—by far the larger number of individuals of a species existing at any time will have been produced asexually, and *the cephalized segments will be those which have been produced in a zone of budding.*¹

¹ This point with regard to the budding zone has not apparently received much attention from students of the Naididae and (in the somewhat scanty literature at my disposal) I cannot find any references as to how many of the segments produced in the budding zone go to the anterior end of the posterior animal in the different genera. My own observations on the genera *Chaetogaster*, *Nais*, *Slavina*, *Stylaria*, *Aulophorus* and *Branchiodrilus* show that the rule just stated holds for these (in *Chaetogaster*, where there are no dorsal setae, cephalization is marked by the regular series of ventral setae beginning only in the sixth segment); and it apparently holds also for *Aeolosoma* (fam. Aeolosomatidae), where the process is similar. It is to be noted however that *Pristina* is a remarkable exception; here no fewer than seven of the anterior segments are formed in the budding zone, though dorsal setae begin on the second segment, and cephalization is therefore confined to the first.

From this it follows, that variations or irregularities in the process of budding will give rise to corresponding variations or irregularities in the degree and form of cephalization.

That the budding zone varies in position has been known for some time. It is usual, following Bourne (5), to denote by n the number of segments of the original animal behind which the budding zone appears, and though Bourne thought at first that n would be found to be constant for each species, it now appears that in a large number of species at least it varies within somewhat wide limits (for examples, cf. Benham (3), Piguet (11), Stephenson (16) (*Stylaria lacustris*)).¹

Variations in position of the budding zone would not necessarily affect the number of cephalized segments; the point has been mentioned, because variations in one respect prepare us to look for variations in other respects. Such have been noted in *Nais communis* by Piguet (11):—"à diverses reprises, j'ai trouvé un certain nombre d'exemplaires qui n'avaient que 4 segments avant celui où débutent les soies dorsales et les cellules chloragènes (normalement, le 6me). J'ai d'abord pensé à une régénération incomplète après mutilation; mais tous ces individus avaient la région antérieure absolument normale, sauf que leur 5me segment était l'homologue du 6me des autres. Il faut donc supposer que le bourgeonnement produit quelquefois, accidentellement peut-être, des spécimens ayant, dans la région du pharynx et de l'oesophage, un segment de moins que les autres." The fact that in *Branchiodrilus hortensis* there may be either four or five cephalized segments (15) belongs here also. And in *Slavina punjabensis* I found (14) a number of irregularities in the results of the budding process;—incomplete differentiation of the head, an eye wanting on one side, fewer setal bundles, and these containing fewer setae than normal;—which might perhaps be partly explained by supposing that separation of the two individuals had taken place before the differentiation of the head had been completed, and that this differentiation would follow after, instead of as usual coming before, the separation. But it is perhaps equally likely that these irregularities were destined to endure.

This brings us to the condition in *B. menoni*. We have here before us a number of variations in the characters of the anterior end of the animal, especially in the numbers of the ventral setal bundles in front of the gills (or of the first dorsal setae). As to how this is related to the process of asexual reproduction, and how far these variations may be due merely to a delayed differentiation of the newly formed head, see the section on Asexual Reproduction. Referring to the discussion there for support, it will be sufficient now to state that in *B. menoni* we have a species which varies within wide limits in regard to cephalization, as manifested especially in the setal distribution.

¹ In the Aeolosomatidae however and in the genus *Chaetogaster*, in which cases the number of body segments is small, n would seem to be fixed for each species, according to observations on all the species that have come under my notice.

The importance of a right estimate of the value of cephalization, as marked by the want of correspondence in the anterior limits of the dorsal and ventral setae, is apparent when we call to mind that this is one of the characters by which the genera of the Naididae are discriminated. Thus the segment on which the dorsal setae begin (reckoning the first segment with ventral setae as the second of the animal's body) figures as a diagnostic mark of genera in Vejdovsky (17, p. 25), and in Michaelsen (8, p. 17). The extent anteriorly of the dorsal setae is the chief, if not the only, distinction between the genera *Naidium* and *Nais*. To quote from a former paper (15):—"Beddard (2, p. 281), merging together a number of genera of other authors under the one name *Nais*, does so largely because they 'agree in the important fact that the first five segments are cephalized,—that the dorsal setae do not commence until the sixth segment,' and by implication would exclude from the genus any form which did not show this cephalization. Similarly *Pristina* and *Naidium* are united by him on the ground of the absence of this feature. Bourne (5) also believed that the number of cephalized segments is constant for the genus, and thought it probable that *Dero furcata*, possessing four achaetous dorsal segments, should on this account be removed from the genus, since the other members of it have five such segments." And specially with regard to *Branchiodrilus*, "the presence of dorsal setae on all segments from the second onwards is mentioned as a feature in the generic diagnosis of *Branchiodrilus* in Bourne's original paper (4), in Beddard's monograph of the Oligochaeta (2), and by Michaelsen (8)."

It is therefore evident that a distinction such as that which obtains between *Branchiodrilus semperi* and *B. hortensis*, where the dorsal setae begin on the second and sixth segments respectively, is held by most authorities as a ground for a generic separation. Holding this view myself, I accordingly separated the Lahore species as a distinct genus, *Lahoria*, though I thought it "perhaps worth while asking whether a cephalization which affects only the setal distribution (for the absence of gills on segments ii—v of the present form [i.e. *B. hortensis*] is evidently correlated with the absence of the setae which are necessary to stiffen them) has the systematic value hitherto generally attributed to it."

It is to be added that the above view, of the absolute value of a different anterior extent of the dorsal setae as a generic character, has not always been strictly maintained. Thus Michaelsen (8) unites into one genus *Paranais* three species known at various times as *Naidium naidina*, *Paranais littoralis*, and *Uncinaiis uncinata*, though their dorsal setae begin respectively on the second, fifth, and sixth segments. And in a recent paper (9) the same author prefers to include my *Lahoria hortensis* as a species of *Branchiodrilus* (as I do in the present paper), allowing the numerous close structural resemblances to over-ride the somewhat artificial distinction based on the distribution of the dorsal setae.

With the discovery of *B. menoni* the case becomes stronger. I was in doubt at first as to whether it would not be advisable to unite it with Bourne's worm under the same species, *B. semperi*; since the points of structural agreement are many, and in some cases extend into detail; and there can at least be little doubt of a close genetic connection. Yet, allowing the usual value to cephalization, the difference between some specimens of *B. menoni* and *B. semperi* would be generic; and indeed the same might be said of specimens of *B. menoni* alone, when compared one with another.

The conclusion to be drawn is that *the degree of cephalization in the Naididae is correlated with the behaviour of the segments of the budding zone,¹ and that variations in both, of considerable extent, may occur within the same species. The form of cephalization which is characterized by the absence of dorsal setae from a number of the anterior segments of the body has been evolved repeatedly, in different groups of the Naididae, and at different times. The degree of cephalization is not necessarily a generic character, since differing degrees of cephalization may coexist with a remarkable similarity in general organization.*

One point of a more speculative nature remains. In the case of *Branchiodrilus hortensis*, which usually has five prebranchial segments, specimens are occasionally met with which possess only four such segments; in these cases the first gilled segment would seem to be homologous throughout, i.e. the sixth segment of some individuals is homologous with the fifth of others. Similarly, according to Piguet, in *Nais communis* (v. ant.):—"mais tous ces individus (i.e. those with only four segments in front of that on which the dorsal setae began) avaient la région antérieure absolument normale, sauf que leur 5me segment était l'homologue du 6me des autres."

Similar considerations must be extended to *Branchiodrilus menoni*; the first gilled segment is homologous, throughout the individuals of the species, though these individuals vary as regards the number of segments intercalated in front of this fixed point and behind the mouth.

But while some specimens of *B. menoni* agree in the arrangement of their segments (as determined by the setal bundles) with *B. semperi*, others agree with *B. hortensis*. It follows that the first gilled segment is homologous in these two species, i.e. segment vi of *B. hortensis* is homologous with segment ii of *B. semperi*.

If this is the case, then we must infer that the same holds generally in the Naididae, and that the segment immediately succeeding those produced in the budding zone,—usually, but not always, that on which the dorsal setae begin,—is homologous throughout the group.

¹ Compare however what was said previously (footnote p. 230) regarding *Pristina*.

As to whether this would lead to difficulties with regard to the homologies of the genital organs or not I cannot say. It would be interesting to have details of the budding process and of the position of the genital organs in *Naidium*, where the dorsal setae begin on the second segment; but these are lacking. The above views would not lead to any difficulties in the case of *Pristina*; here the testes are in segment vii, the ovaries in viii, i.e. the genital organs are displaced two segments backwards as compared with other genera. But the segments contributed to the animal's head from the budding zone are also more numerous than usual, seven instead of five, and therefore the testes are still in the last segment to be added from the budding zone, as in *Nais* and other genera.

II.

Branchiura sowerbyi, Bedd.

This interesting worm, belonging to that small group of Oligochaeta which possess gills, was first described by Beddard (1) in 1892 from specimens obtained from the mud of the *Victoria regia* tank in the Royal Botanical Society's Gardens in London; of these specimens only one was sexually mature, and this furnished the material for his description of the genital organs. No more was heard of this worm till 1908, when Michaelsen (7) found specimens, among them several sexually mature, in a warm water tank of the Botanical Gardens at Hamburg; Michaelsen's account deals exclusively with the genital system, in which he finds a number of differences as compared with Beddard's description. L. Perrier (10) shortly afterwards notified the discovery of numerous specimens in the Rhone, but did not add any anatomical details. Lastly in 1911 I (13) found the worm in a nullah near Lahore in the Punjab; I was able to add a number of anatomical facts to those recorded by Beddard, but none of my specimens were sexually mature.

I have since then received specimens from two sources. In May 1911 Mr. Gravely of the Indian Museum sent me a tube containing living specimens of the worm taken in Calcutta; they were obtained from mud in an earthenware basin containing aquatic plants planted in mud and water in the Museum garden. It is noteworthy that the worms were put into the tube on the 12th May, and were received by post in Lahore at 4.30 p.m. on the evening of the 15th; the tube was opened immediately, and the worms were found to be still quite lively. The mean temperature at Lahore for the 24 hours was at this date 90°, the maximum in the shade 106°F, and the temperatures must certainly have been higher in a railway van coming from the south.

A few observations were made on the movements of the living worm. As remarked above, they were quite active. The posterior part of the body was at times held quite still while the

anterior part was wriggling; the movements of the posterior part, when these occurred, were either irregular wriggings or regular undulating movements. The gills in these specimens showed no movements of their own when the tail was at rest. The worms manifested a sharp and sudden response to a touch with a needle; they contracted somewhat, and then as a rule remained quite motionless for a short time, subsequently resuming their movements.

As to their external characters, the gill region was short; in one case well developed gills ceased suddenly a little distance in front of the hinder end, and behind this point there were only tubercles,—about a dozen in both dorsal and ventral series, the two or three most posterior being slightly larger than the rest; this peculiarity was possibly due to previous injury. On holding the tube up to the light and looking through it the gills were invisible to the naked eye in the living animal on account of their transparency; their length was not greater than the diameter of the body. The length of the animals was from $1\frac{3}{4}$ to 2 inches when extended, and their breadth 1 mm. or more. One specimen exhibited genital organs, as described below.

Again in November 1911 I received from the Indian Museum a tube of these worms, preserved, which had been taken in Madras in the mud from the *Victoria regia* tank in the Agrihorticultural Society's gardens, in September-October, 1907, by Prof. K. Ramunni Menon. The specimens were in a bad state of preservation, and consisted of 18 fragments, of sizes from 25 to 2 mm., mostly small; these had apparently belonged originally to two worms, of which neither showed sexual organs. The peculiarity about these specimens was that they were constricted, in transverse section, so as to show a somewhat figure-of-eight appearance; but the dorsal, and still more the ventral, surface was flattened, the ventral surface, in the region in front of the gills, giving the appearance of a flat sole.

The occurrence of a sexual specimen among the worms received from Calcutta offers the opportunity of adding a few remarks on the genital organs. The differences between the descriptions given by Beddard and by Michaelsen are very considerable. As briefly as possible, the chief of these are as follows:—Michaelsen finds that the vas deferens enters the proximal expanded portion of the atrium very obliquely through the wall of the latter, nearly but not quite at its rounded extremity; this portion of the atrium is lined by long columnar epithelium, surrounded by a voluminous investment of glandular cells, and encroaches posteriorly, where the vas deferens joins it, on segment xii. It merges anteriorly into the middle region of the atrium, which is narrower, undergoes several irregular windings, and before becoming the distal region of the atrium is joined by the paratrium. The distal region of the atrium is again wider, is bent at its upper end like a hook, but its main portion passes vertically downwards to the male aperture. The paratrium is a long

diverticulum from the middle region of the atrium, closely bound up with the atrium for some distance near its origin, then separating from it though still running parallel; it extends back through the whole extent of segment xii, has an insignificant lumen, and is, like the proximal portion of the atrium, covered with a thick layer of glandular cells. A special ovoid coelomic sac encloses the distal section of the atrium and so much of its middle section and of the paratrium as are bound up together. The spermathecae consist of a duct with an expanded spherical ampulla.

Beddard on the other hand shows the vas deferens as joining the atrium about the middle of the length of the latter. The internal half of the atrium has thus the appearance of being a diverticulum of the male efferent canal; it is a large ovoid sac, with a considerable lumen and a voluminous investment of gland cells of peritoneal origin. The distal half of the atrium, below the junction of the vas deferens, is tubular, and is surrounded by a considerable muscular investment. The spermathecae are pear-shaped.

The differences briefly indicated above might possibly be explained, according to Michaelsen, in one or more of three ways. First, Beddard's specimen might not have been fully mature; but this explanation is in any case not by itself sufficient, and moreover the clitellum was well developed in Beddard's specimen, and the spermathecae contained spermatozoa. Or Beddard may have been misled, owing to the scantiness of his material, and the difficulty of working out a complete description from one specimen only; in this case it may have happened that Beddard has overlooked the paratrium, and mistaken the relation of vas deferens to atrium. Lastly, the specimens of the two observers may have belonged to different species; this however Michaelsen thinks very unlikely, since if the above differences do actually exist they are not of specific but of generic importance.

The sexual specimen from Calcutta, mentioned above, was pretty certainly not fully mature; in the sections, ripe spermatozoa are indeed seen entering the seminal funnel, and the sperm sac extends as far backwards as segment xiv; but the clitellum is indistinguishable, the spermathecae contain no spermatozoa, and there is no ovisac with contained ova. But in the circumstances above mentioned, the examination of other sexual specimens of this worm is a matter of some interest and importance; and the present specimen has probably this advantage, that it will at least indicate whether the differences in the two already published accounts are or are not due to the first of Michaelsen's suppositions,—i.e. to Beddard's having worked on an immature specimen.

Briefly, the Calcutta specimen agrees with Michaelsen's description in all essential points; and a full account would therefore be quite superfluous. It will only be necessary to refer to the figures appended, and to mention the characters in which the present specimen differs from Michaelsen's account.

(i) The atrium and paratrium are confined to segment xi, and do not encroach on xii.

(ii) The proximal part of the atrium is a spherical sac, sharply marked off from the middle portion, and lined by cubical, not columnar, epithelium (pl. xii, figs. 1, 4).

(iii) There is no bulky covering of gland cells surrounding either atrium or paratrium (pl. xii, figs. 1—4).

(iv) The lower portion of the paratrium runs side by side with the middle region of the atrium in a common sheath (pl. xii, fig. 2), as in Michaelsen's specimens, but their lumina never unite, and open separately into the distal section of the atrium (pl. xii, fig. 3).

(v) The combined atrium and paratrium undergo fewer windings in the coelomic sac than is described by Michaelsen.

(vi) The distal section of the atrium is straight throughout, not hooked at its dorsal extremity (pl. xii, fig. 5).

(vii) The spermathecae are small, egg-shaped, with thick walls and small lumen.

(viii) The female efferent apparatus is not described by Michaelsen. Beddard describes an oviduct opening on the furrow between segments xi and xii. I find an ovarian funnel on septum 11/12 (pl. xii, fig. 1), which leads to the exterior by a short oviduct opening on segment xii, a little distance behind the level of septum 11/12.

I think it probable that most, if not all, the differences between the Hamburg specimens and the present one are to be referred to their being in different stages of development. And since the present specimen is presumably at a less rather than a more advanced stage of development than that described by Beddard, and since nevertheless it shows a fairly close agreement with Michaelsen's description, it does not seem likely that the discrepancies in the accounts of Beddard and Michaelsen are due to differences in the degree of maturity of their respective specimens. The explanation of those discrepancies is therefore to be sought in one of the other directions indicated by Michaelsen.

III.

Limnodrilus socialis, Stephenson.

The above worm was recently described by me (13) from Lahore, where it is common. I have twice received specimens alive from Mr. Gravely of the Indian Museum; the first occasion was in March 1911, the worms having been taken in a masonry drain at Belgatchia near Calcutta, the second in May 1911, when a tube of these worms, taken within the precincts of the Museum, was received at the same time and under the same conditions as the *Branchiura sowerbyi* previously mentioned.

Since the shape of the cerebral ganglion is largely used for purposes of discrimination and identification, I append a sketch of it, from a specimen in which it was well seen (fig. 4).

IV

Enchytraeus indicus, sp. nov.

I received from the Indian Museum in October last a small tube of worms collected by Mr. S. P. Agharkar, of the Elphinstone College, Bombay, in the neighbourhood of that city. Mr. Agharkar's note concerning the specimens is as follows:—"Oligochaete found in egg membranes of the common pond snail *Ampullaria*. They were found in the eggs of this snail which I collected on August 18th. The eggs were kept in a moist place for hatching, and on the 6th September, 1911, the young snails came out one by one. In some of these eggs, instead of the young snail, I found this worm. In other cases however it was found in the membrane surrounding the young snail."

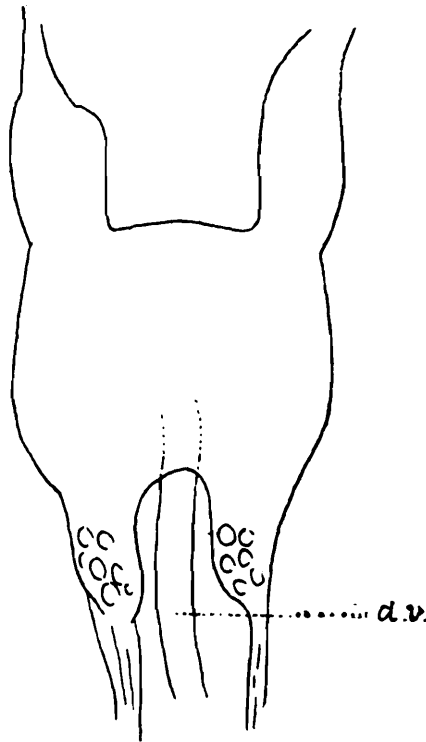


FIG. 4.—*Limnodrilus socialis*; cerebral ganglion, from above. *d.v.*, dorsal vessel.

The tube contained six specimens, of which one was very small, in a good state of preservation.

External characters.—The length was about 4 mm., the colour brownish; number of segments 31. The prostomium was short and bluntly conical; there was a head-pore between prostomium and first segment. The clitellum embraced segments xii—xiii; it was absent however from the median portion of the ventral surface of these segments.

The *setae* are of the type which is ordinarily found in the genus,—shaft straight with however a slight proximal curve, without nodulus, gently swollen towards the free extremity, and pointed at the end. In length they are approximately 50 μ . The

ventral series are three per bundle in segments ii—xi, absent in xii and two per bundle behind this. The dorsal series are two per bundle throughout.

The *alimentary canal* begins in a tubular buccal cavity lined by low, approximately cubical, epithelium. The pharynx succeeds, and is in turn followed by the ciliated oesophagus, narrow as far as segment vi, a little wider in vii and viii; its calibre finally increases in xiv where the tube becomes the intestine; the cilia are specially long in segments vii—xi. Three pairs of septal glands are present, in segments iv, v and vi; their position would perhaps be more accurately described by saying that they are in close connection with septa 4/5, 5/6 and 6/7, which split to enclose them; the posterior pair of glands are united ventrally underneath the oesophagus. Peptonephridia are present as narrow coiled tubes in segment iv.

The *dorsal vessel* begins in segment xiii apparently, or at dissepiment 12/13. It divides just behind the level of the mouth; the two divisions unite again ventrally, probably in segment v, to form the ventral vessel.

The *nephridia* are of the compact type, with a small anteseptal portion and a pear-shaped postseptal; the latter twice as long as the anteseptal, the broad end anterior, the narrow end continued into the duct, which passes downwards and backwards. The duct is about half as long as the postseptal portion, and duct and postseptal together are about twice as long as broad. The first nephridium is in segment v.

The *cerebral ganglion* is large, in segment ii, and has the dorsal vessel closely applied to it underneath. From sections it appears to be slightly convex behind, or at any rate not indented.

Reproductive organs.—The testes are in xi, attached to septum 10/11; there are no sperm-sacs. The funnels are in xi; they are much smaller than is usual in the family, and do not diverge very greatly from the ordinary form; thus there is a small open funnel-like mouth, which is succeeded by a portion of the tube composed of columnar, clear and mucous-looking cells (cf. pl. xii, fig. 6, drawn from a specimen in cedar oil). The vas deferens passes through septum 11/12, is coiled in the anterior part of segment xii, but straight in its posterior portion; it is very narrow, its diameter being 7-8 μ . The penial body, in the posterior part of xii, is spherical, has a diameter of 40-45 μ , and opens on the surface by a wide aperture (pl. xii, fig. 6).

The ovary is attached to septum 11/12. Ova are found in all segments from viii to xii inclusive; segment xii may be largely filled by them (pl. xii, fig. 6). The funnel is a backward depression of septum 12/13 on each side, at its ventral attachment to the body-wall, whence the short narrow oviduct leads directly to the exterior.

The spermathecae open to the exterior in the intersegmental groove 4/5; the ampulla of each is small, approximately spherical or ovoid, in diameter about 30 μ ; it probably communicates with

the oesophagus, though my preparations do not show the actual opening. The duct is several times as long as the ampulla, and is bent once or twice in its course ; in diameter it is 11-12 μ .

I may add a few remarks on two of the above characters. The first is the penial body. The Enchytraeidae possess in general glandular structures surrounding the external end of the vas deferens, but differ among themselves in the disposition of the gland-cells ; in some cases there are a number of separate aggregates of these cells, opening on the surface of the body around the male aperture, while in other cases the whole of the gland-cells are compacted into a spherical, ovoid, or reniform penial body, surrounding the last part of the vas deferens. Eisen (6) proposes this distinction as a means of separating the Enchytraeidae into two subfamilies, the Lumbricillinae which have, and the Enchytraeinae which have not, a penial body. I have shown however (12) that the representative genera of the subfamilies, *Lumbricillus* and *Enchytraeus*, are connected by a number of forms which have a more or less intermediate position ; and that in particular a penial body occurs in more than one species of *Enchytraeus*. It is interesting to find that this is the case in the present species also.

The second point is the condition of the seminal funnel. Its general form in the Enchytraeidae is described by the word 'barrel-shaped,' and this form is occasioned by the excessive elongation of the cells composing the first part of the duct ; at the same time the cells become clear and stain only slightly, due presumably to the formation within them of a mucous substance. In the present species the funnel is small, and the change in the cells comparatively slight ; the condition is therefore intermediate between that usual in other families and that which is characteristic of the Enchytraeidae.

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PLATE XI.

Explanation of Figures.

FIG. 1. *Branchiodrilus menoni*; anterior end of a specimen with four ventral setal bundles in prebranchial region; no ventral setal bundle is to be made out in the segment of the first gill; the first gill has apparently been damaged; $\times 85$.

FIG. 2. *Branchiodrilus menoni*; anterior end of a specimen with three ventral setal bundles in prebranchial region; the second gill has been damaged; the dorsal vessel is seen on the left side of the oesophagus; $\times 150$.

FIG. 3. *Branchiodrilus menoni*; anterior end of a specimen with no ventral setae in prebranchial region; none could be seen in the first gilled segment either; $\times 85$.

FIG. 4. *Branchiodrilus menoni*; a specimen in which asexual division is taking place, and is apparently nearly completed; $\times 68$.

FIG. 5. *Branchiodrilus menoni*; transverse section of the prebranchial region, showing structure of pharynx and position of pigment cells. The specimen is that shown in fig. 1; $\times 150$.

FIG. 6. *Branchiodrilus menoni*; transverse section through the sixth gill, showing position of blood-vessels, pigment cells, etc.; same specimen as fig. 4; $\times 150$.

Alim., alimentary canal; *chl.*, chloragogen cells (much resembling pigment cells); *c. m.*, circular muscular layer; *d. v.*, dorsal vessel; *ep.*, surface epithelium; *g.*, gill; *l. v.*, lateral commissural vessel; *l. m.*, longitudinal muscular layer; *pig.*, pigment cells in various situations; *ph.*, pharynx; *v. n. c.*, ventral nerve cord (the apparently empty space dorsal to it in fig. 6 is the giant fibre); *v. v.*, ventral vessel.

All the figures drawn with Zeiss's Abbe's drawing apparatus. The two sections (figs. 5 and 6) are seen from their front face; hence left and right are reversed.

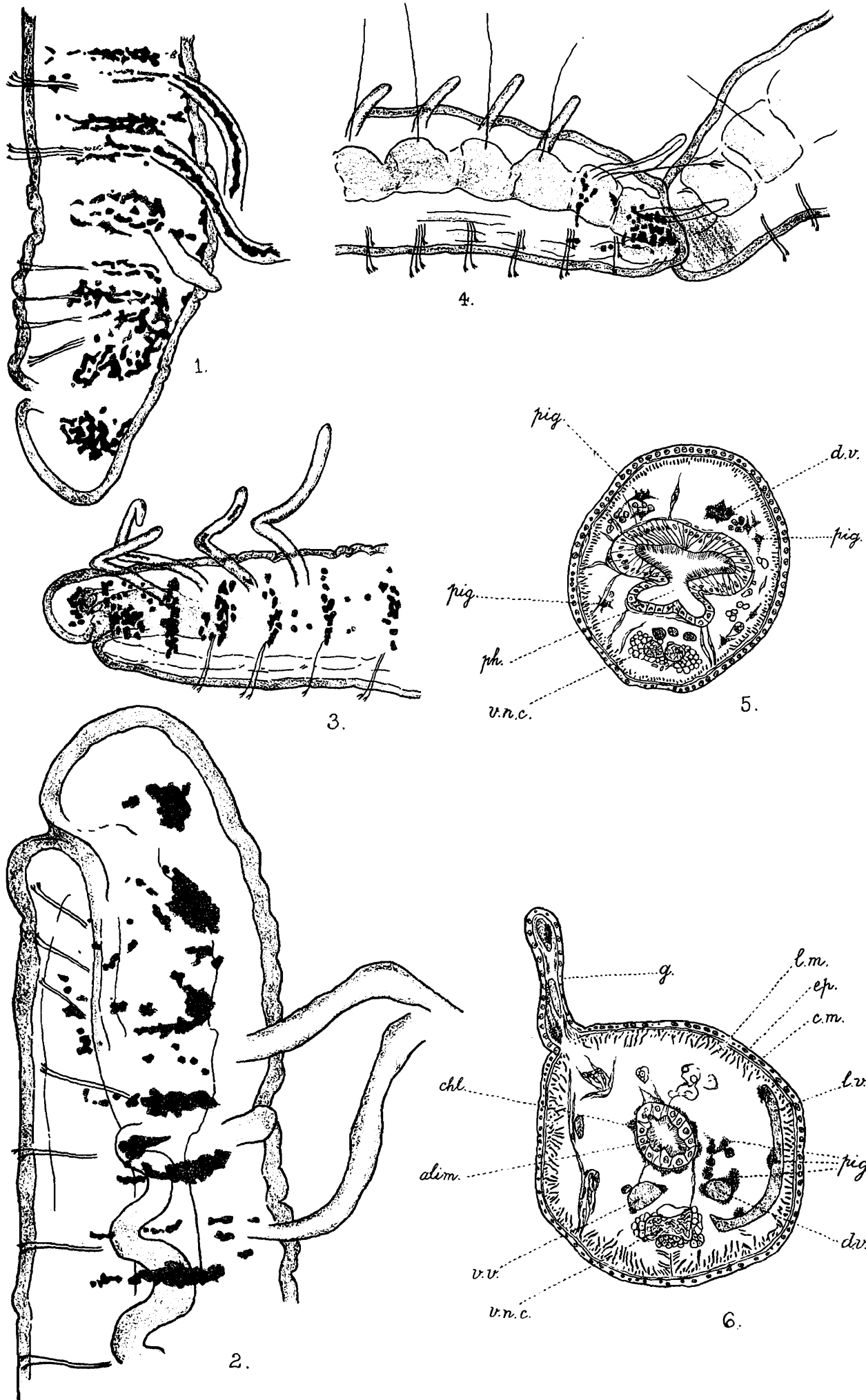


PLATE XII.

Explanation of Figures.

FIG. 1. *Branchiura sowerbyi*; oblique section through posterior portion of segment xi; $\times 120$.

FIG. 2. *Branchiura sowerbyi*; section through middle portion of atrium with paratrium; $\times 410$.

FIG. 3. *Branchiura sowerbyi*; section through upper portion of coelomic sac, showing junction of paratrium and middle region of atrium with distal portion of atrium; $\times 330$.

FIG. 4. *Branchiura sowerbyi*; section through proximal region of atrium and paratrium outside coelomic sac; $\times 240$.

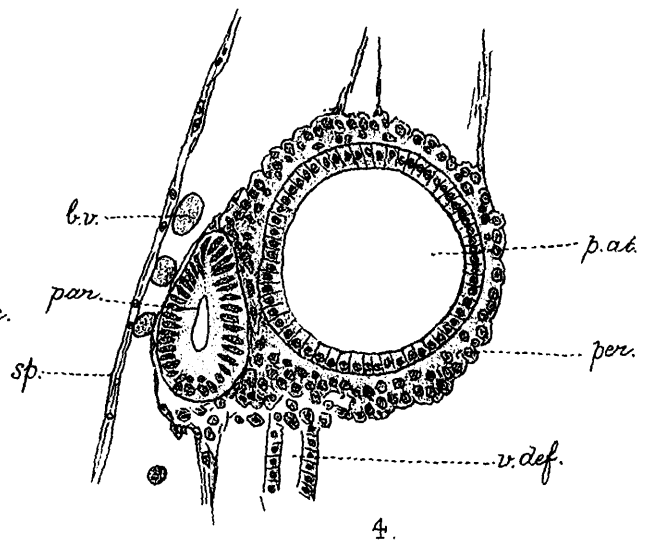
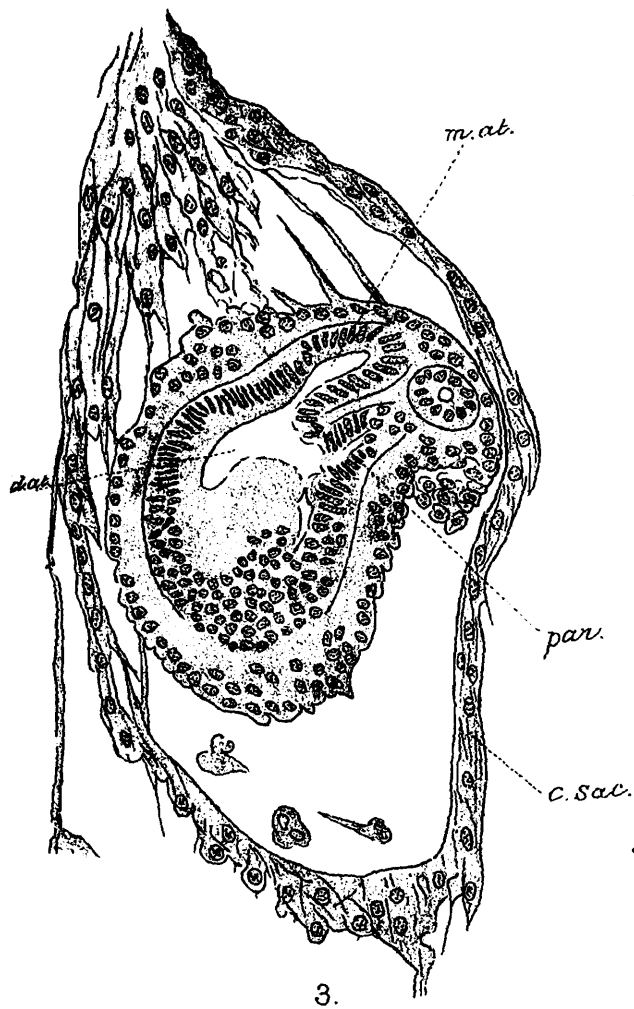
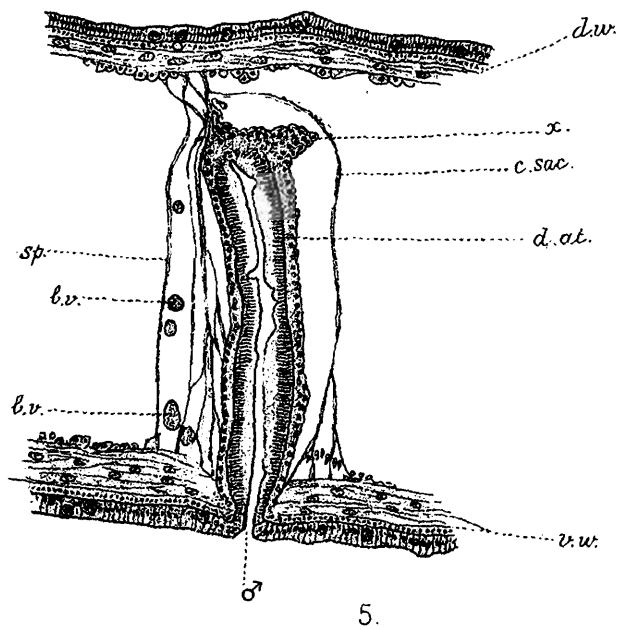
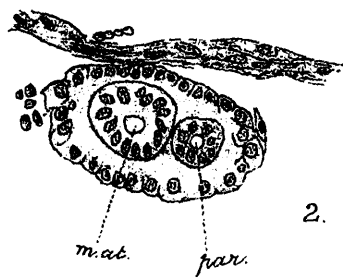
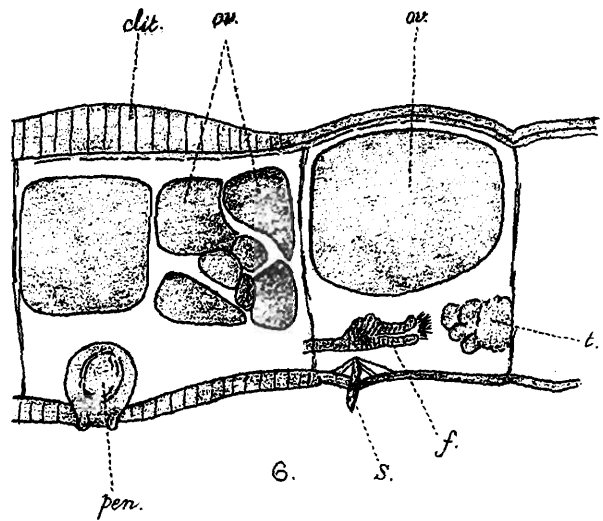
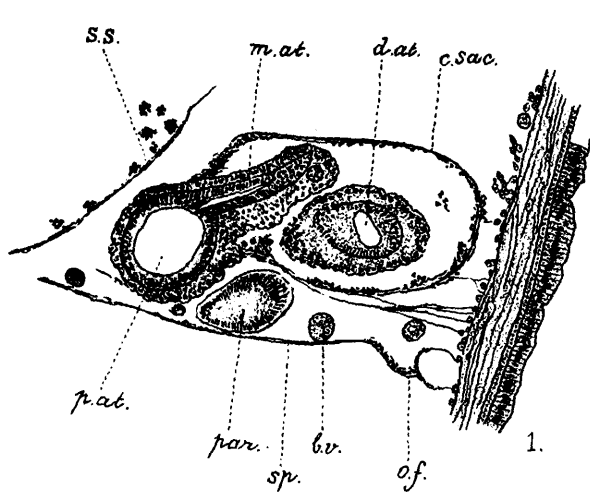
FIG. 5. *Branchiura sowerbyi*; vertical section through coelomic sac and distal region of atrium; $\times 95$.

The above five figures drawn by Abbe's drawing apparatus from a series of longitudinal sections through the anterior end of a single specimen; the sections pass pretty accurately through the distal portion of the atrium on one side (fig. 5), but obliquely on the other (fig. 1).

B. v., blood-vessel; *c. sac.*, wall of coelomic sac; *d. at.*, distal portion of atrium; *d. w.*, dorsal body-wall; *m. at.*, middle portion of atrium; *o. f.*, ovarian funnel; *par.*, paratrium; *p. at.*, proximal portion of atrium; *per.*, peritoneal cells round proximal portion of atrium, corresponding to the glandular cells of other observers; *sp.*, septum 11/12; *s. s.*, sperm sac; *v. def.*, vas deferens; *v. w.*, ventral body-wall; $\times$, at upper end of distal portion of atrium, indicates the place where, in a neighbouring section, the paratrium and middle portion of atrium enter; σ male aperture.

FIG. 6. *Enchytraeus indicus*; segments xi and xii, from a specimen mounted whole in cedar oil.

Clit., clitellum; *f.*, seminal funnel; *ov.*, ova; *pen.*, penial body; *s.*, seta; *t.*, testis.



XXII FAUNA SYMBIOTICA INDICA

No. 4.—*CARIDINICOLA*, A NEW TYPE OF TEMNOCEPHALOIDEA.

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

The object of the present note is to give a concise systematic description of an interesting symbiotic flatworm and to state what little is known of its habits. In preparing the description I have been indebted to the assistance of Mr. F. H. Gravely, who will, I hope, publish before very long a detailed anatomical account of the Temnocephaloidea represented in the collection of the Indian Museum and will discuss the morphology of the species described below.

I. SYSTEMATIC.

Class TEMNOCEPHALOIDEA.

It is perhaps doubtful whether the members of the so-called class Temnocephaloidea are sufficiently distinct from the Trematoda to be given that rank, and the peculiar little worm discussed in this paper is in many respects intermediate between the two "classes." For the present, however, the recognized classification may be accepted as convenient.

The Temnocephaloidea or Temnocephala, whatever their precise rank, are small parasitic flatworms with tentacles at the anterior end of the body and a large ventral sucker at the posterior extremity. They have a capacious sack-shaped alimentary canal with an anterior mouth but without a posterior aperture. The external surface is clothed with a delicate chitinous cuticle but in some cases bears cilia on certain parts of the body. Immediately below the cuticle there is a definite epidermis, in which, however, cell-walls do not occur. The genital organs lie behind or on the ventral surface of the alimentary canal in the posterior part of the body; the genital pore is situated near the posterior extremity or in the middle of the ventral surface.

A single species (*Scutariella didactyla*)¹ has been found in Europe but the group as a whole is characteristic of tropical and subtropical, or at any rate southern countries. It apparently has its headquarters in Australia, but is also found in New Zealand, in Malaysia and in S. America. Only one Indian species [Wood-Mason (12)] has hitherto been identified,² namely *Temnocephala semperi*, Weber, which is common on freshwater

¹ Mrázek, Sitz. K. Böhm. Gesellsch. Wiss. Prag 1907, p. 1, pl.

² Mr. Gravely has recently identified specimens after comparison with some of Prof. Max Weber's original examples from Java.

crabs of the genus *Potamon* (especially *P. manii*, Rathbun) in hill-streams in parts of Tenasserim.

The Temnocephaloidea appear to be confined to fresh water and to live, without exception, symbiotic rather than parasitic lives. In habits they are predaceous, but they invariably attach themselves to a host which they can conveniently employ as a beast of burden and a stalking-horse in the pursuit of their prey. Each species affects a single host or a group of closely allied hosts. Most of the Temnocephaloidea are found attached to Decapod Crustacea; the Australian species inhabit the gill-chamber of crayfish; the Malayo-Burman *Temnocephala semperi* lives on the ventral surface of crabs; one S. American form attaches itself to aquatic tortoises, while another penetrates within the pulmonary chamber of the Gastropod *Ampullaria*. The species to be discussed in this paper, like the allied European form, is associated with small prawns of the family Atyidae.

The Temnocephaloidea may conveniently be divided into three families as follows:—

- I. At least four anterior tentacles; posterior sucker circular; alimentary canal much shorter than body, with the genital organs posterior to it.
 - A. No lateral tentacles; no anterior sucker; pulsatile excretory pouches present . TEMNOCEPHALIDAE.
 - B. Lateral as well as anterior tentacles; an anterior sucker in front of the mouth; no pulsatile excretory pouches. ACTINODACTYLELLIDAE.
- II. Only two anterior tentacles; anterior margin of posterior sucker cleft; alimentary canal extending to posterior extremity, with the genital organs on its ventral surface; no pulsatile excretory pouches SCUTARIELLIDAE.

The third family appears to be considerably more remote from the two first than either of the latter is from the other, but it has not hitherto been recognized as distinct. It consists of two allied genera, *Scutariella*, Mrázek, and *Caridinicola*, gen. nov. The former is known from a single species from Montenegro; the latter from a single Indian species. The family may therefore be said to agree with most of the secondary divisions in the Temnocephaloidea in consisting almost of a minimum of forms. Only 5 genera (*Temnocephala*, *Craspedella*, *Actinodactylella*, *Scutariella* and *Caradinicola*) are known in the "Class" and of these *Temnocephala* is the only genus that is not monotypic, while the Temnocephalidae is the only family hitherto recognized that includes more than one genus, *Craspedella* as well as *Temnocephala* belonging to it.

Fam. SCUTARIELLIDAE, nov.

The two species included in this family are both minute, flattened, more or less ovoid or shield-shaped organisms associated with little freshwater prawns of the family Atyidae. They differ from all other known Temnocephaloidea in the following characters:—

- (1) There are only two anterior tentacles, which differ in structure and function from those of *Temnocephala*.
- (2) The posterior sucker is cleft anteriorly in such a way that it becomes either heart-shaped or horseshoe-shaped.
- (3) There are no external cilia on any part of the body.
- (4) The alimentary canal extends backwards to the posterior extremity.
- (5) The genital organs lie beneath instead of behind the alimentary canal and the genital pore is situated in the middle of the ventral surface.

In the absence of lateral tentacles the Scutariellidae agree with the Temnocephalidae but they resemble *Actinodactylella*, Maxwell (7, 8) in the absence of pulsating excretory pouches and in the arrangement of the genital organs. The external cuticle is minutely ringed.

CARIDINICOLA, gen. nov.

The mouth is almost precisely terminal and the whole pharynx can be extruded in the form of a proboscis. The tentacles arise on the dorsal surface, one on either side of the mouth. At the base of each tentacle, on the ventral surface, there is a small sucker. The posterior sucker is horseshoe-shaped. The excretory system opens on either side by a pore on the lateral margin almost on a level with the eyes. There are two testes on either side, a larger and more conspicuous external and anterior testis and a smaller inner and internal one. The penis is armed with chitin and directed from right to left; the ovary resembles that of *Temnocephala* in structure and lies a little to the left of the middle line; the vitellarium does not cover the dorsal surface of the alimentary canal. Each tentacle has a large ganglion at its base. An elongated gland runs along each side of the anterior part of the body towards the tip of the tentacle.

Type, *Caridinicola indica*, nov.

Distribution.—The Ganges and the Mahanaddi rivers, eastern India.¹

CARIDINICOLA INDICA, sp. nov.

External characters.—The animal is highly contractile and almost protean in form, but is always flattened dorso-ventrally, more or less produced at the anterior end and truncate posteriorly.

¹ Since this was written Mr. Gravely has obtained specimens of *Caridinicola* on *Caridina sumatrensis* in the Western Ghats.

When normally contracted it resembles a median longitudinal section of a cone in outline. In length an adult individual can extend instantaneously from 0.5 mm. to 2.0 mm. The integument is colourless and transparent and the rings on the cuticle very narrow. The tentacles are extremely short and have a bluntly rounded tip; they are soft and apparently devoid of cuticle; when the animal is fully extended they have the appearance of being mounted on short peduncles. The mouth opens between them at the base of a depression which becomes crateriform when the proboscis is fully retracted and the whole animal fully extended. There are two eyes situated on the anterior half of the dorsal surface some distance behind the base of the tentacles; the eyes are directed forwards and outwards; they are black in colour.

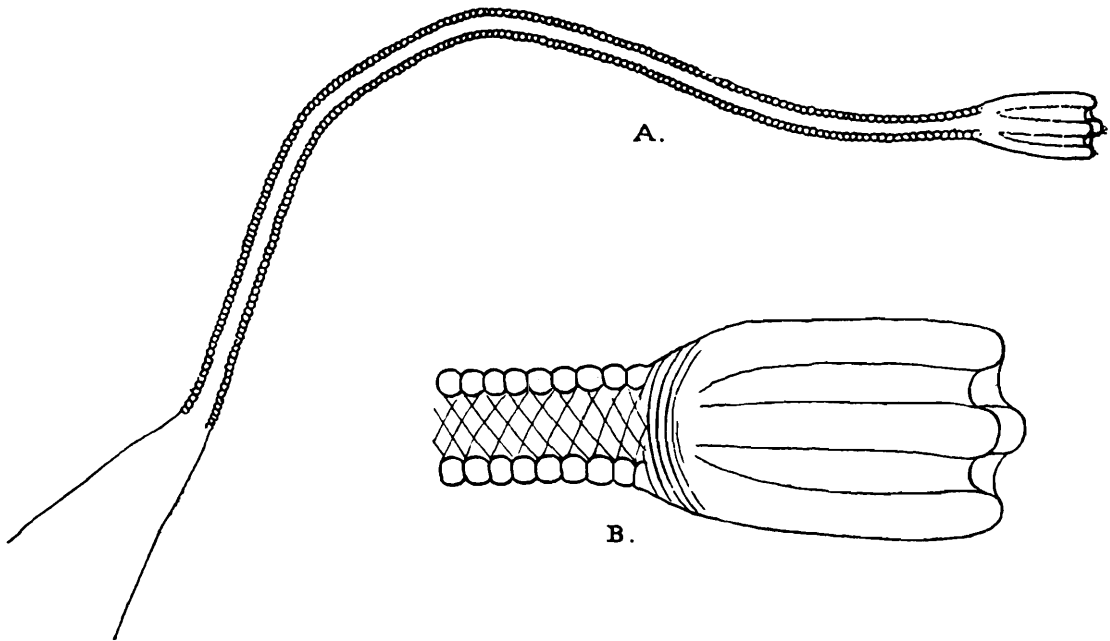


FIG. 1.—Chitinous armature of intromittent organ of *Caridinicola indica*.

A.—The entire armature, very highly magnified.

B.—The terminal cup, still more highly magnified. The stem or intermediate portion and the basal funnel are represented in optical section.

When the animal is fully contracted the posterior sucker sometimes becomes almost heart-shaped, but as a rule it resembles the figure formed by a straight line the extremities of which are curved upwards through the greater part of a circle, the distance apart of the incomplete circle thus formed varying with the state of contraction of the animal.

Alimentary canal.—The mouth opens into an elongate cylindrical but highly muscular pharynx (oesophagus) which can be thrust out bodily to nearly half the length of the animal. The tip of this organ is surrounded by a circle of minute prominences on each of which a sense-organ provided with a minute chitinous tooth is situated; the whole ring is folded inwards when the proboscis is retracted. Strong, almost transverse retractor muscles, are

attached to the base of the pharynx. The intestine is rather longer and much more bulky than the pharynx; it is indistinctly sacculated at its anterior end.

Genitalia.—Only the penis need be described here. The chitinous part of this organ (fig. 1) consists of three regions:—(1) a proximal, funnel-shaped base, (2) an elongate cylindrical stem and (3) a cup-shaped apex. The basal funnel occupies about $\frac{1}{6}$ of the length of the whole structure and has a perfectly smooth external surface; it is almost twice as long as its basal diameter. The stem is about 34 times as long as its own transverse diameter, maintains the same diameter throughout its length, is circular in cross-section and occupies $\frac{5}{6}$ of the whole structure. It is ornamented externally with minute rounded prominences with which it is closely covered, the prominences forming parallel transverse rings round it. The terminal cup is about $1\frac{1}{3}$ times as long as broad and only about $\frac{1}{10}$ the length of the stem. Its sides, which are nearly parallel, are supported by four equidistant vertical bars, each of which is about equal in breadth to the space which separates it from the next bar. At the rim of the cup the bars project upwards for a short distance, their tips being bluntly rounded.¹

Excretory system.—A pore which I believe to be excretory is situated on each side of the body close to the edge of the dorsal surface and a little posterior to the eye. These pores are easily seen in living specimens.

Eggs.—The eggs are nearly circular as seen from the side but broadly oval as seen from above. Each is provided with a stalk considerably shorter than its own diameter. They are somewhat variable in size but measure on an average about 0.24×0.19 mm. in dorsal view. The external covering is chitinous but very thin and quite smooth; it has a distinct yellowish tinge.

Type (a specimen mounted in glycerine) No. Z.E.V. 3060, Ind. Mus.

Localities, etc.—River Mahanaddi and canal opening thereinto at Cuttack and R. Mahanaddi at Sambalpur, Orissa (February and March); river Ganges near Rajmehal, Bengal (March) (*B. I. Chaudhuri*).

Hosts.—*Caridina propinqua*, de Man (4) and *C. sumatrensis*, Bouvier (3).

II.—BIOLOGICAL.

The first specimens of *Caridinicola* were found attached to antennae of prawns of the genus *Caridina* taken at Cuttack in February and preserved in spirit. Others were discovered loose in the same bottle. They were, naturally enough, mistaken for small leeches by my assistant who was sorting out the contents of the bottle. As the species was evidently one of considerable interest, I took the opportunity to revisit Cuttack last March and found the worm abundant in the gill-chambers of *C. propinqua*,

¹ These details can only be seen with the aid of an oil-immersion lens after the specimen has been treated with caustic potash.

which swarmed among water-weeds at the edge of the Mahanaddi and also in a canal at the same place. Loose specimens were subsequently found in bottles of *Caridina sumatrensis* from Sambalpur in Orissa and Rajmehal in Bengal.

In the river and canal at Cuttack small Decapod and Schizopod Crustacea are extremely abundant. At least three species of *Caridina* (*C. nilotica*, Roux) (*s.l.*), *C. propinqua*, de Man, and *C. sumatrensis*, Bouvier, occur among weeds at the edge, and also numerous small (mostly immature) Palaemonidae; while the water is often full of large shoals of the little estuarine Mysidae *Potamomysis assimilis* and *Macropsis orientalis*, Tattersall (10).

In spite of a careful search, I did not find *Caridinicola* on any species of *Palaemon* or Mysidae at Cuttack or on *Caridina nilotica*. I cannot, however, be sure that it did not occur on *C. sumatrensis*, although all the specimens of *Caridina* on which I know that I took it are assigned by Mr. Kemp to *C. propinqua*; for the immature individuals of the two prawns resemble one another very closely.

I have not been able to find *Caridinicola* on *Caridina propinqua* in the neighbourhood of Calcutta, but this may be due to the fact that the prawn in this district is only found in distinctly brackish water, whereas the water of the Mahanaddi at Cuttack is very nearly, if not quite, fresh. That of the Mahanaddi at Sambalpur and of the Ganges at Rajmehal is of course quite fresh. Nothing is yet known of the distribution of *Caridina propinqua*, which has hitherto been recorded only from the Ganges delta, but it is very closely related indeed to *C. fossarum*, Heller, from Persia, and it is probable that closely allied forms extend all over the territory intermediate between that country and Lower Bengal. *C. sumatrensis* appears to be distributed over a considerable part of the Oriental Region.

The host of *Scutariella* is *Atyäephyra desmarestii*, the only non-cavernicolous European Atyid.

The habitual position of *Caridinicola* on its host is inside the gill-chamber, in which it lies attached to the gills. In most cases it can be readily detected in this position with the aid of a low-power microscope by an external examination of the prawn, whose integument is rarely pigmented so deeply as to render the operculum opaque. If the water in which the prawn is living, however becomes foul or if any noxious substance is added to it, the worm immediately emerges from the anterior end of the chamber and makes its way rapidly along the antenna or antennule. After gesticulating wildly in a manner that will be described presently, it then makes off in search of a new environment, being by no means wholly dependent on the prawn for the power of locomotion. For this reason very few specimens can be found on prawns which have been kept in captivity for more than a few hours, unless precautions are taken to keep the water fresh.

Caridinicola, though not markedly gregarious, is usually found in parties of two or three and, so far as my observations go,

such parties are usually confined to one gill-chamber, that on the other side of the prawn remaining vacant.

The eggs are attached to the gill-filaments of the host and are apparently deserted by their parent before they hatch. I found numerous examples far advanced in development at the beginning of March. There are as a rule not more than half a dozen on one host.

The food of *Caridinicola* consists mainly if not entirely of minute Protozoa and Protophyta. The contents of the alimentary canal as a rule consists of a brownish granular substance, probably excretory and containing large numbers of Diatom and Desmid skeletons. The tests of Rhizopod Protozoa are often present also in considerable numbers.

Prey is evidently captured by means of the pharynx, which can, as already stated, be thrust out bodily in the form of a pro-

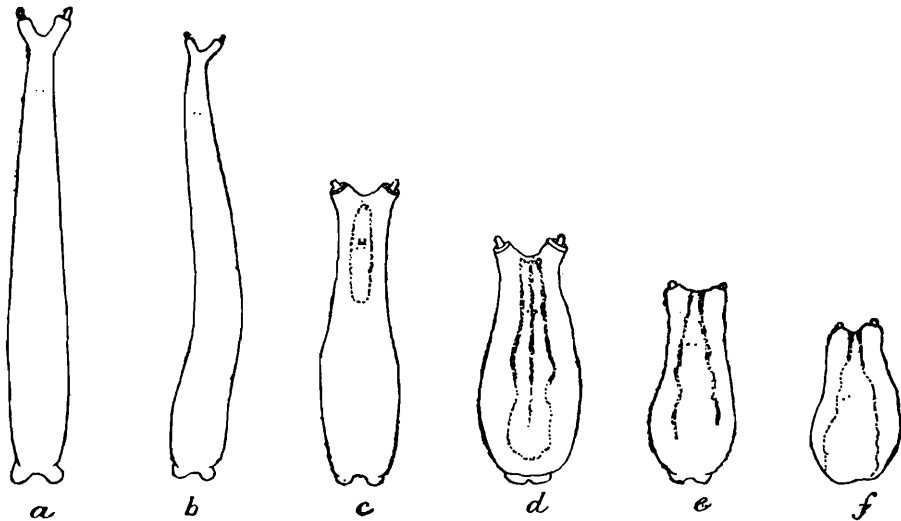


FIG. 2.—A single individual of *Caridinicola indica* in different stages of contraction.

boscis. I have not been so fortunate as to see the process, but Babu Abohya Charan Chowdhary, the Museum draftsman, tells me that while he was drawing the sketches reproduced in fig. 2, he saw the worm suddenly shoot out its proboscis and seize therewith a "small insect" which was running past. The proboscis was then rapidly withdrawn. The "small insect" was probably an Infusorian. The animal can easily be induced to extrude its proboscis by the exercise of pressure. Apparently the extrusion takes place more readily when the whole body is in a state of moderate contraction and is brought about by lateral contraction of the muscles of the body-wall, which are very well developed, aided by those of the organ itself. Retraction is affected by means of the retractor muscles situated at the base of the oesophagus. Doubtless the sense-organs surrounding the mouth enable the animal to decide whether the prey captured should be swallowed

or rejected, while the little teeth with which they are provided assist in its retention.

When *Caridinicola* is undisturbed in the gill-chamber of its host it habitually remains with its body in a state of moderate retraction, approximately as in fig. 2 *d*. The posterior sucker is firmly fixed to a gill-filament and the body is arched upwards and forwards in such a way that the eyes look directly forwards and outwards, the anterior extremity being bent considerably downwards. If any disturbance occurs, however, the animal immediately straightens itself and elongates its body to the utmost. Such attitudes as those shown in fig. 2 *a* and *b* are only adopted just before it begins to move forwards. Apparently the rule that it emerges from the anterior end of the gill-chamber is absolute, and it invariably escapes *viâ* the antenna or antennule. As soon as it reaches the filamentous part of one of these appendages it stays its course and remains for some little time with the peculiar posterior sucker clasped round the hair like structure. The body is stretched to the utmost and moves rapidly upwards and downwards and from side to side, often gyrating almost as if on a pivot; but the sucker retains a firm hold. The tentacles during these evolutions exhibit curious twitching movements apparently neither correlated in the case of the two tentacles nor rhythmical. At length the *Caridinicola* releases hold of its host and drops to the bottom or onto a convenient weed. It seems probable that it habitually deserts its host at night, for I found it difficult to procure specimens on *Caridina* in the Mahanaddi early in the morning.

Progression is effected by means of "looping." The body is first held upright and stretched to the greatest possible length. The anterior extremity is then bent downwards and the surface along which progression is to be effected touched gently by the tentacles with their characteristic twitching movements. The two little anterior suckers next take hold, and the posterior sucker is released, drawn forward to a position immediately behind that occupied by them and then affixed again. The animal is now in readiness for a new move forwards.

Taking the above-stated observations into consideration, it seems probable that the tentacles are, as their structure would suggest, primarily of use as sensory organs. They seem to play no other part in progression than that of testing the ground before the anterior suckers attach themselves to it. They have, I think, another function, namely that of finding the right host. I noticed that if a *Caridinicola* were removed from its host and placed in a dish of water in which a *Caridina* of the right species was present, it immediately stood up in the water on its posterior extremity and, after twisting about in all directions and flicking its tentacles, finally directed them in the direction of the *Caridina* and then moved rapidly towards it. This happened whether the *Caridina* was dead or alive; indeed, even if it were torn in pieces, the little worm appeared to be attracted by the fragments and attached itself to one of them.

The eyes probably serve another purpose. As the worm sits in the gill-chamber of its host, they are, as I have already stated, directed straight in front of it. The current of water that flows constantly through the gill-chamber must bring in many of the little organisms on which *Caridinicola* feeds, and it is reasonable to assume that it catches these organisms by means of its protrusible pharynx. In order to do so, however, it must first become aware of their presence. There is every probability that it does so by seeing them, for the walls of the gill-chamber of *Caridina propinqua* are of glassy transparency and offer hardly any obstacle to the passage of light, while even those of *C. sumatrensis*, although they are as a rule much more densely pigmented, are by no means opaque.

SUMMARY

1. The new genus *Caridinicola* constitutes with *Scutariella*, Mrázek, a family of "Temnocephaloidea" of which the latter is the type.
2. The family Scutariellidae is distinguished from other families of the group, among other characters, by the fact that the intestine extends to the posterior end of the body and that the genital organs, therefore, lie on its ventral surface instead of posterior to it.
3. *Caridinicola* is distinguished from *Scutariella* by the possession of a pair of small anterior suckers, by the terminal position of the mouth and by the peculiar shape of the posterior sucker.
4. *Caridinicola indica* is found only in association with certain species of the Atyid genus *Caridina*, namely *C. propinqua*, de Man, and *C. sumatrensis*, Bouvier.
5. It captures its prey by means of a protrusible pharynx or oesophagus.
6. Its tentacles are sense-organs and are apparently employed in testing the nature of the surface along which the animal is moving and also in finding the host.
7. The eyes are probably used for the detection of prey.
8. Progression is affected by "looping."

In conclusion I must again express my indebtedness to Mr Gravely and also to Mr. Stanley Kemp, who has given me great assistance in identifying the hosts of *Caridinicola indica*.

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9. Mrázek "Ein Europäischer Vertreter der Gruppe Temnocephaloidea," Sitzungsber. K. Böhm. Gesellsch. Wiss., 1907, p. 1.
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11. Weber "Über Temnocephala Blanchard," Zool. Ergebn. in Niederländisch Ost-Indien i, p. 1 (1890).
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XXIII PRELIMINARY DESCRIPTION OF A FRESHWATER MEDUSA FROM THE BOMBAY PRESIDENCY

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

Mr. F. H. Gravely of the Indian Museum and Mr. S. P. Agharkar of the Elphinstone College, Bombay, have recently obtained many specimens of the medusa referred to on p. 144, vol. lxxxvii of *Nature*. The following preliminary description is based on an examination of these specimens, which are several hundreds in number and come from the Yenna and Koyna valleys in the Satara district of the Bombay Presidency.

LIMNOCNIDA INDICA, sp. nov.

This medusa is closely allied to *L. tanganyicae* (Bohm)¹ and *L. rhodesiae*, Boulenger,² but differs from both in the arrangement of its tentacles and sense-organs.

Dimensions.—The smallest specimen (fig. 1) I have seen is about 1.75 mm. in diameter and has probably been, at any rate when in a state of contraction, at least as deep as broad. Full-grown medusæ are 15 mm. in diameter and almost three times as broad as deep.

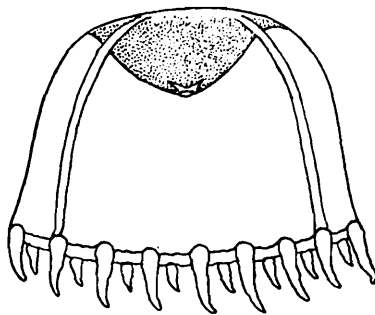


FIG. 1.—Young medusa of *Limnocrnida indica*.

Umbrella.—The umbrella is very shallow and almost flat on the dorsal surface in the adult; in the young it is distinctly flattened above but not so broadly as in the adult.

¹ Günther (R.T.), *Ann. Mag. Nat. Hist.* (6) xi, p. 269 (1893); *Quart. Journ. Micro. Sci.* xxxvi, p. 271 (1894); *P.Z.S.*, 1907 (ii), p. 643; Browne in Graham Kerr's *The Work of John Samuel Budgett*, p. 471 (1907); Boulenger (C.L.), *Quart. Journ. Micro. Sci.* lvii, p. 83 (1911).

² Boulenger (C.L.); *tom. cit.*, p. 427 (1912).

Manubrium.—The manubrium in most of Mr. Gravelly's and Mr. Agharkar's specimens has the saucer-like form characteristic of the genus, consisting merely of a shallow ring and opening nearly as wide as the velum. In some few adult individuals, however, it is in a more or less contracted condition, while in one young one (fig. 1) its margin has been drawn together in such a way as to close the mouth almost completely, leaving only a minute star-shaped aperture. Mr. Gravelly informs me that even the largest medusæ are quite capable of keeping their mouths closed, so long as they are in good health.

Gonads.—The gonads surround the manubrium as in other members of the genus. In the male the testis forms a uniform opaque white ring, but in the female the ring is grooved vertically at frequent intervals so that it has a crimped appearance. The grooves extend from the upper part of the manubrium downwards

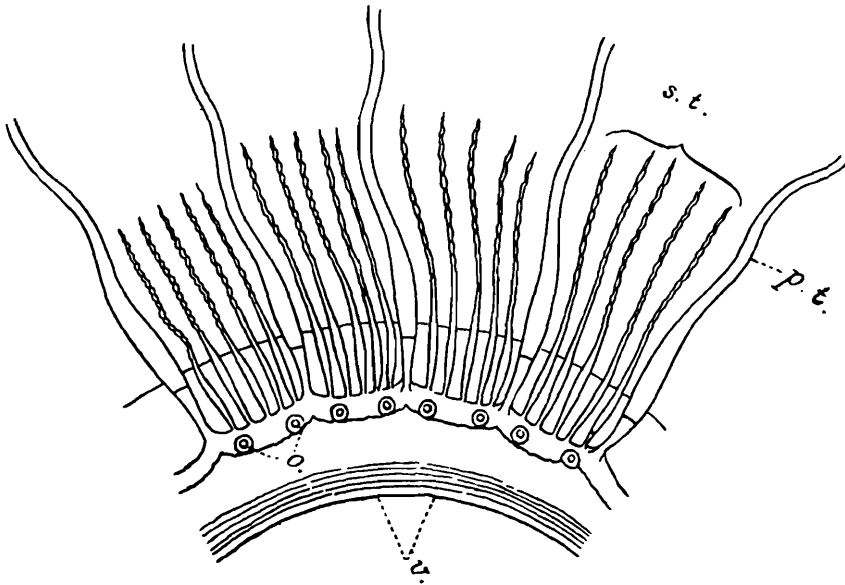


FIG. 2.—Tentacles and sense-organs as seen from below, o.=otocyst; p. t.=primary tentacle; s.t.=secondary tentacle; v.=velum.

but do not reach its distal margin. They do not form distinct loculi in the ovary, for the ova, which are arranged horizontally, extend across them. A number of minute greenish cells (possibly symbiotic algae) exist in the outer covering of the ovary and give it a faint yellowish tinge. The eggs are very small; when ripe and apparently just about to be emitted from the ovary they are circular and from 0.04 to 0.06 mm. in diameter. At an earlier stage they are produced and pointed at one side.

Tentacles.—The tentacles appear, at any rate in the adult, to have a much more definite arrangement (fig. 2) than is the case either in *L. tanganicae* or *L. rhodesiae*. In general structure they agree with the tentacles of these species. They may be divided at sight into two series that may be called primary and secondary; those of each series having a distinctive structure, position and number. The primary tentacles are much stouter at the base and

also much longer than the secondary ones. They extend upwards from the base through the jelly of the bell for a short distance and on emergence therefrom lie parallel to its external surface, each in a shallow groove, for about twice the distance for which they are enclosed in the jelly. This groove extends to the edge of the umbrella. On its termination the tentacle bends outwards and upwards and then downwards. At the point at which it does so there is only a very slight prominence on the surface of the umbrella. The base of the primary tentacle is both constricted from side to side and flattened dorso-ventrally. On the dorsal surface, where it is in contact with the mesogloea below the ectoderm of the bell, its endoderm contains numerous small polygonal cells of a yellowish colour due to their thickened walls.

The secondary tentacles are not only much shorter but also more nearly cylindrical and equal than the primary ones. They project practically straight out from their base, which is not, or only to a very slight extent, enclosed in the jelly.

The full number of tentacles is 384. Every primary tentacle is followed by five secondary ones arranged in a straight line with their bases a little further from the velum.¹ There are thus 64 series of six tentacles each, each consisting of one primary and five secondary tentacles. The radial tentacles are followed by five secondary tentacles just as other primary tentacles are.

It might be possible to divide the primary tentacles into several series by their length and in the adult medusa the radials are distinctly longer than the others; but the differences in this respect are slight and apparently unimportant. In the young medusa 1.75 mm. in diameter only two series can be distinguished and the radial tentacles are very little if at all longer than the others. At this stage there are 24 primary tentacles and each is followed by a single secondary one, which is distinguished not only by its smaller size but also by being placed a little lower on the edge of the bell as seen from the side or above.

Sense-organs.—The otocysts are comparatively large, at least equalling the base of the largest tentacles in diameter. They also have a very definite arrangement in the adult. Every set of five secondary tentacles has two otocysts at its base and these two are separated from the next pair by the base of a primary tentacle and by an outward emargination of the inner edge of the ring of thickened tissue at the base of the tentacles. It is always quite clear, in well-preserved specimens, that the otocysts are not situated at the base of the primary tentacles and are not surrounded by anything like a tentacular bulb. In the young medusa already alluded to there are only three fully formed otocysts in each quadrant, *i.e.*, only twelve in all; while in an older medusa measuring 3.25 mm. in diameter there are five in each quadrant.

¹ Owing to the fact that the base of the primary tentacle is embedded in the jelly, this tentacle, unless a very careful examination is made from below, has the appearance of arising further from the velum than the secondary tentacle.

In the adult medusa the total number is 128. The sense-organs have the structure characteristic of *Limnocybida*.

Nematocysts.—The nematocysts resemble those of other species of *Limnocybida* both in shape and in arrangement. Round the margin of the bell they form a "nettle-band," in which they are found in various stages of development, always lie parallel to the external surface and never possess cnidocils. In the basal part of the primary tentacles they have the same position and still lack cnidocils. In this region they are very numerous. From a point a short distance beyond that at which the tentacle projects from the edge of the bell, however, they are arranged in very definite papillae. In these they stand out almost vertically from the surface and are provided with cnidocils. On the distal part of the tentacle the papillae are arranged in transverse rings round it, each ring consisting of four papillae. On the secondary tentacles the papillae extend nearly to the base.

Types (many specimens from Medha, Yenna valley, between Mahabaleshwar and Satara). No. Z.E.V $\frac{5101}{7}$ Ind. Mus. (*F. H. Gravely*: May, 1912).

Distribution.—Pools in streams in the Western Ghats that finally enter tributaries of the Kistna river, Satara district, Bombay Presidency.

On the manubrium of specimens from Tambi in the Koyna valley I found numerous examples of the Infusorian *Trichodina pediculus*, Ehrenberg, a species which in Europe lives symbiotically on *Hydra* and other aquatic organisms.



XXIV. ON A NEW GENUS OF INDIAN
THRIPS (THYSANOPTERA) INJURIOUS
TO TURMERIC.

By RICHARD S. BAGNALL, *F.L.S.*, *F.E.S.*

(Plate vii.)

Through the kindness of Dr. N. Annandale I am able to describe the following interesting species of Thrips which was submitted to me with other Indian material in 1909. The specimens were collected more than thirty years ago, and on that account are not in such good condition as one would wish. I have however made a greatly enlarged drawing which shows the chief features of both sexes, and whilst the following description is a very complete one, considering the fragmentary state of the material, I hope later to have the pleasure of examining some newly collected specimens and thus be enabled to more accurately describe and figure certain parts.

Apart from its economic importance the species is one of considerable interest. It belongs to the sub-order Terebrantia and in certain features, such as the general character of the head and prothorax and the form of the antennæ, it would appear to be closely related to the genus *Heliothrips*, but a number of strong and peculiar characters (italicized in the generic description) are of such importance, I consider, as to render it advisable to place the genus into, at least, a sub-family of its own, the Panchaethripinae.

Dr. Annandale has sent me the following transcription of the reference to the specimens, which appeared in the "Indian Museum Notes," Vol. I, 1889-1891—Entomology Notes—by E. C. Cotes, p. 109:—

"Specimens were received on 21st May, 1889, from the Board of Revenue, Madras, through the Superintendent, Government Central Museum, Madras. *Sutta thegulu*, small black-winged insect, frequently jumps from one place to another. This attacks the plant when two months old. The leaves become rolled up, greenish in colour, turning pale yellow, and the leaves gradually become dry. This spoils the turmeric crop, and rhizomes are not developed. Eggs are also deposited on the back of the leaves. *Sutta thegulu* is considered to be a severe form of attack."

Order THYSANOPTERA.

Suborder Terebrantia.

Fam. THRIPIDAE, Hal.

Sub-fam. *PANCHAETOTHRIPINAE*, mihi.Gen. *PANCHAETOTHRIPS*, nov.

Head short and strongly transverse, *posteriorly strongly chitinized in the form of a raised collar*; frons depressed; cheeks roundly contracted before collar. Eyes prominent and protruding, ocelli present. *Antennæ* long, eight-jointed, joints three and four very long and slender five and six broadly united, the style bristle-like with the eighth joint much longer than the penultimate. Maxillary palpi long and slender, three-jointed. Prothorax strongly transverse, without prominent bristles. Pterothorax large. Wings present, not reticulated; spines on fore-wing exceptionally long and strong; *fore-vein apparently merged with costa, and hind-vein obsolete.*

Abdomen broadly ovate, *depressed and margined laterally; tenth segment in the female cylindrical and almost closed ventrally; Ovipositor very long and slender, almost straight. Anal spines exceptionally long and strong.*

Type *Panchaetothrips indicus*, mihi.

PANCHAETOTHRIPS INDICUS, sp. nov.

♀ Length 1.3 mm. Length of last abdominal segment about 0.25 mm. Colour brown or yellow-brown, the pterothorax, the last abdominal segment and often the hind part of body darker; sides of pterothorax shaded with grey. Fore-tibiæ yellow at apex, intermediate and hind femora yellowish basally and apically, and the tibiæ lighter at knees and shaded thence from brown to clear yellow at apex; all tarsi yellow. First antennal joint yellowish-brown, second concolorous with head, joints three to five clear yellow, almost white, shaded with light brown at tips; apical joints light brown.

Surface of head lightly reticulated, most strongly laterally and in the space between each posterior ocellus and eye; transversely striated below collar. Strongly transverse, widest across eyes; space between eyes almost three times the width of an eye; frons slightly produced, separating the basal antennal joints and having the apex narrowly emarginate. Forehead depressed from about a line drawn across the anterior fifth of the eyes; cheeks slightly rounded and thence strongly narrowed basally to collar which is apparently raised laterally and dorsally. Eyes large, prominent and very coarsely faceted; ocelli rather large, oviform; anterior

ocellus forwardly directed, placed in centre of forehead on a line drawn through the anterior fifth of eyes; posterior pair on a line drawn through the posterior third of eyes, the space separating them being as great as that between each ocellus and eye. Mouth-cone reaching across prosternum. Maxillary palpi three-jointed, long and slender. Antennæ widely separated at base, more than three times as long as the head; first joint short, cylindrical and narrower than the second; second widest at middle where it is about as broad as long, slightly narrowed distally and truncate at apex; third and fourth extremely slender, almost spindle-formed; fifth slightly stouter and broadly jointed to the sixth which is roundly narrowed apically; seventh styliform, parallel sided, and eighth continued in the form of a bristle. Relative lengths of joints:—6, 12, 24, 19.5, 17, 10, 5, 15. In one specimen the fourth joint is only very little shorter than the preceding.

Prothorax strongly transverse, without any conspicuous spines; surface finely and irregularly striated transversely. Pterothorax large; mesothorax roundly widened to juncture with the metathorax which has the sides roundly narrowed to the base of abdomen. Both meso- and metathorax laterally convex and with the surface reticulated. Surface of all the legs similarly reticulated; hind pair much longer than the others. Tibia of each hind leg furnished with a series of minute bristles for practically the whole length of the inner margin. Wings strong and reaching to the last abdominal segment; fore-wing narrowing rather unevenly from the basal fourth; basal part with a series of four long strong bristles on the fore-margin, the third being the longest, and a series of ten very long and strong spines on the costa, the last of which is the shortest. There are three spines on the basal part of the fore-vein; this vein appears to be carried to the extreme tip in the form of a thickened fore-margin, and is furnished in the apical half with six spines. There is one short and one long spine just under the first costal spine, but there appears to be no trace whatever of a hind-vein nor of any spines set on a line corresponding with such a vein. The fore-fringe is poorly developed whilst the cilia of the hind-fringe are closely spaced, long and slightly wavy. The hind-wing has the median vein well-developed, and the hairs of the fore-fringe are much shorter and more widely spaced than those on the hind margin.

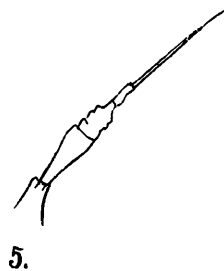
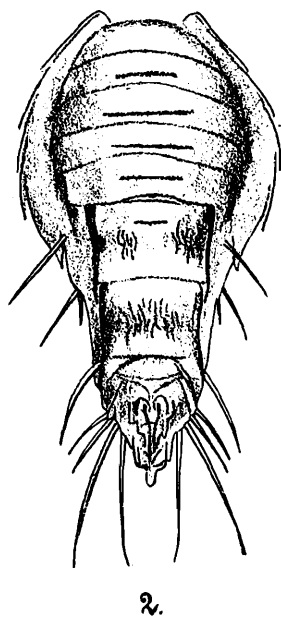
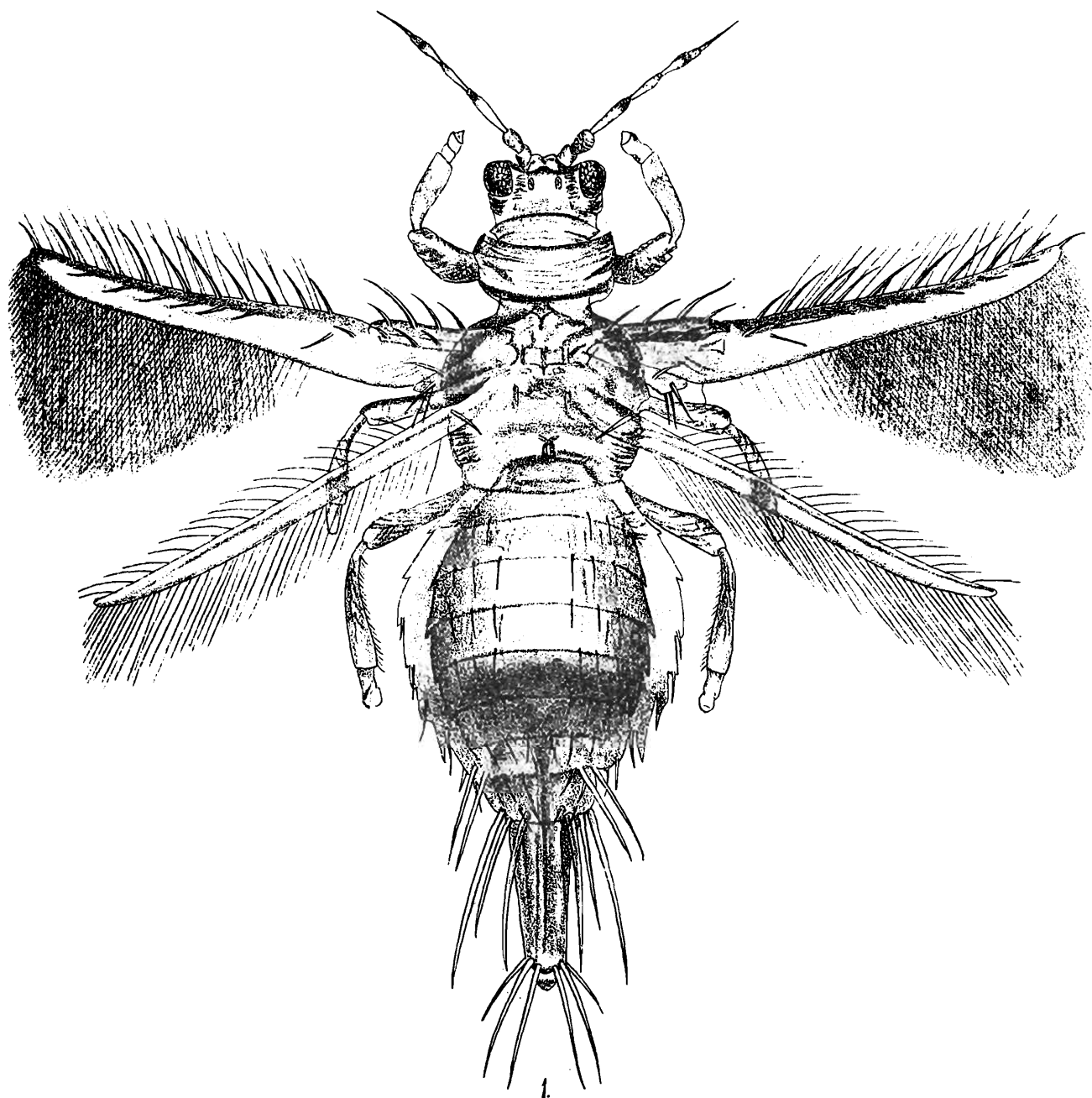
The abdomen is strongly depressed and margined laterally; and excluding the last segment is broadly oval, in some specimens circular. Towards the apex the posterior angles of the segments are produced into overlapping spinous processes. The last segment is very large and elongated in the form of a tube, bearing at its apex four long and two shorter spines, all of which are exceptionally stout. The apex of the ninth segment is furnished with a series of long, stout spines, the longest over reaching the tip of the last segment; the eighth is furnished at its posterior margin with similar but short spines. Ovipositor very long and slender, almost straight.

- ♂. Smaller and narrower, end of abdomen and genital armature as shown in plate vii, figure 2. Sternites two to six with an elongated chitinous thickening.

Habitat.—India; on the leaves of turmeric (*Curcuma longa*), Madras, 1889.

EXPLANATION OF PLATE VII.

- FIG. 1.—*Panchætothrips indicus* gen. et sp. nov. ♀ × 85.
,, 2. ,, ,, abdomen of ♂ × 85.
,, 3. ,, ,, ovipositor, ♀ × 85.
,, 4. ,, ,, maxillary palpus × about
400.
,, 5. ,, ,, end of right antenna ×
about 150.



XXV. THE AQUATIC CHELONIA OF THE MAHANADDI AND ITS TRIBUTARIES

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

The smaller streams that join to form the Mahanaddi (literally the "Great River") rise in various mountain-ranges in the Central Provinces of India and their united waters flow eastwards through Orissa to the Bay of Bengal, which they reach by several mouths. The Mahanaddi river-system is thus, on the eastern side, the most northerly system of any importance in Peninsular India properly so called, that is to say India south of the Ganges and the Indus. From the Gangetic system it is not separated either by any great distance or by any very important natural barrier; the most northerly mouth of the Mahanaddi is hardly more than 100 miles south of that of the R. Hughli, and there are neither mountain-ranges nor deserts between them.

Almost all that is known of the aquatic chelonia of the Mahanaddi river-system is contained in a paper by the late Dr. W. T. Blanford published in the *Journal of the Asiatic Society of Bengal* in 1870 and entitled "Notes on some Reptilia and Amphibia from Central India." In preparing my recent account of the Indian Trionychidae (*Rec. Ind. Mus.*, VII, pp. 151-180) I had before me most of the specimens of that family collected by Dr. Blanford but was unable, for lack of further material, to add much to what he had written. Now, however, thanks to the assistance given me by Mrs. F. deMonte of Cuttack in Orissa, Mr. T. Southwell, Deputy Director of Fisheries, Bengal, and Mr. B. L. Chaudhuri of the Indian Museum, it has become possible to deal in a more satisfactory manner both with Dr. Blanford's specimens and with those that have recently been acquired. Even so, I have only been able to prove the existence in the Mahanaddi and its tributaries of four aquatic tortoises, although at least eleven species that may be called strictly aquatic haunt the waters of the Ganges. These eleven species are the following:—

<i>Trionyx gangeticus</i>	} Trionychi- dae.	<i>Hardella thurgi</i>	} Testudini- dae.
<i>Trionyx hurum</i>		<i>Batagur baska</i>	
<i>Emyda granosa</i>		<i>Kachuga lineata</i>	
<i>Pelochelys cantoris</i>		<i>Kachuga dhongoka</i>	
<i>Chitra indica</i>		<i>Kachuga smithii</i>	
		<i>Kachuga tectum</i>	

It is probable that at least three of the Gangetic Testudinidae also occur in the Mahanaddi system, viz., *Kachuga lineata*, *K. dhongoka* and *Batagur baska*. Of the first I have examined a young specimen taken by the late Dr. W. T. Blanford¹ in the lower reaches of the Godaverī, while the second is represented in the Indian Museum by quite typical examples from the Nerbadda and from Hyderabad, and the third by a skull from the Godaverī. Of the four forms, moreover, of which specimens have actually been obtained from the Mahanaddi, three are so closely related to Gangetic forms that they may be regarded merely as subspecies or local races thereof. The distribution of the fourth is still very imperfectly known; it may occur in the upper reaches of the Ganges.

The following are the four tortoises actually known to live in the Mahanaddi:—

TRIONYCHIDAE.

Trionyx gangeticus mahanaddicus,
subsp. nov.
Trionyx leithii.
Emyda granosa intermedia.

TESTUDINIDAE.

Kachuga tectum intermedia.

The type specimens of all except *Trionyx leithii* are in the collection of the Indian Museum.

Fam. TRIONYCHIDAE.

TRIONYX GANGETICUS MAHANADDICUS, subsp. nov.

Trionyx gangeticus, Cuv. var. (*partim*), Blanford, J.A.S.B. (2) XXXIX, p. 344 (1870).

Trionyx gangeticus, Annandale, *Rec. Ind. Mus.* VII, Addenda Nos. 16781, 16791, 16792, 1087-8, p. 180, pl. v, fig. 2 (1912).

Closely allied as the Mahanaddi *Trionyx* is to the typical *T. gangeticus* I now think, after examining a fully adult specimen, that it must be recognized as a distinct race. It may be defined as follows:—

Costal plates eight pairs, the last well developed and in contact in the middle line; two neurals between the first pair of costals; plates coarsely pitted and vermiculate. Epiplastra narrowly separated in front of the entoplastron, which forms an obtuse angle; existing plastral callosities very large, but no entoplastral callosity. Plastron as in *T. gangeticus*.

Head moderate; snout (on skull) considerably longer than orbit; interorbital region, in the adult, a little narrower than the nasal fossa; postorbital arch about half as wide as greatest diameter of orbit; mandible with inner edge strongly raised,

¹ Identified by Dr. Blanford as "*Batagur elliotti*?" J.A.S.B. (2) 1879, p. 110.

forming a sharp ridge, which sends off a short triangular tubercle at the symphysis; *immediately in front of this tubercle a deep transverse semi-circular depression; diameter of mandible at symphysis equal to or a little less than greatest diameter of orbit; a faint longitudinal ridge in this region; alveolar part of the lower jaw relatively shorter than in T. gangeticus; coronal bone more nearly vertical; both jaws, in adult, less blunt at the tip.* Branchial skeleton as in *T. gangeticus*.

Dorsal surface of carapace pale olive without radiating lines in the young; in the adult, dark olive with pale yellowish vermiculate veinings over the bony carapace and a more or less distinct marbling on the margin; dorsal surface of limbs and neck dark olive, the anterior part of the latter marbled with dull yellow; head yellowish olive in old individuals, green in young ones; on the vertex behind the eyes two broad, dark olive ^-shaped bars of irregular outline and often more or less interrupted; a straight but otherwise similar bar running obliquely on each side from behind the eye to near the gape; numerous dark-olive spots of different sizes between and behind the bars, between the eyes, on the snout and the sides of the head; these spots growing relatively larger with age; the whole ventral surface greyish white.

Distribution.—Hasdo river (tributary of the upper Mahanaddi), Bilaspur district, Central Provinces; Sambalpur and Cuttack, Orissa.

Type.—Skeleton (skin of head in spirit): No. 17014 in the Indian Museum Register of Reptiles, etc.

I have examined four individuals in the flesh and after preservation, as well as the two young skulls obtained by Dr. Blanford in the Hasdo river; three of my specimens were obtained by Mrs. F. deMonte from fishermen at Cuttack, which is situated at the upper end of the Mahanaddi delta, while the fourth was taken at Sambalpur, some distance higher up the river, by Mr. B. L. Chaudhuri. In skull-characters the six individuals agree closely, allowance being made for differences in age. It is evident that in this race pigmentation increases with age, the opposite being the case in that of the Ganges; for the young specimens are stated by Dr. Blanford to have had no dark markings on the carapace and apparently only a dark veining on the head, while the largest individual examined (the type) was much darker than others of smaller size. The entire disk of this individual (a male) was 70 cm. long by 55 cm. broad, while the bony carapace was 38 cm. by 46 cm.

It is evident that Dr. Blanford was dealing with two distinct species in writing the description cited above, for the very young individuals to which he referred as being ocellate on the back actually represent not the new subspecies but *T. leithii*, Gray. The skull of that species is narrower than that of either form of *T. gangeticus*, the symphysis of the lower jaw longer and the inner edge of the mandible without any trace of a ridge.

The following are the measurements of four skulls of *T. gangeticus mahanaddicus*:—

	No. 17014.	No. 16790.	No. 15912	No. 1088.
Length	100 mm.	102 mm.	87 mm.	65 mm.
Greatest breadth	97 „	73 „	65 „	44 „
Length of snout	29 „	27 „	24 „	17 „
Length of orbit	18 „	15 „	15 „	13 „
Width of postorbital arch	8 „	7 „	8 „	4 „
Interorbital width	13 „	13 „	15 „	
Width of nasal aperture	17 „	16 „	15 „	
Length of mandibular symphysis	18 „	16 „	14 „	.

No. 1088 is one of Dr. Blanford's specimens from the Hasdo river in the Central Provinces; the other skulls are from Orissa. The length of the skull is measured in each case from the tip of the snout to that of the articular condyle.

TRIONYX LEITHII (GRAY) (1870).

Aspilus cariniferus (*partim*), Gray, *Suppl. Cat. Sch. Rept.* I, p. 101 (1870).

Trionyx gangeticus, Cuv. var. (*partim*), Blanford, *J. A. S. B.* (2) XXXIX, p. 344 (1870)

Trionyx leithii and *gangeticus* (*partim*), Gray, *P. Z. S.* 1873, pp. 49 and 17, fig. 3 (p. 48), pl. viii.

Trionyx sp. ?, Blanford, *J. A. S. B.* (2) XLVIII, p. 110 (1879).

Trionyx leithii, Boulenger, *Cat. Chel. Brit. Mus.*, p. 249 (1889) and *Faun. Brit. Ind. Rept.*, p. 12; Annandale, *Rec. Ind. Mus.* VII, pp. 159, 160, fig. 2 (1912).

Young specimens of this species were obtained by the late Dr. W. T. Blanford in the Hasdo river. The species is also known from the Western Ghats and the Godaveri, Kistna and Nelambar rivers and is said to occur in the Indus or the Upper Ganges.

EMYDA GRANOSA INTERMEDIA, Annandale.

Emyda vittata ? Peters, Blanford, *J. A. S. B.* (2) XXXIX, p. 343 (1870).

Emyda vittata, *id.*, *ibid.* XLVIII, p. 111 (1879): Annandale, *Rec. Ind. Mus.* I, p. 397 (1907).

Emyda granosa intermedia, *id.* *ibid.* VII, pp. 171, 172, pl. VI, fig. 3 (1912).

I have recently examined several additional specimens from Cuttack and Sambalpur. They agree well with the type, except that one old male has the shell olive-brown instead of olive-green.

The dark reticulation is, however, well marked on its disk. The disk of my largest specimen (a female) measures 306 × 270 mm. The race is apparently found all over central and eastern India from the headwaters of the Mahanaddi to the mouth of the Godaveri.

Fam. TESTUDINIDAE.

KACHUGA TECTUM INTERMEDIA (Blanford).

Emys (*Pangshura*) *tectum*, Bell var. *intermedia*, Blanford, J.A.S.B. (2) XXXIX, p. 339, pl. xiv.

Pangshura tecta var. *intermedia*, *id.*, *ibid.* XLVIII, p. 110.

Kachuga intermedia, Boulenger, *Faun. Brit. Ind. Rept.*, p. 43.

This form is very common both at Cuttack and at Sambalpur; I have examined a large series of living examples as well as many skeletons and skulls. So far as I can discover, there is no constant structural difference between it and the *K. tectum* of the Ganges, although in the great majority of individuals the second neural plate is much shorter. I have, however, seen individuals of *intermedia* in which it was no longer than is usual in *tectum*, and of the true *tectum* in which it was just as short as it is in *intermedia*; nor is the outline of its posterior margin by any means constant in either race. The coloration of the two races is, however, always different, at any rate in fresh or well preserved specimens, and in young individuals of *intermedia* the carapace is never so deep in the middle as it is in the Gangetic race. The carapace of *intermedia* is always much paler than it is in the true *tectum* and instead of the posterior part of the head being occupied by a broad V-shaped red or orange mark, it is for the most part of the same dull olive as the snout. There is always a conspicuous red spot behind each tympanum and sometimes less distinct and paler red marks can be detected on the top of the head behind the eyes. There are no spots on the dorsal surface of the limbs, but the thighs and often the upper arms are striped with pale olive. In the true *tectum* it is noteworthy that the V-shaped red or orange mark on the head is occasionally broken up into a coronal of spots.

The shell of the largest specimen of the race *intermedia* that I have measured is 260 mm. long by 245 mm. wide, the measurements being taken along the curves. I cannot distinguish the skulls of the two races.

It is probable that the race *intermedia* occurs all over the river-systems of the Mahanaddi and the Godaveri and that the typical *tectum*¹ is confined to those of the Indus, the Ganges and the Brahmaputra. Several specimens from the Godaveri in the collection of the Indian Museum were labelled "*tectum*" by the late Dr. J. Anderson, but a close comparison has assured me that

¹ Siebenrock regards *Pangshura cochinchinensis*, Tirant, as a synonym of *K. tectum*: see Tirant, *Etudes Div. Miss. Pavie* III, p. 494, and Siebenrock, *Zool. Jahrb. Suppl.* X, 1909, p. 454.

they actually represent the southern race, the colour of the carapace being quite distinct. It is probable moreover, that other herpetologists, misled by the belief that in *intermedia* the second neural plate is always transverse, may have identified specimens incorrectly. Mr. Boulenger records specimens of *K. tectum* from the Cuttack river and the Deccan (*Cat. Chel. Brit. Mus.*, p. 59), but both in his "Catalogue" and in the "Fauna" he states that the recent distribution of *K. tectum* is the "Ganges and Indus systems." In this I think he is right, for *K. cochinchinensis* (Tirant) probably represents a distinct race, as that of the Upper Brahmaputra may also do.

XXVI ON A SMALL COLLECTION OF
RECENT CRINOIDS FROM THE
INDIAN OCEAN

By AUSTIN H. CLARK, B.A., F.R.G.S.

Some time after the completion of my report¹ upon the Crinoids collected by the "Investigator" I received a few additional specimens which had escaped notice when that collection was sent to me.

In order that the published records of the large and important collection belonging to the Indian Museum may be complete these specimens are listed here.

One of the items of interest brought to light by the study of this material is the discovery of a new species of *Oligometra* allied to the Australian *O. adeonæ*, in the Andaman Islands. Up to a few weeks ago *O. adeonæ* in North Australia and the Aru Islands and *O. thetidis* in New South Wales were supposed to represent a somewhat anomalous type of the genus peculiar to Australia; but very recently a related species, *O. marginata*, has been described from Solor Strait in the Lesser Sunda Islands, where it was dredged by the Dutch steamship "Siboga." Not only does this new species greatly increase the known geographical range of this curious group, but it possesses an additional interest in being intermediate in its characters between this group within the genus *Oligometra* and the species of the genus *Prometra*, furnishing new evidence of the very close inter-relationships between all of the genera comprised within the family Colobometridæ.

Almost equally interesting is the new species of *Zygometa* herein described. Although not greatly different from *Z. comata*, which occurs from the Mergui Archipelago to the Philippine Islands, it appears to be quite distinct, and it appears to occupy a habitat considerably to the westward of that of any other species of the family.

Family COMASTERIDÆ.

Subfamily CAPILLASTERINÆ.

CAPILLASTER SENTOSA (P. H. Carpenter).

8° 51' 30" N. lat., 81° 11' 52" E. long.; 28 fathoms.—One small broken specimen.

¹ Echinoderma of the Indian Museum, Part VII, Crinoidea. Calcutta, 1912.

Family ZYGOMETRIDÆ.

ZYGOMETRA ANDROMEDA, sp. nov.

The centrodorsal is thin discoidal, the bare dorsal pole large, slightly concave, finely granular, 2.5 mm. in diameter.

The cirri are XXI, 27-30 (usually the latter), 13 mm. to 15 mm. long; the longest segments are about one-third broader than long; dorsal spines, which are long and sharp, are developed from the eighth or ninth segment onward.

The arms are about twenty-five in number, 50 mm. to 55 mm. long; the division series and arms resemble those of *Z. comata*, but the distal edges of the radials and the proximal and distal edges of the ossicles of the division series and, to a lesser extent, of the first two brachials, are thickened and everted, this eversion being finely scalloped or tuberculated so that the edges of the ossicles appear beaded; the summit of the eversion may be smooth, but is usually very finely spinous; the flattened lateral edges of the ossicles of the division series and the first two brachials are very finely spinous, the dorsal surface is unmodified; the distal edge of the first syzygial pair bears a row of small rounded obscure tubercles, and there is usually a similar, but less evident row at the syzygial line. Beyond the fourth brachial the arms are smooth, resembling those of *Z. comata*.

P₁ is composed of twenty-four segments and is 9.5 mm. long.

Locality.—India.

EUDIOCRINUS MINOR, A. H. Clark.

Andaman Islands.—One specimen, with arms 35 mm. long.

Family HIMEROMETRIDÆ.

HETEROMETRA REYNAUDII (J Müller).

India.—Two specimens; one of these has twenty arms about 65 mm. long; one IIBr 2, and nine IIBr 4 (3+4) series are present; the other has twelve arms 25 mm. long; there are 15—18 cirrus segments of which the fifth or sixth and following bear dorsal spines.

? *India*.—Two very small specimens; one of these has ten arms 15 mm. long; the cirri are XI', the longest with 17 segments of which the ninth and following bear dorsal spines, the shorter with 12 segments, none of which bear dorsal spines; the other individual is also ten armed; the longest cirri are 10 mm. long with 22 segments, dorsal spines being developed from the seventh onward; the smallest cirri are 2.5 mm. long with 9 segments, quite without dorsal spines, and exactly resembling the cirri of young examples of *Antedon bifida*.

HETEROMETRA PULCHRA, A. H. Clark.

Arrakan Coast.—Two small broken specimens.

Family STEPHANOMETRIDÆ.

STEPHANOMETRA INDICA (E. A. Smith).

8° 51' 30" N lat., 81° 11' 52" E. long.; 28 fathoms.—Two specimens; P₁ has fifteen segments.

Family MARIAMETRIDÆ.

DICHROMETRA PROTECTUS (Lütken).

India.—One specimen with thirty arms.

Family COLOBOMETRIDÆ.

DECAMETRA MOEBIUSI, A. H. Clark.

? *India.*—One specimen.

COLOBOMETRA DISCOLOR, A. H. Clark.

Off Table Island, Andamans; 15-35 fathoms.—One specimen.

PROMETRA BREVICIRRA, A. H. Clark.

? *India.*—One specimen.

OLIGOMETRA INTERMEDIA, sp. nov.

The centrodorsal is small, discoidal, the dorsal pole flat, papillose, 0.8 mm. in diameter.

The cirri are very short, very stout, and strongly curved, IX, 10-11, 2.5 mm. long; the earlier segments are broader than long, but the sixth and following are about as broad as long; the second segment has the distal dorsal edge produced and finely spinous, this becoming on the fourth a median transverse ridge with prominent lateral angles which project slightly beyond the lateral profile of the segment and encroach slightly on the lateral surface; on the outer segments this transverse ridge becomes narrower and partially resolves itself into paired transversely elongate spines, at the same time moving to a position proximal to median; here there may be an eversion of the median part of the distal dorsal edge of the segments so that the segments may present more or less of the "bidentate" appearance characteristic of *O. adeonæ* and *O. marginata*.

The ten arms are about 18 mm. long; the division series and arms in general resemble those of *O. serripinna*, but the ossicles of the IBr series and the first brachials have broad and prominent ventrolateral processes as in the species of *Stephanometra*.

P_a is absent; P_1 is 2.5 mm. long with eight segments, and is the longest and stiffest pinnule on the arm, though it is not especially stout; the first segment is half again as broad as long, the second is about as long as broad, the third is twice as long as broad, the fourth and fifth are between two and one half and three times as long as broad; the following rapidly decrease in size; the third and following bear long and prominent spines at the prismatic angles which after the fourth are very conspicuous; P_2 is 2 mm. long with eight segments, exactly resembling P_1 ; P_3 is small and slender, about 1 mm. long with about eight segments; the following pinnules are weak and delicate, not tapering so rapidly as P_3 .

Locality.—Andaman Islands.

OLIGOMETRA SERRIPINNA (P. H. Carpenter).

“*Investigator*” Station No. 95; 15-25 fathoms.—One specimen; the synarthrial tubercles and the processes on the lower pinnules are strongly marked.

Arrakan Coast.—One small and immature specimen.

Family TROPIOMETRIDÆ.

TROPIOMETRA ENCRINUS, A. H. Clark.

Sadras.—One specimen.

Family ANTEDONIDÆ.

Subfamily ZENOMETRINÆ.

PSATHYROMETRA MAJOR, A. H. Clark.

“*Investigator*” Station No. 115; 188-220 fathoms.—One small specimen; there are four or five cirrus sockets in the outer columns.

PSATHYROMETRA MIRA, A. H. Clark.

West of Alleppey, Travancore ($9^{\circ} 34' 57''$ N lat., $75^{\circ} 36' 30''$ E. long); 406 fathoms.—One specimen, not quite mature, and one typical specimen.

Thirteen miles south by west from North Sentinel Island, Andamans; 130-250 fathoms.—One small specimen.

Seven miles south-east by south from Ross Island; 265 fathoms.—One small specimen.

PSATHYROMETRA INUSITATA, A. H. Clark.

Seven miles south-east by south from Ross Island; 265 fathoms.—One small specimen.

Family PENTAMETROCRINIDÆ.

PENTAMETROCRINUS VARIANS (P. H. Carpenter).

“ *Investigator* ” Station No. 114; 922 fathoms.—One small specimen.

XXVII. CONTRIBUTIONS TO THE FAUNA
OF YUNNAN BASED ON COLLECTIONS
MADE BY J COGGIN BROWN, B.Sc.,
1909-1910

PART VIII.—EARTHWORMS.

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

I received from the Indian Museum in November, 1911, four tubes containing earthworms, collected by Mr. J Coggin Brown of the Geological Survey of India, in Yunnan and the Shan States. Of these one tube contained a single specimen, which, owing to its being sexually quite immature, was unidentifiable. The rest were all species of *Pheretima*.

PHERETIMA BROWNI, sp. nov.

A large number of specimens, all in a bad state of preservation, owing apparently to the whole of the specimens having been placed in far too small a quantity of preservative fluid.

Tengyueh, Yunnan.

EXTERNAL CHARACTERS.—*Length* 4 inches; maximum *breadth* 3 mm.; *segments* about 108. *Colour* dark brown, often with a purple tinge.

Prostomium small, prolobous.

First *dorsal pore* in the intersegmental furrow $11/12$.

Clitellum xiv—xvi=3; no trace of annulation and no setæ visible on the clitellum.

Male apertures on segment xviii, nearly one-third of the circumference apart, with 12 setæ intervening. The apertures are large, and are not situated on papillæ

Female aperture median, anteriorly in segment xiv.

Spermathecal apertures in furrows $7/8$ and $8/9$.

No *genital papillæ* or other special marks.

The setæ form a ring which is closed ventrally, and almost closed dorsally; the setæ are a little closer together ventrally than laterally and dorsally, and those of segments iv—ix are enlarged. Numbers of setæ:— $23/v$, $34/ix$, ca. $41/xiii$, $44/xix$.

INTERNAL ANATOMY.—The *septa* are so softened that it is impossible to tell which are thickened, probably $6/7$ and $7/8$, possibly also $10/11$ and $11/12$ are stouter than the rest; and $8/9$ is probably absent.

The *gizzard* occupies segments viii—ix. The *intestine* begins in xv. There are a pair of *intestinal diverticula* in xxvi; these are elongated, conical, without secondary projections; they extend forwards through segments xxv—xxiii.

The last *heart* is in segment xiii.

The *seminal funnels* are in x and xi, enclosed in small testicular sacs; the sacs of each pair are separate, not conjoined across the middle line. The *seminal vesicles* are paired, of moderate size, in segments xi and xii.

The *prostates* are of moderate size, and flattened against the body-wall; each consists of two principal lobes, one anterior, the other posterior to the origin of the duct; both lobes are divided up into numerous lobules.

The *spermathecæ* possess an irregularly shaped, roughly ovoid ampulla, with a broad short duct. The diverticulum arises from near the distal end of the duct; it is variable, often coiled, thin and narrow for the most part, and dilated at its internal end; when uncoiled it is about equal in length to the ampulla or somewhat shorter.

PHERETIMA DIVERGENS (Mchlsn.) var. *YUNNANENSIS* var. nov.

A single specimen, in a tube along with *P. hawayana*.

Tengyueh, Yunnan.

EXTERNAL CHARACTERS.—*Length* $3\frac{3}{4}$ inches; *breadth* 3 mm., *segments* 108, *colour* yellowish brown.

Prostomium epilobous $\frac{1}{3}$.

No *dorsal pores* visible in front of clitellum.

Clitellum includes segment xiv—xvi=3; there are a few setæ ventrally on xvi, otherwise the clitellum is without setæ.

Male apertures on segment xviii, at an interval of nearly one-third of the circumference, in the line of the ring of setæ. About 12 setæ intervene between the apertures; there are however no setæ immediately to the inner side of these latter.

Female aperture a minute pore, mid-ventrally on xiv.

Spermathecal apertures small, in intersegmental furrows $\frac{5}{6}$, $\frac{6}{7}$, $\frac{7}{8}$, $\frac{8}{9}$ (on right side only those in $\frac{5}{6}$ and $\frac{6}{7}$ visible). The interval between the apertures of opposite sides is equal to about 11 or 12 setæ.

Genital papillæ are present on segments vii, viii and ix, in pairs; on the anterior part of the segment between the setal ring and the anterior boundary of the segment; the interval between the papillæ of each pair is equal to 7 or 8 setæ.

Midventrally, in the line of the setal rings of vi—ix and xi—xiii, there are appearances which might possibly represent faintly marked copulatory areas, but more probably are due to post-mortem changes, or to the specimen having been rubbed.

The *setæ* form closed rings. Those on the anterior segments as far back as vii or viii are enlarged somewhat, but not markedly. The intervals between the setæ are approximately the same all

round the ring. The following numbers were counted:—ca. $86/vii$, ca. $47/xiii$, $46/xvii$, and 50—56 in the middle region of the body.

INTERNAL ANATOMY.—*Septa* $5/6$, $6/7$, $7/8$ are moderately thickened, $8/9$ and $9/10$ are absent, $10/11$ and $11/12$ considerably thickened, $12/13$ and $13/14$ slightly so.

The *gizzard* occupies segments viii—ix. The *intestine* begins in xvi; there is a well-marked typhlosole. A pair of large conical *intestinal diverticula* originate in xxvi.

The last *heart* is situated in segment xiii; ‘*blood glands*’ are present, a pair in each segment, along the course of the dorsal vessel on the intestine, as in *P. posthuma*.

The *nephridial system* is micronephric; the nephridia are very minute, scattered over the internal surface of the body-wall.

Testes and *seminal funnels* are enclosed in testicular sacs, of moderate size, paired, quite separate from each other, in segments x and xi. The two *vasa deferentia* of each side unite into one at the posterior boundary of xi.

The *seminal vesicles*, in segments xi and xii, are paired, of com-

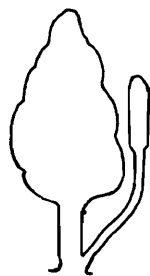


FIG. 1.—Spermatheca of *Pheretima divergens* var. *yunnanensis*.

paratively small size, irregularly lobulated, with in every case a fairly distinct mesially projecting lobe.

Prostates are absent. The terminal portion of the male duct on each side is much thickened and looped.

The *spermathecæ* (fig. 1) are in four pairs, corresponding to furrows $5/6$ — $8/9$. The ampullæ are of an inverted pear-shape (the broader end below), the duct is thick and short,—one-third the length of the ampulla. From the distal end of the duct arises the diverticulum, thin and tubular for most of its extent but swollen at its proximal end; the length of the diverticulum varies; it is mostly $1/2$ — $3/4$ as long as the ampulla and duct; the figure was drawn from one of the organs where it was even longer than the upper of these limits. In the case of the most posterior pair of spermathecæ in the specimen here described, the swollen end of the diverticulum was more rounded, and not so elongated as in the rest.

Corresponding to the papillæ on segments vii, viii, and ix, there are seen on the inner side of the body wall small *accessory glands*, white and tuft-like; sessile on the body-wall (ix), or with a short thick duct (vii), or consisting of two minute tufts (viii).

The present species has not so far been recorded from India. Since in the specimen here described there are certain fairly well marked differences from the typical form,—in size, in the presence of setæ on the clitellum, in the details of the spermathecal apparatus,—it appears advisable to describe it as a separate variety.

The figure of the spermathecal apparatus may be compared with that given in the original description of the worm (Michaelsen, Arch. für Naturgesch., vol. 58, 1892), the gizzard is there said to occupy segments ix—x, and the hearts to be situated in segments x—xii.

PHERETIMA HAWAYANA (Rosa).

This species has been previously described under a number of different names (*cf.* Beddard, Proc. Zool. Soc. Lond., 1900, p. 645), from many different countries. The species is apparently a variable one, and one form, previously described separately as *P. barbadensis* (Bedd.), but included in *P. hawayana* by Beddard in the paper just referred to, is considered by Michaelsen to have the value of a subspecies (Michaelsen, Mem. Ind. Mus., vol. 1, No. 3, 1909, p. 187).

I give a fairly complete description of the specimens in the present collection, since they are of interest from the fact that they are in some ways intermediate between the typical form of *P. hawayana* and the subspecies *barbadensis*, and hence help to confirm Beddard's view as to the specific identity of the two.

Six specimens, in a tube with a single specimen of *P. divergens* var. *yunnanensis*.

Tengyueh, Yunnan.

EXTERNAL CHARACTERS.—*Length* 2—4 inches; *breadth* 3—4 mm.; *segments* 88—90. *Colour* of most of the specimens a dirty yellowish brown.

Prostomium epilobous $\frac{1}{2}$; sometimes with a transverse fissure in addition completing the anterior boundary of segment i, *i.e.* a combined prolobus and epilobous condition.

First dorsal pore in intersegmental furrow $\frac{10}{11}$.

Clitellum includes segments xiv—xvi=3; without setæ.

Male pores on xviii, $\frac{2}{7}$ of the circumference apart on small or very small papillæ.

Female pore on xiv, mid-ventral, in a transversely extended depression.

Spermathecal apertures three pairs, in furrows $\frac{6}{8}$, $\frac{6}{7}$, $\frac{7}{8}$.

Genital papillæ, etc.—Internal to the male apertures on segment xviii, and either in the same transverse line with them or at a slightly posterior level, were a number of small pigmented spots, either one or two on each side. These had, except in one case, the character of depressions; in only the one exception was the spot a papilla. When more than one spot was present, they were separate, not fused.

In one specimen a pair of small papillæ, each with a darker centre, was present on the posterior part of segment vii, nearly in the groove $\frac{7}{8}$, and slightly median to the position of the spermathecal apertures.

The *setæ* formed an unbroken ring; they were slightly closer together ventrally than dorsally; those of segments iii—viii were enlarged. The following numbers were counted:— $\frac{44}{ix}$, $\frac{49}{xi}$, $\frac{56}{xii}$, $\frac{64}{xix}$, $\frac{56}{xxvii}$.

INTERNAL ANATOMY.—*Sepia* $\frac{5}{6}$ and $\frac{6}{7}$ moderately thick, $\frac{7}{8}$ considerably thickened, $\frac{8}{9}$ and $\frac{9}{10}$ absent, $\frac{10}{11}$ — $\frac{12}{13}$ somewhat thickened.

Intestinal diverticula small, conical, originating in segment xxvii; in one specimen there were one (right side) or four (left) small rounded secondary diverticula on the ventral border of the primary diverticula.

Small *testicular sacs*, completely separated, in x and xi; *vesiculæ seminales*, irregularly lobulated in xi and xii.

Prostates large, in six segments (xvii—xxii), divided up into a corresponding number of lobes by the septa. A thick yellow duct, with an S-shaped curve, rises from the middle portion of the gland in segment xix, the vas deferens joins the gland anterior to, but near, the origin of the prostatic duct.

Accessory prostates correspond in position to the genital spots on segment xviii.

The *spermathecae* are three pairs; the ampulla is ovoid in shape, narrowing gently to the duct, which is of considerable length, three-quarters as long as the ampulla. The diverticulum is often coiled; it is a narrow tube which when uncoiled equals the ampulla in length in some cases, while in others it is only two-thirds or one-half as long.

An *accessory gland* was present on each side in the specimen which possessed the papillæ posteriorly on segment vii; the glands corresponded in position with these papillæ, and were sessile on the inner face of the body-wall.

Remarks.—Writing of Beddard's inclusion of *P. barbadensis* with *P. hawayana* Michaelsen [says:—"I am not yet quite convinced that this view is correct. Till now I have not seen a specimen—and I have examined many—which aroused any doubt as to whether it should be placed in the typical form or in the subsp. *barbadensis*. In the generally more robust typical form with stronger setæ in the anterior part of the body the papillæ near the male pores are always united at each side, occupying an oblong oval area medial from the male pores and mostly somewhat oblique. In the subsp. *barbadensis* the papillæ near the male pores are scattered, partly very near the male pores, partly near the median ventral line."]

In the present specimens the dark spots near the male apertures had as a rule the character of slight depressions rather than of papillæ; they were not confluent, and in this respect resembled the papillæ of the subsp. *barbadensis* rather than those

of the typical form. But the setæ of the anterior segments were stronger than those of the remaining segments, which Michaelsen, in the passage just quoted, gives as a characteristic of the typical form.

In the '*Tierreich*' (Oligochaeta, 1900) Michaelsen describes the two forms as separate species. In the fact that the setæ are disposed in an unbroken chain, and that the clitellum occupies the whole of three segments, the present form agrees with *P. barbadensis*; while in having secondary diverticula from the intestinal cæca, and a curved prostatic duct, it resembles *P. hawayana*. Occupying thus an intermediate position, it serves to confirm Beddard's view of the unity of these two species.

PHERETIMA POSTHUMA (L. Vaill.).

A number of specimens, mostly mature.

Ye-nan-Gyaung, Magwe, N. Shan States, Upper Burma.



XXVIII. A CATALOGUE OF THE ASIATIC
 NAIADES IN THE COLLECTION OF THE
 INDIAN MUSEUM CALCUTTA, WITH
 DESCRIPTIONS OF NEW SPECIES

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

Plate VIII.

In compiling the following catalogue the scheme generally followed is that used by Mr. C. T. Simpson in his valuable work "Synopsis of the Naiades, or Pearly Freshwater Mussels" ¹; occasionally however the author, after examining the large series of specimens not only in the Indian, but also in the British Museum, has had to deviate from that system, but as far as possible Simpson's work has been incorporated in the present catalogue.

The author's thanks are especially due to Mr. Edgar A. Smith, I.S.O., of the British Museum, whose unrivalled knowledge and great courtesy in placing specimens in his hands for examination have largely helped him in his labour.

Three extra-Indian species are figured in the plate that accompanies this catalogue; the new Indian forms here described will be figured later in a volume of the "Fauna of British India."

Fam. UNIONIDAE.

Subfam. UNIONINAE, Swainson, 1840.

Gen. *Hyriopsis*, Conrad, 1853

1. *Hyriopsis bialatus*, Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 579,=*Unio delphinus*, Grunner, Arch. für Naturg., I, 1841, p. 276, pl. ix, figs. 1, 1a-c,=*Margaron (Unio) delphinus*, Lea, Syn., 1852, p. 19; 1870, p. 28,=*Unio megapterus*, Morelet, J. de Conch., XXI, 1863, p. 159.

Siam (Russel coll.), Reg. Nos. $\frac{2542}{1}$, $\frac{5032}{1}$; Pahang River, Malay Peninsula (Dr. Cantor), Reg. No. $\frac{1991}{1}$; Cambodia, Reg. No. $\frac{5228}{1}$.

2. *Hyriopsis cumingii* (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 579,=*Unio cumingii*, Lea, Proc. Ac. Nat. Sci. Philad., VII, 1852, p. 54; Lea, Jl. Ac. Nat. Sci. Philad., IV, 1860, p. 240, pl. xxxv., fig. 120,=*Margaron (Unio) cumingii*, Lea, Syn., 1852, p. 19; 1870, p. 28.

Shanghai Market, Reg. No. $\frac{4956}{1}$; Shanghai, Reg. No. $\frac{693}{1}$.

¹ Proc. U.S. Nat. Mus., Washington, D.C., XXII, 1900, pp. 501—1044.

3. **Hyriopsis myersianus** (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 580, = *Unio myersianus*, Lea, Proc. Ac. Nat. Sci. Philad., VIII, 1856, p. 92; Jl. Ac. Nat. Sci., III, 1857, p. 290; Obs., VI, 1857, p. 10, pl. xxii, fig. 2, = *Margaron (Unio) myersianus*, Lea, Syn., 1870, p. 28, = *Unio housei*, Lea, Proc. Ac. Nat. Sci. Philad., VIII, 1856, p. 92; Jl. Ac. Nat. Sci. Philad., III, 1858, p. 291, pl. xxiii, fig. 3, = *Margaron (Unio) housei*, Lea, Syn., 1870, p. 28.

Cambodia, Reg. No. $\frac{1998}{1}$; Pitsanuloke, N. Siam (H. W. Biggie), Reg. No. $\frac{1447}{1}$.

4. **Hyriopsis schlegeli** (von Martens), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 581, = *Unio schlegeli*, von Martens, Mal. Blatt., VII, 1861, p. 55; Kobelt, Abh. Senck. Nat. Ges., XI, 1879, p. 421, pl. xiv, = *Barbala schlegeli*, Paetel, Conch. Sam., III, 1890, p. 175.

Lake Biwa, Japan (J. Anderson), Reg. Nos. $\frac{524}{1}$, $\frac{525}{1}$, $\frac{526}{1}$, and $\frac{527}{1}$.

Gen. **Chamberlainia**, Simpson, 1900.

5. **Chamberlainia hainesiana** (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 582, = *Unio hainesianus*, Lea, Proc. Ac. Nat. Sci. Philad., VIII, 1856, p. 92; Jl. Ac. Nat. Sci. Philad., III, 1857, p. 289, pl. xxi, fig. 1, = *Margaron (Unio) hainesianus*, Lea, Syn., 1870, p. 28, = *Unio imperialis*, Morelet, Rev. et Mag. Zool., XIV, 1862, p. 480.

Siam (*ex coll.* Richtofen), Reg. Nos. $\frac{5161}{1}$ and $\frac{629}{1}$.

Gen. **Cristaria**, Schumacher, 1817.

Subgen. **Cristaria**, Schumacher, 1817.

6. **Cristaria plicata** (Leach), von Ihering, Abh. Senck. Nat. Ges., XVIII, 1893, p. 147; Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, pp. 583—584, = *Dipsas plicatus*, Leach, Zool. Miscell., I, 1815, p. 120, pl. iii, = *Mytilus plicatus*, Solander in Gray, Ann. of Phil., IX, 1825, p. 27, = *Appius plicatus*, Gray in Menke, Syn. Meth. Moll., 1830, p. 106, = *Margarita (Dipsas) plicatus*, Lea, Syn., 1836, p. 47; 1838, p. 28, = *Margaron (Dipsas) plicatus*, Lea, Syn., 1852, p. 46; 1870, p. 74, = *Unio plicatus*, Sowerby, Conch. Icon., XVII, 1868, pl. liv, fig. 280, = *Dipsas plicatus*, Troschel, Arch. für Naturg., XIII, 1874, p. 272; Kobelt, Abh. Senck. Nat. Ges., XI, 1879, p. 429, pls. xv—xvii, xviii, fig. 1, = *Barbala plicata*, H. and A. Adams, Gen. Rec. Moll., II, 1857, p. 501, pl. cxvii, figs. 4, 4a, = *Anodonta plicata*, Schrenck, Reis. und F. Am. Lande, II, 1867, p. 704, pl. xxvii, fig. 4, = *Anodonta (Dipsas) plicata*, Clessin, Conch. Cab. Ano., 1876, p. 240, pl. xxi, figs. 1, 2, = *Cristaria tuberculata*, Schumacher, Ess. Nouv. Syst., 1817, p. 140, pl. xx, fig. 2, = *Anodonta dipsas*, Blainville, Man. Mal., 1825, p. 538, pl. lxvi, fig. 2, = *Symphanota bialata*, Lea, Tr. Am. Phil. Soc., 1830, p. 445, pl. xiv, fig. 24, = *Unio bialata*, Hanley, Test. Moll., 1842, p. 219; Biv. Shells, 1843, p. 214, pl.

xxii, fig. 4, = *Barbala bialata*, Chenu, Mas., 1859, p. 145, fig. 717, = *Unio bialatus*, Deshayes, Tr. Elem. Conch., 1839, p. 19, pl. xxxi, fig. 3, = *Anodonta magnifica*, Clessin, Conch. Cab. Ano., 1870, p. 123, pl. xxxv, fig. 1, = *Dipsas occidentalis*, Heude, Conch. Fl. Nank., IX, 1885, pl. xlvi, = *Barbala occidentalis*, Paetel, Conch. Sam., III, 1890, p. 175, = *Barbala plicatula*, Paetel, Conch. Sam., III, 1890, p. 175.

Cambodia, Reg. No. $\frac{5033}{1}$; Lake Biwa, Japan (J. Anderson), Reg. Nos. $\frac{529}{1}$, $\frac{530}{1}$, $\frac{531}{1}$, $\frac{532}{1}$; Shanghai, Reg. No. $\frac{602}{1}$.

7. **Cristaria bellua** (Morelet), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, 1900, p. 584, = *Anodonta bellua*, Morelet, Rev. et Mag. Zool., XVIII, 1866, p. 167; Ser. Conch., IV, 1875, p. 331.

Cambodia, Reg. No. $\frac{5062}{1}$.

8. **Cristaria herculea** (Middendorff), von Ihering, Abh. Senck. Nat. Ges., XVIII, 1893, p. 146; Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 584, = *Anodonta herculea*, Middendorff, Bull. Phys. Math. Ac. St. Pet., VI, 1848, p. 303; Sib. Reise, II, 1851, p. 278, pl. xxi, fig. 5, xxii, figs. 1, 2, xxvi, figs. 1, 2, = *Anodonta (Dipsas) herculea*, Clessin, Conch. Cab. Ano., 1875, p. 175, pl. lix, figs. 1, 2, = *Barbala herculea*, Paetel, Conch. Sam., III, 1890, p. 175, = *Dipsas plicata* var. *clessini*, Kobelt pars, Abh. Senck. Nat. Ges., XI, 1879, p. 429, pl. xv? = *Craspedodonta smaragdina*, Anton, Verz. der Conch., 1839, p. 16, No. 592; Clessin, Conch. Cab. Ano., 1875, p. 93, pl. xxvii, fig. 2.

Amur region, Reg. No. $\frac{4979}{1}$; Lena River, E. Siberia, Reg. No. $\frac{631}{1}$.

Subgen. **Pletholophus**, Simpson, 1900.

9. **Pletholophus swinhoei** (H. Adams), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 586, = *Unio swinhoei*, H. Adams, Proc. Zool. Soc. London, 1866, p. 319; Sowerby, Conch. Icon., XVI, pl. xlii, fig. 232, = *Anodonta swinhoei*, H. Adams, Proc. Zool. Soc. London, 1866, p. 446; Clessin, Conch. Cab. Ano., 1876, p. 125, pl. lxxv, fig. 6, = *Anodon swinhoei*, Sowerby, Conch. Icon., XVI, 1868, pl. xxvii, fig. 108, = *Margaron (Unio) swinhoei*, Lea, Syn., 1870, p. 45.

Canton, Reg. Nos. $\frac{1890}{1}$, $\frac{5067}{1}$; Formosa, Reg. No. $\frac{5171}{1}$.

10. **Pletholophus reiniana** (von. Martens), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 585; von. Martens, Jahrb. Mal. Ges., II, 1875, p. 136, pl. iii, fig. 4, = ? *Dipsas reiniana*, Kobelt, Abh. Senck. Nat. Ges., XI, 1879, p. 432, pl. xii, fig. 4, xxi, fig. 2, = *Anodonta reiniana*, von Ihering, Abh. Senck. Nat. Ges., XVIII, 1893, p. 147, = *Barbala reiniana*, Paetel, Conch. Sam., III, 1890, p. 175.

Lake Biwa, Japan (J. Anderson), Reg. No. $\frac{533}{1}$.

Gen. **Lepidodesma**, Simpson, 1896.

11. **Lepidodesma languilati** (Heude), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, pp. 586 and 587, = *Unio*

languilati, Heude, J de Conch., XXII, 1874, p. 116; Conch. fluv. Nank., 1875, Pt. I, pl. vii,=*Lepidodesma languilati*, Simpson, Proc. U.S. Nat. Mus., XVIII, 1896, p. 311,=*Cristaria megadesma*, von Martens, S.B. Nat. Fr., 1875, p. 3; Mal. Bl., XXVI, 1875, p. 187,=*Barbala megadesma*, Paetel, Conch. Sam., III, 1890, p. 175. China, Reg. No. $\frac{523}{1}$.

Gen. **Pilsbryoconcha**, Simpson, 1900.

12. **Pilsbryoconcha exilis** (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 587,=*Anodonta exilis*, Lea, Tr. Am. Phil. Soc., VI, 1839, p. 81, pl. xxii, fig. 68,=*Margarita* (*Anodonta*) *exilis*, Lea, Syn., 1838, p. 32,=*Anodon exilis*, Catlow and Reeve, Conch. Nom., 1845, p. 66,=*Margaron* (*Anodonta*) *exilis*, Lea, Syn., 1852, p. 51; 1870, p. 82,=*Monocondylaea exilis*, Paetel, Conch. Sam., III, 1890, p. 174,=*Anodonta siliqua*, Küster? Conch. Cab. Ano., 1852, p. 57, pl. xiv, fig. 5,=*Anodonta polita*, Mouss., L. and Süss. Moll., Java, 1849, p. 98, pl. xix, figs. 2 and 3,=*Margaron* (*Anodonta*) *polita*, Lea, Syn., 1852, p. 53,=*Anodon politus*, Sowerby, Conch. Icon., XVII, 1867, pl. xii, fig. 36,=*Monocondylaea compressa*, Lea, Proc. Ac. Nat. Sci. Philad., VII, 1863, p. 190; Jl. Ac. Nat. Sci. Philad., VI, 1866, p. 30, pl. xi, fig. 29,=*Pseudodon compressa*, Conrad, Am. Jl. Conch., I, 1865, p. 213,=*Margaron* (*Monocondylaea*) *compressa*, Lea, Syn., 1870, p. 73,=*Spatha compressa*, Paetel, Conch. Sam., III, 1890, p. 188,=*Anodon javana*, Sowerby, Conch. Icon., XVII, 1867, pl. xi, fig. 33,=*Anodon gracilis*, Sowerby? Conch. Icon., XVII, 1867, pl. xiv, fig. 45,=*Anodon kellekti*, Sowerby? Conch. Icon., XVII, 1867, pl. xix, fig. 71,=*Anodonta sempervivens*, Deshayes, Nouv. Arch. de Mus., X, 1874, p. 120, pl. v, figs. 4, 5. Java, Reg. No. $\frac{5025}{1}$.

Gen. **Anodonta** (Bruguiere em), Lamarck, 1799.

13. **Anodonta woodiana**, Lea,=*Symphanota woodiana*, Lea, Tr. Am. Phil. Soc., V, 1834, p. 42, pl. v, fig. 13,=*Margarita* (*Anodonta*) *woodiana*, Lea, Syn., 1836, p. 48; 1838 p. 29,=*Anodon woodiana*, Catlow and Reeve, Conch. Nom., 1845, p. 68; Sowerby, Conch. Icon., XVII, 1870, pl. xxxvi, fig. 149,=*Anodonta woodiana*, Hanley, Test. Moll., 1842, p. 215; Biv. Shells, 1843, p. 315; H. and A. Adams, Gen. Rec. Moll., II, 1857, p. 503; Clessin, Conch. Cab. Ano., 1875, p. 146, pl. xlviii, figs. 1, 2,=*Margaron* (*Anodonta*) *woodiana*, Lea, Syn., 1852, p. 47; 1870, p. 75,=*Symphanota magnifica*, Lea, Tr. Am. Phil. Soc., V, 1834, p. 42, pl. v, fig. 14,=*Margarita* (*Anodonta*) *magnifica*, Lea, Syn., 1836, p. 48; 1838, p. 29,=*Anodonta magnifica*, Hanley, Test. Moll., 1842, p. 215; Biv. Shells, 1843, p. 215; H. and A. Adams, Gen. Rec. Moll., II, 1857, p. 503; Chem. Man., 1859, II, p. 156, fig. 719,=*Anodon magnifica*, Catlow and Reeve, Conch. Nom., 1845, p. 67; Sowerby, Conch. Icon., XVII, 1870, pl. xxv, fig. 96,=*Margaron* (*Anodonta*) *magnifica*, Lea, Syn., 1852, p. 47; 1870, p. 75,=*?Anodonta aurata*, Küster, Conch. Cab. Ano., 1853,

p. 30, pl. vi, fig. 2, = *Anodon rotundatus*, Swainson, Ex. Conch., 2nd Ed., 1841, pl. xxxvii, = *Anodon gibbum*, Benson, Jl. As. Soc. Beng., XXIV, 1855, p. 135, = *Anodon gibba*, Sowerby, Conch. Icon., XVII, 1867, pl. vi, fig. 13; Heude, Conch. Fl. Nank., VII, 1881, pl. li, fig. 95, = *Margaron (Anodonta) gibba*, Lea, Syn. 1870, p. 81, von Martens, Nov. Conch., IV 1876, p. 159, pl. cxxxvi, figs. 6, 7, = *Anodonta gibba*, Clessin, Conch. Cab. Ano., 1875, p. 181, pl. lx, fig. 4, = *Anodon tricostatus*, Sowerby, Conch. Icon., XVII, 1870, pl. xxv, fig. 98, = *Anodonta edulis*, Heude, J. de Conch., XXII, 1874, p. 117, = *Anodon edulis*, Heude, Conch. Fl. Nank., I, 1875, pl. viii, fig. 18, = *Anodonta edulis*, Paetel, Conch. Sam., III, 1890, p. 179, = *Anodon securiformis*, Heude, Conch. Fl. Nank., III, 1877, pl. xviii, fig. 39, = *Anodonta securiformis*, Paetel, Conch. Sam., III, 1890, p. 107, = *Anodon nigricans*, Heude, Conch. Fl. Nank., III, 1877, pl. xix, fig. 41, = *Anodonta nigricans*, Paetel, Conch. Sam., III, 1890, p. 182, = *Anodon piscatorum*, Heude, Conch. Fl. Nank., IV, 1878, pl. xxvi, fig. 56, = *Anodon elliptica*, Heude, Conch. Fl. Nank., IV 1878, pl. xxvii, fig. 58, = *Anodon fusca*, Heude, Conch. Fl. Nank., IV, 1878, pl. xxviii, fig. 59, = *Anodon frinianum*, Heude, Conch. Fl. Nank., IV, 1878, pl. xxviii, fig. 60, = *Anodon joreti*, Heude, Conch. Fl. Nank., IV, 1878, pl. xxix, fig. 62, = *Anodon striata*, Heude, Conch. Fl. Nank., IV, 1878, pl. xxx, fig. 63, = *Anodonta striata*, Paetel, Conch. Sam., III, 1890, p. 185, = *Anodon pacifica*, Heude, Conch. Fl. Nank., IV, 1878, pl. xxxii, fig. 66, = *Anodon tumida*, Heude, Conch. Fl. Nank., V, 1879, pl. xxxv, fig. 69, = *Anodonta tumida*, Paetel, Conch. Sam., III, 1890, p. 186, = *Anodon subtetragona*, Heude, Conch. Fl. Nank., V, 1879, pl. xxxvi, fig. 70, = *Anodon lineata*, Heude, Conch. Fl. Nank., V, 1879, pl. xxxvi, fig. 71, = *Anodonta lineata*, Paetel, Conch. Sam., III, 1890, p. 181, = *Anodon irregularis*, Heude, Conch. Fl. Nank., V, 1879, pl. xxxvii, fig. 73, = *Anodonta irregularis*, Paetel, Conch. Sam., III, 1890, p. 180, = *Anodon melanochlorea*, Heude, Conch. Fl. Nank., 1879, pl. xxxviii, fig. 74, = *Anodonta melanochlorea*, Paetel, Conch. Sam., III, 1890, p. 182, = *Anodon agriculturalum*, Heude, Conch. Fl. Nank., V, 1879, pl. xxxix, fig. 75, = *Anodonta agriculturalum*, Paetel, Conch. Sam., III, 1890, p. 176, = *Anodon mingorum*, Heude, Conch. Fl. Nank., V, 1879, pl. xl, fig. 77, = *Anodonta mingorum*, Paetel, Conch. Sam., III, 1890, p. 182, = *Anodon bigibba*, Heude, Conch. Fl. Nank., VI, 1880, pl. xli, fig. 78, = *Anodonta bigibba*, Paetel, Conch. Sam., III, 1890, p. 177, = *Anodon despecta*, Heude, Conch. Fl. Nank., V, 1880, pl. xli, fig. 79, = *Anodon obtusa*, Heude, Conch. Fl. Nank., VI, 1880, pl. xlii, fig. 80, = *Anodon navicula*, Heude, Conch. Fl. Nank., VI, 1880, pl. xlii, fig. 81, = *Anodonta navicula*, Paetel, Conch. Sam., III, 1890, p. 182, = *Anodon orbicularis*, Heude, Conch. Fl. Nank., VI, 1880, pl. xlii, fig. 82, = *Anodonta orbicularis*, Paetel, Conch. Sam., III, 1890, p. 182, = *Anodon limosa*, Heude, Conch. Fl. Nank., VI, 1880, pl. xliii, fig. 83, = *Anodonta limosa*, Paetel, Conch. Sam., III, 1890, p. 181, = *Anodon livida*, Heude, Conch.

Fl. Nank., 1880, pl. xliii, fig. 84,=*Anodonta livida*, Paetel, Conch. Sam., III, 1890, p. 181,=*Anodon castanea*, Heude, Conch. Fl. Nank., 1880, pl. xliii, fig. 85,=*Anodonta castanea*, Paetel, Conch. Sam., III, 1890, p. 177,=*Anodon minuta*, Heude, Conch. Fl. Nank., VI, 1880, pl. xliv, fig. 86,=*Anodonta minuta*, Paetel, Conch. Sam., III, 1890, p. 182,=*Anodon succinea*, Heude, Conch. Fl. Nank., VI, 1880, pl. xliv, fig. 87,=*Anodonta succinea*, Paetel, Conch. Sam., III, 1890, p. 185,=*Anodon chiniana*, Heude, Conch. Fl. Nank., VI, 1880, pl. xlv, fig. 88,=*Anodonta chiniana*, Paetel, Conch. Sam., III, 1890, p. 177,=*Anodonta scaphydium*, Heude, Conch. Fl. Nank., VI, 1880, pl. xlvi, fig. 89,=*Anodonta scaphydium*, Paetel, Conch. Sam., III, 1890, p. 184,=*Anodon puerorum*, Heude, Conch. Fl. Nank., VII, 1880, pl. xlvii, fig. 90,=*Anodonta puerorum*, Paetel, Conch. Sam., III, 1890, p. 183,=*Anodon indecora*, Heude, Conch. Fl. Nank., VI, 1880, pl. xlviii, fig. 91,=*Anodonta indecora*, Paetel, Conch. Sam., III, 1890, p. 180,=*Anodon sorini*, Heude, Conch. Fl. Nank., VII, 1881, pl. xlix, fig. 92,=*Anodonta sorini*, Paetel, Conch. Sam., III, 1890, p. 185,=*Anodon rosea*, Heude, Conch. Fl. Nank., VII, 1881, pl. l, fig. 93,=*Anodonta rosea*, Paetel, Conch. Sam., VII, 1890, p. 184,=*Anodon aubreyi*, Heude, Conch. Fl. Nank., VII, 1881, pl. lii, fig. 97,=*Anodonta aubreyi*, Paetel, Conch. Sam., III, 1890, p. 176,=*Anodon confusa*, Heude, Conch. Fl. Nank., VII, 1881, pl. liii, fig. 99,=*Anodonta confusa*, Paetel, Conch. Sam., III, 1890, p. 178,=*Anodon obtusata*, Heude, Conch. Fl. Nank., VII, 1881, pl. liv, fig. 100,=*Anodon rubella*, Heude, Conch. Fl. Nank., VII, 1881, pl. liv, fig. 100 bis,=*Anodonta rubella*, Paetel, Conch. Sam., III, 1890, p. 184,=*Anodon pulchella*, Heude, Conch. Fl. Nank., VII, 1881, pl. lv, fig. 101,=*Anodonta pulchella*, Paetel, Conch. Sam., III, 1890, p. 183,=*Anodon florida*, Heude, Conch. Fl. Nank., VII, 1881, pl. lv, fig. 102,=*Anodonta florida*, Paetel, Conch. Sam., III, 1890, p. 179,=*Anodonta retusa*, Heude, Jl. de Conch., XXXII, 1884, p. 20,=*Anodon intermerata*, Heude, Conch. Fl. Nank., IX, 1885, pl. lxvii, fig. 130,=*Anodonta intermerata*, Paetel, Conch. Sam., III, 1890, p. 180,=*Anodon filippiana*, Heude, Conch. Fl. Nank., IX, 1885, pl. lxviii, fig. 131,=*Anodonta filippiana*, Paetel, Conch. Sam., III, 1890, p. 183,=*Anodon fantozatiana*, Heude, Conch. Fl. Nank., IX, 1885, pl. lxix, fig. 132,=*Anodonta fantozatiana*, Paetel, Conch. Sam., III, 1890, p. 179.

Canton River, Reg. Nos. $\frac{4941}{1}$, $\frac{4942}{1}$; Shanghai, Reg. Nos. $\frac{5022}{1}$, $\frac{5058}{1}$, $\frac{5042}{1}$, $\frac{607}{1}$, $\frac{5178}{1}$, $\frac{604}{1}$, $\frac{606}{1}$; N. China, Reg. No. $\frac{5231}{1}$; Zinzay, N. China, Reg. No. $\frac{5168}{1}$.

14. *Anodonta* sp.? A single, malformed specimen. Kandahar, Reg. No. $\frac{4948}{1}$.

Gen. *Gabilliotia*, Servain, 1890.

15. *Gabilliotia euphratica* (Bourguignat), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 650,=*Unio euphraticus*,

Bourguignat, Test. Nov., 1852, p. 28; Cat. Rais., 1853, pl. iv, figs. 1—3, = *Pseudodon euphratica*, Conrad, Am. Jl. Conch. I, 1865, p. 233, = *Margaritana euphratica*, von Martens, Vorderas. Conch., 1874; Kobelt, Icon., new ed., II, 1886, p. 26, pl. xlv, fig. 266, = *Leguminaia euphratica*, Westerlund, Faun. Pal., II, Pt. 7, 1890, p. 188, = *Unio churchillianus*, Sowerby, Conch. Icon., XVI, 1868, pl. xcvi, fig. 526.

Bagdad, Reg. No. $\frac{1982}{1}$.

Gen. *Solenaia*, Conrad, 1868.

16. *Solenaia soleniformis* (Benson), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 656, = *Anodonta soleniformis*, Benson, Journ. As. Soc. Beng., V, 1836, p. 750, = *Spatha soleniformis*, Hanley and Theobald, Conch. Ind., pl. ix, fig. 1, = *Mycetopus soleniformis*, Fischer, Jl. de Conch., XXXVIII, 1890, p. 94, = *Margaron (Unio) bensoni*, Lea, Syn., 1870, p. 57, = *Mycetopus bensonianus*, Paetel, Conch. Sam. III, 1890, p. 186.

Cachar, Reg. Nos. $\frac{4700}{1}$, $\frac{5059}{1}$, $\frac{5060}{1}$.

Gen. *Margaritana*, Schumacher, 1817.

17. *Margaritana margaritifera* (Linnaeus), Schumacher, Ess. Nouv. Syst., I, 1817, p. 124, pl. x, fig. 4; Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 674—677, etc., = *Mya margaritifera*, Lister, Hist. Anim. Ang. App., 1865, pl. i, fig. 1, etc., = *Mya margaritifera, testa ovali oblonga, etc.*, — Möller, Zool. Danicae, 1776, p. 245; Chemnitz, Conch. Cab. VI, 1782, p. 15, pl. i, fig. 5, = *Baphiae margaritifera*, Meuschen, Mus. Gevers., 1787, p. 472, = *Unio margaritifera*, Draparnaud, Tab. Moll. Fr., 1801, p. 107; Hist. Moll. Fr., 1806, p. 132, pl. x, figs. 17—19, pl. xi, fig. 5? etc., = *Alasmodonta margaritifera*, Conrad, New F. W. Shells, 1834, p. 72, = *Margarita (Margaritana) margaritifera*, Lea, Syn., 1836, p. 45; 1838, p. 28, = *Margaron (Margaritana) margaritifera*, Lea, Syn., 1852, p. 43; 1870, p. 69, = *Baphia margaritifera*, H. & A. Adams, Gen. Rec. Moll., II, 1857, p. 499; III, pl. cxvii, figs. 2, 2a, = *Unio margaritiferus*, Retzius, Dis. S. Hist. Nat., 1788, p. 16; Spengler, Skriv. Nat. Selsk., III, 1793, p. 52; Turton, Conch. Ins. Brit., 1822, p. 241, pl. xvi, fig. 1, = *Alasmodon margaritiferus*, Brown, L. & F. W. Conch., 1836, p. 112, pl. xxi, fig. 13, pl. xxii, figs. 1, 3, = *Margaritana margaritiferus*, Westerlund, Faun. Pal., II, Pt. 7, 1890, p. 184, = *Alasmodon margaritiferum*, Fleming, Hist. Brit. Moll., 1828, p. 417, = *Unio margaritifer* var. *minor*, Rossmässler, Icon., Pt. 2, 1835, p. 19, pl. ix, fig. 129, = *Unio margaritifer*, Küster, Conch. Cab., 1856, p. 130, pls. xxxviii, xxxix, = *Unio (Margaritana) margaritifera*, Schrenck, Reis. und F. in Amur Lande, II, 1867? p. 700, = *Unio auricularius*, Spengler, Skriv. Nat. Selsk., III, 1793, p. 44, = *Unio elongata*, Lamarck, An. sans. Vert., VI, 1819, p. 70, = *Damaris elongata*, Leach, Syn. Moll. Gt. Brit., 1852, p. 322, = *Margaritana elongata*, Westerlund,

Faun. Pal., II, Pt. 7, 1890, p. 185; Locard, Coq. de Fr., 1893, p. 149, fig. 162,=*Unio elongatus*, Nilsson, Hist. Moll. Swec., 1822, p. 16; Sowerby, Conch. Icon., XVI, 1868, pl. lxxvi, fig. 397,=*Alasmodonta arcuata*, Barnes, Am. Jl. Sci., VI, 1823, p. 227, pl. xii, fig. 20,=*Mya arcuata*, Eaton, Zool. Text book, 1826, p. 222,=*Alasmodon arcuata*, Stimpson, Shells of New Eng., 1851, p. 15; Küster, Conch. Cab., 1856, p. 293, pl. xxxix, fig. 1,=*Unio sinuata*, C. Pfeiffer, Nat. Deutsch L. & W. Moll., Pt. 2, 1825, p. 33, pl. vii, fig. 4,=*Unio roissyi*, Michaud, Comp. Hist. Moll. Fr., 1831, p. 112, pl. xvi, fig. 28,=*Margaritana roissyi*, Westerlund, Faun. Pal., II, Pt. 7, 1890, p. 186,=*Unio tristis*, Morelet, Moll. Portugal, 1845, p. 107, pl. xiii, fig. 2,=*Margarita (Unio) crassiamus*, Lea, Syn., 1836, p. 40; 1838, p. 26,=*Unio (Alasmodonta) dahuricus*, Middendorff, Bull. Phys. Math. Ac. St. Petersb., IX, 1850, p. ?; Sib. Reise, II, 1851, p. 275, pl. xxvi, figs. 3, 5,=*Unio dahuricus*, Middendorff, L. & S. Moll. Sib., 1859, p. 26,=*Unio (Margaritana) dahurica*, Kobelt, Abh. Senck. Nat. Ges., XI, 1875, p. 427; Kobelt, Faun. Jap. Ext., 1879, p. 143, pl. xiii, figs. 1, 2,=*Alasmodon falcata*, Gould, Proc. Boston. Soc. Nat. Hist., III, 1850, p. 294; Otia Conch., 1862, p. 87; U. S. Expl. Exp. XII, 1852, p. 433, figs. 545, 545a, 545b,=*Unio falcatus*, Sowerby, Conch. Icon., XVI, 1868, pl. lxxv, fig. 390,=*Unio (Alasmodonta) complanatus*, Middendorff, Sib. Reise, II, 1851, Pt. I, p. 273, pl. xxvii, figs. 1-6,=*Margaritana complanata*, Westerlund, Fauna Pal., II, Pt. 7, 1890, p. 187,=*Alasmodon yubaensis*, Trask, Proc. Cal. Acad. Sci., I, 1855, p. 30,=*Margaritana raveneliana*, Chenu, Man., 1859, II, p. 144, fig. 714.

Chitose, Yezo, Japan (J. Anderson), Reg. No. $\frac{539}{1}$.

Gen. *Unio*, Retzius, 1788.

18. *Unio mussolianus*, Küster, Conch. Cab. Unio., 1861, p. 244, pl. lxxxii, fig. 1,=*Unio bourguignatianus*, Lea, Proc. Ac. Nat. Sci. Philad., VII, 1863, p. 189; Jl. Ac. Nat. Sci. Philad., VI, 1866, p. 54, pl. xviii, fig. 51,=*Margaron (Unio) bourguignatianus*, Lea, Syn., 1870, p. 39,=*Unio rasmus*, Lea, Proc. Ac. Nat. Sci. Philad., VII, 1863, p. 189; Jl. Ac. Nat. Sci. Philad., VI, 1866, p. 50, pl. xvii, fig. 47,=*Margaron (Unio) rasmus*, Lea, Syn., 1870, p. 58,=*Unio mosulensis*, Lea, Proc. Ac. Nat. Sci. Philad., VII, 1863, p. 190; Jl. Ac. Nat. Sci. Philad., VI, 1866, p. 52, pl. xvii, fig. 49,=*Margaron (Unio) mosulensis*, Lea, Syn., 1870, p. 48,=*Margaritana mosulensis*, Paetel, Conch. Sam., III, 1890, p. 173.

River Tigris, Reg. No. $\frac{5011}{1}$.

19. *Unio modiola*, sp. n. (Pl. viii, figs. 1, 2.)

Shell elongately oblong, somewhat curved, solid, covered with a chocolate coloured, laminiferous periostracum, both valves concentrically striate; umbones large, but not prominent, somewhat coarsely corrugate; dorsal margin slightly arched; ventral margin curvedly excavated in the median posterior region; anterior side somewhat produced, rounded above, sloping below; posterior

side produced, rounded; cardinal teeth rather anteriorly situate, triangular, erect; lateral teeth anteriorly very short, posteriorly elongate and abruptly terminating; anterior adductor scars deeply impressed; posterior scars slight; interior of shell very slightly iridescent, sculptured with fine irregular ridges somewhat resembling the marks of coarse finger prints.

Long. 45, lat. 86 mm.

Hab.—River Tigris, Reg. No. $\frac{2434}{1}$ [Type].

20. *Unio mongolicus*, Middendorff, Sib. Reise, II, 1851 p. 277, pl. xxvii, figs. 7, 8.

Upper Indus, Reg. No. $\frac{5054}{1}$.

21. *Unio tigridis*, Bourguignat, Test. Nov. Saul., 1852, p. 30 Cat. Rais. Moll., 1853, p. 77, pl. iv, figs. 7, 9, = *Unio truncatus*, Swainson, Zool. Ill., 2nd Ser., I, 1829, pl. x, = *Margarita (Unio) truncatus*, Lea, Syn., 1836, p. 21; 1838, p. 18, = *Margaron (Unio) truncatus*, Lea, Syn., 1852, p. 26; 1870, p. 39, = *Unio dignatus*, Lea, Proc. Ac. Nat. Sci. Philad., VII, 1863, p. 189; J1. Ac. Nat. Sci. Philad., VI, 1866, p. 51, pl. xvii, fig. 48, = *Margaron (Unio) dignatus*, Lea, Syn., 1870, p. 39, = *Margaron (Unio) tigris*, Lea, Syn., 1870, p. 39, = ? *Unio kisonis*, Kobelt, Icon., 1st sup., 1895, p. 17, pl. vii, figs. 2, 3.

River Tigris, Asiatic Turkey, Reg. No. $\frac{625}{1}$.

22. *Unio terminalis*, Bourguignat, Test. Noviss., 1852, p. 31; Cat. Rais. Moll., 1853, p. 76, pl. iii, figs. 4—6 etc., = *Margaron (Unio) terminalis*, Lea, Syn., 1870, p. 39.

Jordan Valley, Reg. No. $\frac{4724}{1}$.

23. *Unio ascia*, Hanley, Rec. Biv. Shells, 1856, p. 385, pl. xxiii, fig. 20.

Penang, Reg. No. $\frac{4055}{1}$.

24. *Unio perakensis*, sp. n. (Pl. viii, figs. 5, 6.)

Shell closely allied to *Unio pressirostris*,¹ Von Martens, of which it may ultimately prove to be a variety, but differing from that species in its less cuneate form and larger size, in its less contracted anterior side and more obtuse and sloping posterior side.

Long. 31, lat. 85.5, diam. 21 mm.

Hab.—Perak, Reg. No. $\frac{616}{1}$ [Type].

Gen. *Shistodesmus*, Simpson, 1900.

25. *Shistodesmus lampreyanus* (Baird and Adams), Simpson, Syn. Naides, Proc. U. S. Nat. Mus., XXII, p. 804, = *Unio (Dysnomia) lampreyanus*, Baird and Adams, Proc. Zool. Soc. London, 1867, p. 491, pl. xxvi, figs. 2, 2a, = *Margaron (Unio) lampreyanus* Lea, Syn., 1870, p. 30.

Shanghai, Reg. No. $\frac{608}{1}$.

¹ Nachrichtsbl. d. D. Malak. Ges., 1900, p. 14.

Subfam. *HYRINAE*, Swainson.

Gen. *Nodularia*, Conrad, 1853.

Sec. *LANCEOLARIA*, Conrad, 1853.

26. *Nodularia (Lanceolaria) oxyrynchus* (Mart.), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 807, = *Unio oxyrynchus*, Martens, Mal. Blatt. VII, 1861, p. 57; Kobelt, Abh. Senck. Nat. Ges. XL, 1879, p. 420, pl. xiii, figs. 3, 4.

Japan, Reg. No. $\frac{5229}{1}$.

Sec. *NODULARIA*, Conrad, 1853.

27. *Nodularia (Nodularia) douglasiae* (Gray), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 808; Griff. An. King. XII, 1833, (p. 601, index 1834), pl. xxi, fig. 2, = *Unio murchisonianus*, Lea, Tr. Am. Phil. Soc., V, 1834, p. 33, pl. iii, fig. 6; Obs., I, 1834, p. 145, pl. iii, fig. 6, = *Margarita (Unio) murchisonianus*, Lea, Syn., 1836, p. 14; 1838, p. 14, = *Margaron (Unio) murchisonianus*, Lea, Syn., 1852, p. 21; 1870, p. 32, = *Unio osbecki*, Phil. Zeits. für Mal., 1845, p. 164; Conch., III, Pt. II, p. 45, pl. iii, fig. 1, = *Margaron (Unio) osbecki*, Lea, Syn., 1852, p. 21; 1870, p. 32, = *Unio nux-persicus*, Dunker, Zeits. für Mal., 1848, p. 83; Musgrave, Phot. Conch., 1863, pl. i, fig. 10, = *Margaron (Unio) nux-persicus*, Lea, Syn., 1870, p. 32, = *Unio sculptus*, Deshayes, Bull. Nouv. Arch. Mus., IX, 1873, p. 9, pl. i, figs. 3, 3a, = *Unio dactylinus*, Heude, Conch. Fl. Nank., 1885, pl. lxxv, = ? *Unio pictorum* var. *longirostris*, West, Kong. sv. vet. Ak. Hand., XIV, No. 12, p. 74, = *Unio schrencki*, West, = *Unio abbreviatus*, West.

Ningpo, China, Reg. No. $\frac{5227}{1}$; Shanghai, Reg. No. $\frac{2561}{1}$; N. China, Reg. No. $\frac{5166}{1}$; China, Reg. No. $\frac{605}{1}$.

27a. Var. *shanghaiensis*, Lea, = *Unio shanghaiensis*, Lea, Proc. Ac. Nat. Sci. Philad., III, 1859, p. 153; Jl. Ac. Nat. Sci. Philad., IV, 1860, p. 242, pl. xxxvi, fig. 121.

Shanghai, Reg. No. $\frac{2555}{1}$; Chinkiang, China, Reg. No. $\frac{5226}{1}$.

28. *Nodularia (Nodularia) caerulea* (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 811, = *Unio caeruleus*, Lea, Tr. Am. Phil. Soc., IV, p. 95, pl. xiii, fig. 25; Obs., I, p. 105, pl. xiii, fig. 25, = *Margarita (Unio) caeruleus*, Lea, Syn., 1836, p. 20, = *Margaron (Unio) caeruleus*, Lea, Syn., 1852, p. 30; 1870, p. 47, = *Unio gerbidoni*, Eydoux, Guer. Mag., 1838, p. 9, pl. cxviii, figs. 2, 2a, 2b; Hanley and Theobald, Conch. Ind., 1876, p. 6, pl. xii, fig. 2, = *Unio substriatus*, Lea, Proc. Ac. Nat. Sci. Philad., VIII, 1856, p. 93; Obs. VI, 1857, p. 20, pl. xxvi, fig. 14, = *Margaron (Unio) substriatus*, Lea, Syn., 1870, p. 47, = *Unio humilis*, Lea, Proc. Ac. Nat. Sci. Philad., VIII, 1856, p. 93; Obs., VI, 1857, p. 16, pl. xxvi, fig. 10, = *Margaron (Unio) humilis*, Lea, Syn., 1870, p. 32, = *Unio corrianus*, Küster, Conch. Cab. Unio., 1861, p. 229, pl. lxxvii, fig. 5, = *Unio leioma*, Benson, Ann. Mag. Nat. Hist., 1862, p. 192; Hanley and Theobald, Conch. Ind.,

1876, p. 6, pl. xii, fig. 5, = *Unio pilatus*, Lea, Proc. Ac. Nat. Sci., Philad., X 1866, p. 133; Jl. Ac. Nat. Sci., Philad., VI, 1868, p. 181, pl. xxxviii, fig. 95, = *Margaron (Unio) pilatus*, Lea, Syn., 1870, p. 47, = *Unio evitatus*, Lea, Proc. Ac. Nat. Sci., Philad., X, 1868, p. 133; Jl. Ac. Nat. Sci., Philad., VI, 1868, p. 279, pl. xxxviii, fig. 92, = *Margaron (Unio) cristatus*, Lea, Syn., 1870, p. 47, = *Unio tirostris*, Sowerby, Conch. Icon., XVI, pl. lxxv, fig. 331.

Saharanpur, United Provinces, Reg. Nos. $\frac{5181}{1}$ and $\frac{5189}{1}$; Sind, Reg. Nos. $\frac{5172}{1}$ and from a jheel near Rohri, Sukkur Dist., Reg. Nos. $\frac{5193}{1}$ and $\frac{5194}{1}$; Rajputana, Reg. No. $\frac{5051}{1}$; Singpal Garhi, Nepal, Reg. No. $\frac{5112}{1}$; Kockh(?) Reg. No. $\frac{5097}{1}$; Rampur, Reg. No. $\frac{5063}{1}$; Calcutta, Reg. Nos. $\frac{5176}{1}$, $\frac{4713}{1}$ (W. Theobald), $\frac{5176}{1}$, $\frac{5195}{1}$, $\frac{5157}{1}$, $\frac{5035}{1}$, $\frac{5197}{1}$ (G. Nevill); Belgachia, Calcutta, and Maidan tank (N. Annandale), Reg. Nos. $\frac{4735}{1}$, $\frac{4713}{1}$ and $\frac{4711}{1}$; Siliguri, Reg. No. $\frac{4871}{1}$; Patna, Reg. No. $\frac{2162}{1}$; Phenchooganj, Central Sylhet, Reg. No. $\frac{1562}{1}$; Barrack River, Silchar, Reg. No. $\frac{4863}{1}$; Darjeeling (R. Carter), Reg. No. $\frac{5212}{1}$; Ballygunge, near Calcutta, Reg. No. $\frac{4949}{1}$; Jamalpur, Reg. No. $\frac{5021}{1}$; Sambalpur, Bengal, Reg. No. $\frac{5200}{1}$; Bagh, Central India (W. T. Blanford), Reg. No. $\frac{5222}{1}$; Nerbudda, Central Provinces (W. T. Blanford), Reg. No. $\frac{5203}{1}$; Lower Nerbudda, Central Provinces, Reg. Nos. $\frac{5174}{1}$ and Burwani, $\frac{5173}{1}$; Hazrapur, Bengal, Reg. No. $\frac{5210}{1}$; Rajmahal, Bengal (W. T. Blanford), Reg. No. $\frac{5212}{1}$; Manbhoom, Bengal, Reg. Nos. $\frac{5177}{1}$ and $\frac{5011}{1}$; River Dukkaree, Umballa, Punjab Dist., Reg. No. $\frac{5221}{1}$; Bhagulpur, Bengal (Capt. Sherwill), Reg. No. $\frac{5211}{1}$; Poonasa, Central India (W. T. Blanford), Reg. No. $\frac{5201}{1}$.

28a. Var. *gaudichaudii* (Eydoux), = *Unio gaudichaudii*, Eydoux, Mag. de Zool., 1838, Cl. V, p. 10, pl. cxviii, fig. 3, = *Margaron (Unio) gaudichaudii*, Lea, Syn., 1850, p. 32; 1870, p. 50.

Dacca, Bengal, Reg. No. $\frac{5181}{1}$; Bengal (Laidley), Reg. No. $\frac{5218}{1}$.

28b. Var. *keraudreni* (Eydoux), = *Unio keraudreni*, Eydoux, Mag. de Zool., 1838, Cl. V, p. 8, pl. cxviii, fig. 1, = *Margaron (Unio) keraudreni*, Lea, Syn., 1852, p. 30; 1870, p. 46.

Damuda, Bengal (W. T. Blanford), Reg. No. $\frac{5183}{1}$; Chander-nagore, Bengal, Reg. No. $\frac{5190}{1}$.

29. *Nodularia (Nodularia) shurtleffiana* (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 813, = *Unio shurtleffianus*, Lea, Proc. Ac. Nat. Sci., Philad., VIII, 1856, p. 94; Obs., VI, p. 22, pl. xxvii, fig. 17; Jl. Ac. Nat. Sci., Philad., III, p. 302, = *Margaron (Unio) shurtleffianus*, Lea, Syn., 1870, p. 32.

Myadoug, Burma, Reg. No. $\frac{3839}{1}$; Shuaygoomyo, Burma, Reg. No. $\frac{3810}{1}$; Putna, Mirzapur Dist., U P. (R. Hodgart), Reg. No. $\frac{6091}{1}$; Lucknow (Museum Collector), Reg. No. $\frac{1821}{1}$, (S. Kemp) Reg. Nos. $\frac{5166}{3}$ and $\frac{5167}{1}$.

30. *Nodularia (Nodularia) occata* (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 813, = *Unio occatus*, Lea, Proc. Ac. Nat. Sci., Philad., IV, 1860, p. 307; Jl. Ac. Nat. Sci., Philad., VI, 1863, p. 398, pl. 1, fig. 304; Obs., X, 1863, p. 34, pl. 1,

fig. 304,=*Margaron (Unio) occatus*, Lea, Syn., 1870, p. 31,=*Unio macilentus*, Benson, Ann. Mag. Nat. Hist., Ser. 3, 1862, p. 187; Hanley and Theobald, Conch. Ind., p. 5, pl. x, figs. 2, 4; p. 62, pl. cliv, fig. 5,=*Unio rugosus*, Hanley and Theobald, Conch. Ind., p. 62, pl. cliv, fig. 3.

Saharanpur, Reg. No. $\frac{2553}{1}$; Phenchooganj, Sylhet, Reg. No. $\frac{5140}{1}$; Barrack River, Cachar, Reg. No. $\frac{5046}{1}$; Cachar, Reg. No. $\frac{2562}{1}$; Myadong, Upper Burma, Reg. No. $\frac{6092}{1}$; North-East Cachar, Reg. No. $\frac{5156}{1}$; Pegu, Burma (W. Theobald), Reg. No. $\frac{6093}{1}$ and $\frac{5188}{1}$; Saharanpur, United Provinces (J. Wood-Mason), Reg. No. $\frac{5207}{1}$; Wurda, Central Provinces (W. T. Blanford), Reg. No. $\frac{5205}{1}$; Bharno, Upper Burma, Reg. No. $\frac{5198}{1}$; Calcutta (G. Nevill), Reg. No. $\frac{6094}{1}$.

31. **Nodularia (Nodularia) pachysoma** (Benson), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 813,=*Unio pachysoma*, Benson, Ann. Mag. Nat. Hist., X, 1862, p. 186; Hanley and Theobald, Conch. Ind., 1876, p. 6, pl. xii, fig. 1,=*Margaron (Unio) pachysoma*, Lea, Syn., 1870, p. 63,=*Unio pachystoma*, Paetel, Conch. Sam., III, 1890, p. 162.

Sawaddy, Burma (J. Anderson), Reg. No. $\frac{2415}{1}$; Burma (W. Theobald), Reg. No. $\frac{5155}{1}$; Assam (Robinson), Reg. No. $\frac{5160}{1}$; Irrawaddy (J. Anderson), Reg. No. $\frac{5210}{1}$; Calcutta, Reg. Nos. $\frac{6095}{1}$ and (N. Annandale) $\frac{4742}{1}$; Berhampur (R. E. Lloyd), Reg. No. $\frac{4747}{1}$.

32. **Nodularia (Nodularia) chaudhurii**, sp. n.

Shell small, rather thin, elongately ovate, pale olive, covered with a finely laminiferous periostracum; both valves concentrically striate, sculptured with irregular, minute, nodulous, radiate ridges which appear posteriorly as regular corrugations; umbones small, somewhat prominent; dorsal margin slightly arched; ventral margin straight; anterior side produced, rounded; posterior side bluntly rostrate, abruptly sloping above and below; hinge-teeth elongate, anteriorly projecting; anterior scars deep, roundly triangular; posterior scars scarcely impressed; interior of shell iridescent, nacreous, posteriorly corrugate.

Long. 12.75; lat. 23 mm.

Hab.—Upper Burma, Reg. No. $\frac{2545}{1}$ [Type].

33. **Nodularia (Nodularia) bonneaudi** (Eydoux), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 813,=*Unio bonneaudi*, Eydoux, Mag. de Zool., 1838, pl. 119, figs. 1, 1a; Hanley and Theobald, Cat. L. and F. W. Shells, Brit. Ind., pp. 48, 49; Hanley and Theobald, Conch. Ind., pl. x, fig. 6,=*Margaron (Unio) bonneaudi*, Lea, Syn., 1852, p. 32; 1870, p. 50.

Pegu, Reg. Nos. $\frac{2376}{1}$, $\frac{5101}{1}$, $\frac{2425}{1}$, $\frac{5096}{1}$; Shuaygoomyo, Burma, Reg. Nos. $\frac{5179}{1}$ and (W. T. Blanford) $\frac{5216}{1}$; Zayleyman, Upper Burma (J. Anderson), Reg. No. $\frac{5202}{1}$; Cachar, Reg. No. $\frac{5185}{1}$; Bharno, Reg. Nos. $\frac{5197}{1}$ and (J. Anderson) $\frac{5114}{1}$; Tenasserim (W. T. Blanford), Reg. No. $\frac{5219}{1}$; Myadong, Upper Burma, Reg. Nos.

$\frac{5199}{1}$, $\frac{5233}{1}$; Irrawaddy River at Sagaing (J. Coggin Brown), Reg. Nos. $\frac{4739}{1}$ to $\frac{4741}{1}$.

34. **Nodularia (Nodularia) andersoniana** (Nevill), = *Unio andersonianus*, Nevill, Jl. As. Soc. Beng., XLVI, 1877, p. 40; Yunnan Exp., pl. lxxx, fig. 9.

Barrack River, Silchar; Reg. No. $\frac{4870}{1}$; Assam, Reg. No. $\frac{2499}{1}$; Myadong, Upper Burma (J. Anderson), Reg. Nos. $\frac{5192}{1}$ [Type] and $\frac{5217}{1}$, $\frac{5191}{1}$; Siliguri, N. Bengal, Reg. No. $\frac{5225}{1}$.

35. **Nodularia (Nodularia) pugio** (Benson), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 814, = *Unio pugio*, Benson, Ann. Mag. Nat. Hist., Ser. 3, X, p. 193; Sowerby, Conch. Icon., pl. xcv, fig. 516.

Pegu, Reg. Nos. $\frac{5023}{1}$ and (W. Theobald) $\frac{5170}{1}$; Myadong, Upper Burma (J. Anderson), Reg. No. $\frac{5213}{1}$; Sawaddy, Burma, Reg. No. $\frac{5163}{1}$; Tenasserim, Lower Burma (W. T. Blanford), Reg. No. $\frac{5219}{1}$; Zayleyman (J. Anderson), Reg. No. $\frac{5208}{1}$; Arakan, Reg. No. $\frac{5030}{1}$.

36. **Nodularia (Nodularia) crispata** (Gould), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 815, = *Unio crispata*, Gould, Proc. Bost. Soc. Nat. Hist., I, 1843, p. 141; Otia Conch., 1862, p. 191, = *Unio crispatus*, Catlow and Reeve, Conch. Nom., 1845, p. 58; Hanley and Theobald, Conch. Ind., 1876, p. 21, pl. xlv, fig. 1, = *Margarona (Unio) crispatus*, Lea, Syn., 1870, p. 32, = *Unio scobinatus*, Lea, Proc. Ac. Nat. Sci. Philad., VIII, 1856, p. 93; Obs., VI, 1857, p. 19, pl. xxvi, fig. 13, = *Margarona (Unio) scobinatus*, Lea, Syn., 1870, p. 32, = *Unio mandarinus*, Morelet, J. de Conch., XII, 1863, p. 159, = *Unio pellis-lacerti*, Morelet, J. de Conch., XIII, 1865, p. 22; Sowerby, Conch. Icon., XVI, 1868, pl. lxxxvi, fig. 457, = *Unio venustus*, Morelet, J. de Conch., XIV, 1866, p. 63, = *Unio oblatius*, Lea, Syn., 1870, p. 64.

Siam, Reg. Nos. $\frac{2552}{1}$ and $\frac{4722}{1}$; Battambang, Cambodia, Reg. No. $\frac{5024}{1}$; Bhamo, Reg. No. $\frac{3856}{1}$.

37. **Nodularia (Nodularia) scobina** (Hanley), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 816, = *Unio scobina*, Hanley, Rec. Biv., p. 382, pl. xxiii, fig. 40; Hanley and Theobald, Cat. L. and F. W. Shells Brit. Ind., p. 49; Hanley and Theobald, Conch. Ind., pl. xlvi, fig. 2.

Sibsagar, Assam (S. E. Peel), Reg. No. $\frac{2554}{1}$.

38. **Nodularia (Nodularia) ingallsiana** (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 816, = *Unio ingallsianus*, Lea, Tr. Am. Phil. Soc., X, pl. xxiv, fig. 41; Obs., V, 1852, p. 38, pl. xxiv, fig. 41, = *Margarona (Unio) ingallsianus*, Lea, Syn., 1852, p. 36; 1870, p. 58.

Cambodia, Reg. No. $\frac{5014}{1}$; Siam, Reg. No. $\frac{2556}{1}$.

39. **Nodularia (Nodularia) pazii** (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 816, = *Unio pazii*, Lea, Proc. Ac. Nat. Sci., Philad., VI, 1862, p. 176; Jl. Ac. Nat. Sci., Philad.,

VI, p. 61, pl. xxi, fig. 60; Obs., XI, p. 65, pl. xxi, fig. 60,=*Margaron (Unio) pazii*, Lea, Syn., 1870, p. 39.

China, Reg. No. $\frac{621}{1}$.

40. **Nodularia (Nodularia) olivaria** (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 817,=*Unio olivarius*, Lea, Tr. Am. Phil. Soc., IV, p. 108, pl. xvi, fig. 38; Obs., I, p. 118, pl. xvi, fig. 33; Hanley and Theobald, Conch. Ind., p. 5, pl. x, fig. 1,=*Margarita (Unio) olivarius*, Lea, Syn., 1836, p. 26; 1838, p. 20; 1852, p. 30; 1870, p. 47,=*Unio pumilio*, Küster, Conch. Cab. Unio, 1862, p. 268, pl. xc, fig. 7.

Assam, Reg. Nos. $\frac{2472}{1}$, $\frac{5159}{1}$; Saharanpur, Reg. Nos. $\frac{2445}{1}$ and $\frac{5221}{1}$; East Cachar (Museum Collector), Reg. No. $\frac{5209}{1}$; Moradabad, United Provinces (Laidlay), Reg. No. $\frac{5180}{1}$; North-East Cachar, Reg. No. $\frac{6097}{1}$; Raniganj, Bengal, Reg. No. $\frac{5182}{1}$.

41. **Nodularia (Nodularia) theobaldi** (Nevill, MS.), sp. n.

Shell ovately rectangular, very slightly curved, gaping anteriorly, moderately solid, concentrically striate, covered with a dark, olivaceous periostracum; umbones small, not prominent; dorsal margin somewhat arched, ventral margin slightly excavated in the median region, otherwise straight; anterior side slightly produced and somewhat sharply rounded; posterior side very obtusely rostrate, steeply sloping above, then sharply rounded and again sloping inwards below. Cardinal teeth in right valve roughly triangular, jagged, somewhat inwardly projecting, fitting between two teeth in the left valve which are roughened and of which the anterior is rather broad and massive; lateral teeth in both valves elongate and nearly straight; anterior scars somewhat deeply excavated especially above; posterior scars ovate, lightly impressed; interior of shell nacreous, shading from pale flesh colour to bluish iridescent especially towards the posterior margin.

Long. 34, lat. 60, diam. 19 mm.

Hab.—Manipur, Assam, Reg. Nos. $\frac{4710}{1}$ [Type], $\frac{2478}{1}$.

42. **Nodularia (Nodularia) pecten**, sp. n. (Pl. viii, figs. 3, 4.)

Shell elongately ovate, rather thin, covered with a finely laminiferous periostracum of a pale bluish green colour shading to yellowish green towards the margins, finely concentrically striate and posteriorly ribbed, especially on the left valve; umbones rather small, moderately prominent; dorsal margin very slightly arched; ventral margin gently curved; anterior side rounded; posterior side obtusely rostrate below, sloping above; hinge-teeth in both valves weak, anteriorly erect in right valve, sinuous and almost twisted in the left; posterior teeth nearly straight, moderately elongate; adductor scars scarcely perceptible; interior of shell pearly.

Long. 19, lat. 33.5, diam. 12 mm.

Hab.—Pitsanuloke, N. Siam, Reg. No. $\frac{5061}{1}$ [Type].

The author follows Simpson in placing this and the next two species in the Section *Nodularia*, though, owing to the very

different texture of the shells, it is somewhat difficult to understand his reasons for so placing them.

43. **Nodularia (Nodularia) nuttalliana** (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 817, = *Unio nuttallianus*, Lea, Proc. Ac. Nat. Sci., Philad., VIII, 1856, p. 103; Obs., VI, 1857, p. 30, pl. xxx, fig. 25; Jl. Ac. Nat. Sci., Philad., 1858, Ser. 2, III, p. 310, pl. xxx, fig. 25; Hanley and Theobald, Conch. Ind., p. 19, pl. xli, figs. 5, 6, = *Margaron (Unio) nuttallianus*, Lea, Syn., 1870, p. 74.

Assam, Reg. No. $\frac{5220}{1}$; Cachar, Reg. No. $\frac{5186}{1}$.

44. **Nodularia (Nodularia) involuta** (Benson), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 817, = *Unio involutus*, (Benson), Hanley, Rec. Biv. Shells, 1856, p. 385, pl. xxiii, fig. 19; Hanley and Theobald, Conch. Ind., p. 19, pl. xli, fig. 2.

Sylhet, Reg. No. $\frac{5187}{1}$.

Sec. RADIATULA, Simpson, 1900.

45. **Nodularia (Radiatula) crispisulcata** (Benson), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 820, = *Unio crispisulcatus*, Lea, Ann. Mag. Nat. Hist., X, 1862, p. 193; Sowerby, Conch. Icon., XVI, 1866, pl. xlix, fig. 262, = *Margaron (Unio) crispisulcatus*, Lea, Syn., 1870, p. 149.

Irrawaddy near Thayetmyo (Asiatic Society of Bengal), Reg. No. $\frac{2557}{1}$; Pegu (J. Anderson), Reg. No. $\frac{1712}{1}$; Pegu, Reg. No. $\frac{5162}{1}$; Pegu, Reg. No. $\frac{6098}{1}$.

46. **Nodularia (Radiatula) lima**, Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 820, = *Unio radula* (Benson), Hanley, Rec. Biv. Shells, Supp., 1856, p. 382, pl. xxiii, fig. 41; Hanley and Theobald, Conch. Ind., p. 5, pl. x, fig. 3, = *Dysonomia radula*, Rochebrune, Bull. Soc. Phil., VI, 1882, p. 42.

Siliguri, N. Bengal, Reg. Nos. $\frac{2560}{1}$, $\frac{1725}{1}$, $\frac{3862}{1}$; Sikkim, Reg. No. $\frac{2426}{1}$.

46a. Var. **siliguriensis**, Preston, = *Unio siliguriensis*, Preston, Rec. Ind. Mus., Calcutta, II, Pt. 1, p. 47.

Siliguri, Reg. No. $\frac{6099}{1}$. [Type.]

Having now had an opportunity of examining a good series of *N. lima*, a shell which had previously been inaccessible to me, I have no hesitation in reducing *U. siliguriensis* to a variety of that species.

Gen. **Physunio**, Simpson, 1900.

Sec. PHYSUNIO, Simpson, 1900.

47. **Physunio (Physunio) gravidus** (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 830, = *Unio gravidus*, Lea, Proc. Ac. Nat. Sci., Philad., VIII, 1856, p. 93; Obs., VI, 1857, p. 12, pl. xxiv, fig. 5; Jl. Ac. Nat. Sci., Philad., III, 1858, p. 292, pl. xxiv, fig. 5, = *Margaron (Unio) gravidus*, Lea, Syn., 1870, p. 28, = *Lampsilis gravidus*, Rochebrune, Bull. Soc. Phil., VI,

1882, p. 43, = *Unio abnormis*, Morelet, Rev. et Mag., XIV, 1862, p. 480, = *Unio superbus*, Sowerby, Conch. Icon., XVI, pl. lix, fig. 295.

Cambodia, Reg. No. $\frac{1993}{1}$; Siam, Reg. No. $\frac{2577}{1}$; Pitsanuloke, N. Siam (H. W. Biggie), Reg. No. $\frac{1410}{1}$.

48. **Physunio (Physunio) micropterus** (Morelet), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 831, = *Unio micropterus*, Morelet, J. de Conch., XIV, 1866, p. 63; Ser. Conch., IV, 1875, p. 349, pl. xv, fig. 7.

Cambodia, Reg. No. $\frac{1997}{1}$

Gen. *Dalliella*, Simpson, 1900.

49. **Dalliella purpurea** (Valenciennes), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 832, = *Anodonta purpurea*, Valenciennes, Rec. Obs. Zool., II, 1853, p. 236, pl. xlviii bis, figs. 3, 3a, 3b, = *Margarita (Anodonta) purpurea*, Lea, Syn., 1836, p. 51; 1838, p. 30, = *Anodon purpurea*, Catlow and Reeve, Conch. Nom., 1845, p. 67, = *Margaron (Anodonta) purpurea*, Lea, Syn., 1852, p. 50; 1870, p. 79, = *Anodonta burroughiana*, Lea, Tr. Am. Phil. Soc., V, 1834, p. 105, pl. xvi, fig. 49; Obs., I, 1834, p. 217, pl. xvi, fig. 49, = *Margaron (Anodonta) burroughiana*, Lea, Syn., 1870, p. 81, = *Anodon burroughianus*, Sowerby, Conch. Icon., XVII, pl. xxvii, fig. 103, = *Margarita (Unio) bengalensis*, Lea, Syn., 1836, p. 26; 1838, p. 20, = *Unio bengalensis* Lea, Tr. Am. Phil. Soc., VI, 1838, p. 3, pl. ii, fig. 3; Obs., II, 1838, p. 3, pl. ii, fig. 3, = *Margaron (Unio) bengalensis* Lea, Syn., 1852, p. 30; 1870, p. 47, = *Anodon bengalensis*, Sowerby, Conch. Icon., XVII, pl. xiv, fig. 49, = *Anodonta bengalensis*, Clessin, Conch. Cab. Ano., 1876, p. 173, pl. lvii, fig. 1, = *Unio verecundus* Gould, Proc. Bost. Soc. Nat. Hist., III, 1850, p. 295; U. S. Expl. Exp., XII, 1852, p. 431, figs. 541, 541a, 541b, 541c, = *Unio mauritianus*, Lea, Proc. Ac. Nat. Sci. Philad., III, 1859, p. 152; Jl. Ac. Nat. Sci., Philad., IV, 1860, p. 257, pl. xl, fig. 138, = *Margaron (Unio) mauritianus*, Lea, Syn., 1870, p. 42, = ? *Anodonta heldii*, Küster, Conch. Cab. Ano., 1873, p. 64, pl. xix, fig. 1 = *Anodonta chinensis*, Küster?

Manila, Reg. Nos. $\frac{5027}{1}$, $\frac{5028}{1}$, $\frac{5029}{1}$; Luzon, Reg. No. $\frac{5061}{1}$.

50. **Dalliella subcrassa** (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 833, = *Anodonta subcrassa*, Lea, Proc. Zool. Soc., London, 1850, p. 198; Ann. Mag. Nat. Hist., VIII, 1851, p. 495; Jl. Ac. Nat. Sci., Philad., IV, 1859, p. 236, pl. xxxiii, fig. 115, = *Margaron (Anodonta) subcrassa*, Lea, Syn., 1852, p. 51; 1870, p. 81, = *Anodon subcrassa*, Sowerby, Conch. Icon., XVII, 1867, pl. xiii, fig. 42.

Philippines, Reg. No. $\frac{615}{1}$.

51. **Dalliella insularis** (Drouet), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 834, = *Pseudodon insularis*, Drouet, Rev. Biol. Fr., VI, 1894, p. 217 fig. 2.

Sarawak, Reg. No. $\frac{1977}{1}$

Gen. **Pseudodon**, Gould, 1844.

Sec. TRIGONODON, Conrad, 1865.

52. **Pseudodon (Trigonodon) crebristriatus** (Anthony), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 835, = *Monocondylaea crebristriata*, Anthony, Am. Jl. Conch., I, 1865, p. 205, pl. xviii, fig. 1, = *Trigonodon crebristriata*, Conrad, Am. Jl. Conch., I, 1865, p. 233, = *Margaron (Monocondylaea) crebristriata*, Lea, Syn., 1870, p. 72, = *Unio crebristriatus*, Sowerby Conch. Icon., XVI, 1868, pl. xcv, fig. 517, = *Pseudodon crebristriatum*, Hanley and Theobald, Conch. Ind., p. 5, pl. ix, fig. 3, = *Unio vondembuschi*, Sowerby Conch. Icon., XVI, pl. xcv, fig. 518.

Pegu, Reg. Nos. $\frac{1699}{1}$ and $\frac{5031}{1}$.

52a. Var. **curvata**, var. n.

Shell having the ventral margin more curved, and generally less ovate in shape than in the typical form.

Hab.—Pegu, Reg. Nos. $\frac{1090}{1}$ [Type], $\frac{2135}{1}$.

52b. Var. **peguensis** (Anthony), = *Monocondylaea peguensis*, Anthony, Am. Jl. Conch., I, 1865, p. 205, pl. xviii, fig. 2, = *Margaron (Monocondylaea) peguensis*, Lea, Syn., 1870, p. 73, = *Pseudodon crebristriatum* var. *peguensis*, Hanley and Theobald, Conch. Ind., 1876, p. 5, pl. ix, fig. 5.

Zayleyman, Reg. No. $\frac{2573}{1}$.

Sec. PSEUDODON, Gould, 1884.

53. **Pseudodon (Pseudodon) vondembuschiana** (Lea), Conrad, Am. Jl. Conch., I, 1865, p. 233, = *Margaritana vondembuschiana*, Lea, Proc. Am. Phil. Soc., I, 1840, p. 288; Tr. Am. Phil. Soc., VIII, 1842, pl. xviii, fig. 39; Obs., III, 1842, p. 60, pl. xviii, fig. 39, = *Margaron (Monocondylaea) vondembuschiana*, Lea, Syn., 1852, p. 45; 1870, p. 73, = *Monocondylaea vondembuschiana*, H. and A. Adams, Gen. Rec. Moll., II, 1858, p. 501, = *Monodontina buschiana*, Conrad, Proc. Ac. Nat. Sci., Philad., VI, 1853, pp. 269, 449, = *Unio vonbuschea*, Sowerby, Conch. Icon., XVI, 1866, pl. li, fig. 269, = *Alasmodonta crispata*, Mousson, L. and Süss. W. Moll. Java, 1849, p. 97, pl. xviii, figs. 1, 2, = *Margaritana crispata*, Paetel, Conch. Sam., III, 1890, p. 173, = *Monocondylaea planulata*, Lea, Proc. Ac. Sci., Philad., XI, 1859, p. 187; Jl. Ac. Nat. Sci., Philad., IV, 1859, p. 262, pl. xlii, fig. 142; Obs., VII, 1860, p. 80, pl. xlii, fig. 142, = *Pseudodon planulata*, Conrad, Am. Jl. Conch., I, 1865, p. 233, = *Microcondylaea planulata*, Paetel, Conch. Sam., III, 1890, p. 175, = *Margaron (Monocondylaea) planulata*, Lea, Syn., 1870, p. 73, = *Margaritana fragilis*, Küster, Conch. Cab. Unio, 1862, p. 295, pl. xcvi, fig. 2, = *Microcondylaea fragilis*, Paetel, Conch. Sam., III, 1890, p. 175, = *Monocondylaea rhombica*, Küster, Conch. Cab. Unio, 1862, p. 304, pl. c, fig. 7.

Sarawak, Reg. Nos., $\frac{5049}{1}$, $\frac{5165}{1}$.

54. **Pseudodon (Pseudodon) inoscularis** (Gould), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 837, = *Anodon inoscularis*, Gould, Proc. Bost. Soc. Nat. Hist., I, 1844, p. 160; Hanley and Theobald, Conch. Ind., p. 5, pl. ix, fig. 2, = *Margaron (Monocondylaea) inoscularis*, Lea, Syn., 1870, p. 73, = *Margaritana inoscularis*, Paetel, Conch. Sam., 1890, III, p. 173.

Tenasserim River, Reg. No. $\frac{4957}{1}$; Tenasserim, Reg. No. $\frac{4696}{1}$.

55. **Pseudodon (Pseudodon) cumingii** (Lea), Conrad, Am. Jl. Conch., I, 1865, p. 233, = *Anodonta cumingii*, Lea, Proc. Zool. Soc., London, 1850, p. 199; Ann. Mag. Nat. Hist., VIII, 1851, p. 495; Musgrave in Hanley's Phot. Conch., 1863, pl. i, fig. 6, = *Margaron (Monocondylaea) cumingii*, Lea, Syn., 1852, p. 50, 1870, p. 73, = *Monocondylaea cumingii*, Lea, Jl. Ac. Nat. Sci., Philad., IV, 1860, p. 235, pl. xxxiii, fig. 114; Obs., VII, 1860, p. 53, pl. xxxiii, fig. 114, = *Anodon cumingii*, Reeve, Conch. Icon., XVII, 1870, pl. xxxi, fig. 122, = *Microcondylaea cumingii*, Clessin, Conch. Cab. Ano., 1876, p. 239; pl. lxxxiii, figs. 3, 4, = *Pseudodus cumingii*, de Morgan, Bull. Soc. Zool. de Fr., X, 1885, p. 422.

Cambodia, Reg. Nos. $\frac{4999}{1}$ and $\frac{4951}{1}$; Philippines (W. Theobald), Reg. No. $\frac{614}{1}$.

56. **Pseudodon (Pseudodon) tumidus** (Morelet), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 837, = *Monocondylus tumidus*, Morelet, Jl. de Conch., XIV, 1866, p. 62; Mabilie, Rev. Zool., XXIII, 1872, p. 51, pl. v, figs. 6, 7.

Upper Cambodia, Reg. No. $\frac{4995}{1}$.

57. **Pseudodon (Pseudodon) salwenianus** (Gould), Conrad, Am. Jl. Conch., I, 1865, p. 233, = *Anodon salwenianus*, Gould, Proc. Bost. Soc. Nat. Hist., I, 1844, p. 160, = *Anodonta salweniana*, Gould, Otia Conch., 1862, p. 193, = *Monocondylaea salweniana*, Paetel, Conch. Sam., III, 1890, p. 174, = *Unio salweniana*, Sowerby, Conch. Icon., XVI, 1868, pl. xciv, fig. 513, = *Margaron (Monocondylaea) salweniana*, Lea, Syn., 1870, p. 72, = *Pseudodon salwenianum*, Hanley and Theobald, Conch. Ind., p. 5, pl. ix, fig. 4.

Tenasserim River, Reg. Nos. $\frac{4677}{1}$, $\frac{4983}{1}$ and $\frac{4697}{1}$; Burma, Reg. Nos. $\frac{5049}{1}$ and $\frac{5040}{1}$.

58. **Pseudodon (Pseudodon) cambodjensis** (Petit), Conrad, Am. Jl. Conch., I, 1865, p. 233, = *Monocondylaea cambodjensis*, Petit, Jl. de Conch., VI, 1865, p. 122, = *Margaron (Monocondylaea) cambodjensis*, Lea, Syn., 1870, p. 72.

Cambodia, Battambang, Reg. No. $\frac{1996}{1}$; Cochin China, Reg. No. $\frac{5050}{1}$.

59. **Pseudodon (Pseudodon) ava** (Theobald), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 839, = *Monocondylaea ava* Theobald, Jl. As. Soc. Beng., XLII, 1873, pt. II, p. 209, pl. xvii, fig. 15.

Mandalay (J. Anderson), Reg. No. $\frac{4987}{1}$.

Gen. *Parreysia*, Conrad, 1853.

Subgen. *Parreysia*, Conrad, 1853.

60. *Parreysia corrugata* (Müller), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 841, = *Mya corrugata*, Müller, Verm. Terr. et Fluv., 1774, Pt. 2, p. 214; Besch. Ges. Nat. Ber., IV, 1779, p. 56, pl. iiib, figs. 7, 8, = *Unio corrugata*, Lamarck, An. sans Vert., VI, 1819, p. 79; Deshayes, Enc. Méth., II, 1827, p. 584, pl. ccxlviii, fig. 8, = *Unio (Potamida) corrugata*, Swainson, Tr. on Mal., 1840, p. 268, fig. 51; p. 281, fig. 57, = *Unio rugosus*, Küster, Conch. Cab. Unio., 1862, p. 290, pl. xcvi, fig. 5, = *Unio corrugata*, Retzius, Diss. Hist. Nat., 1778, p. 18; Spengler, Skriv. Selsk. Nat., III, 1793, p. 68; Hanley Test. Moll., 1842, p. 197; Biv. Shells, 1843, p. 197; Hanley and Theobald, Conch. Ind., 1876, p. 21, pl. xlv, figs. 2—5, etc., = *Margarita (Unio) corrugatus*, Lea, Syn., 1836, p. 29; 1838, p. 21, = *Margaron (Unio) corrugatus*, Lea, Syn., 1852, p. 20; 1870, p. 30, = *Mya spuria*, Gmelin, Syst. Nat., 13th Ed., 1788, p. 3222, = *Mya gaditana*, Schreibers, Versuch., 1793, = *Unio multidentatus*, Philippi, Conch., III, 1847, p. 46, pl. iii, fig. 4, = *Margaron (Unio) multidentatus*, Lea, Syn., 1870, p. 50, = *Unio fulmineus*, Philippi, Conch., III, 1847, p. 46, pl. iii, figs. 5, 6, = *Unio lutens*, Lea, Proc. Ac. Nat. Sci. Philad., VIII, 1856, p. 93, = *Unio luteus*, Lea, Jl. Ac. Nat. Sci. Philad., III, 1857, p. 291, pl. xxiv, fig. 4, = *Margaron (Unio) luteus*, Lea Syn., 1870, p. 46, = ? *Unio semirugatus*, Chemnitz, Ill. Conch., 1858 pl. xii, figs. 2, 2a, = *Unio merodabensis*, Küster, Conch. Cab. Unio, 1861, p. 233, pl. lxxviii, fig. 4, = *Unio tennenti*, Hanley and Theobald, Conch. Ind., p. 22, pl. xlv, figs. 7—9.

Garchiroti Tahsil, Chanda, C. P., Reg. No. $\frac{5113}{1}$; River Dukkaree, near Umballa, Reg. No. $\frac{5115}{1}$; Ceylon (Asiatic Society of Bengal), Reg. No. $\frac{2509}{1}$; Séwan, close to the Indus, Reg. No. 2514; Gudur, Madras Presidency (G. H. Tipper), Reg. No. 5113, and a stream two miles north of Gudur (G. H. Tipper), Reg. Nos. $\frac{5112}{1}$ and $\frac{5114}{1}$; Madras, Reg. No. $\frac{2493}{1}$; Manbhoom, Reg. No. $\frac{2506}{1}$; Patna, Reg. Nos. $\frac{2463}{1}$ and $\frac{2507}{1}$; Berhampore, Murshidabad Dist., (S. W. Kemp), Reg. No. $\frac{5057}{1}$; Brahmapuri Tahsil, Chanda, C. P., Reg. No. $\frac{5144}{1}$; Bangalore, Mysore State, Reg. No. $\frac{2474}{1}$; Rhenchooganj, Sylhet, Reg. No. $\frac{3989}{1}$; Loc. ? (Asiatic Society of Bengal), Reg. No. $\frac{2550}{1}$; Singpal Garki, Nepal (R. Hodgart), $\frac{6096}{1}$; Arrah, Reg. No. $\frac{4861}{1}$; Orissa, Reg. No. $\frac{2518}{1}$; Muzafferpore (I. H. Burkill), Reg. No. $\frac{5141}{1}$; Puri, Orissa, Reg. No. $\frac{2515}{1}$; Putna, Mirzapur Dist., U.P. (R. Hodgart), Reg. No. $\frac{6100}{1}$.

60a. Var. *fragilis*, Hanley and Theobald, Conch. Ind., p. 21, pl. xlv, fig. 4.

Puri, Orissa, Reg. No. $\frac{2515}{1}$.

60b. Var. *laevirostris* (Benson), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 842, = *Unio laevirostris*, Benson, Ann. Mag. Nat. Hist., 1862, p. 192; Jl. As. Soc. Beng., 1862,

XXXV, p. 144,=*Unio corrugatus* var. *laevirostris*, Hanley and Theobald, Conch. Ind., 1876, p. 21, pl. xlv, figs. 5, 6.

Chittagong Hills, Reg. Nos. $\frac{2544}{1}$ and $\frac{2464}{1}$; Sadya, N. E. Assam, Reg. No. $\frac{2489}{1}$; Loc. ? (Asiatic Society of Bengal), Reg. No. $\frac{2500}{1}$; Arrah, Reg. No. $\frac{6101}{1}$.

60c. Var. **nagpoorensis** (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 842; Hanley and Theobald, Conch. Ind., p. 21, pl. xlv, fig. 3,=*Unio nagpoorensis*, Lea, Proc. Ac. Nat. Sci., Philad., 1859 (1860), p. 331; Jl. Ac. Nat. Sci., Philad., IV, 1860, p. 270, pl. xlv, fig. 150; Obs., VII, 1860, p. 88, pl. xlv, fig. 150,=*Margaron (Unio) nagpoorensis*, Lea, Syn., 1870, p. 38.

Poona, Reg. No. $\frac{5015}{1}$; a stream two miles north of Gudur, Madras Presidency (G. H. Tipper), Reg. No. $\frac{5111}{1}$; Godavery River, Reg. No. $\frac{2468}{1}$.

61. **Parreysia wynegungaensis** (Lea), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 842,=*Unio wynegungaensis*, Lea, Proc. Ac. Nat. Sci., Philad., 1859 (1860), p. 331; Obs. Unio., VII, p. 89, pl. xlv, fig. 151; Sowerby, Conch. Icon., Unio., pl. xvi, fig. 339,=*Unio wynegungaensis*, Hanley and Theobald, Cat. L. and F. W. Shells Brit. Ind.,=*Margaron (Unio) wynegungaensis*, Lea, Syn., 1870, p. 50.

Ortalai River, Reg. No. $\frac{2521}{1}$; Damuda (W. T. Blanford), Reg. No. $\frac{2465}{1}$; Surat, Reg. No. $\frac{2477}{1}$; Sambalpur, Reg. No. $\frac{2482}{1}$; Godavery River (W. T. Blanford), Reg. Nos. $\frac{4711}{1}$, $\frac{2467}{1}$; from the little 'nuddy' at Barod, about 130 miles S.W. of Sepree, Reg. No. $\frac{5103}{1}$; Assam (*ex coll.* Robinson), Reg. No. $\frac{2551}{1}$.

62. **Parreysia favidens** (Benson), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 842,=*Mya spuria*, Wood, Ind. Test., 1825, p. 12, pl. ii, fig. 35a,=*Unio favidens*, Benson, Ann. Mag. Nat. Hist., X, 1862, p. 188; Hanley and Theobald, Conch. Ind., 1876, p. 6, pl. xi, fig. 1,=*Margaron (Unio) favidens*, Lea, Syn., 1870, p. 38,=*Unio favidens*, Paetel, Conch. Sam., III, 1890, p. 152,=*Unio tirostris*, Musgrave in Hanley's Phot. Conch., 1863, pl. ii, fig. 9,=*Unio tripartitus*, Lea, Proc. Ac. Nat. Sci., Philad., VII, 1863, p. 190; Jl. Ac. Nat. Sci., Philad., VI, p. 57, pl. xix, fig. 55,=*Margaron (Unio) tripartitus*, Lea, Syn., 1870, p. 35,=*Unio favidens* var. *marcens*, Benson, Ann. Mag. Nat. Hist., X, 1862, p. 188,=*Unio marcens*, Hanley and Theobald, Conch. Ind., 1876, p. 19, pl. xlii, figs. 4—6.

Moradabad (Asiatic Society of Bengal), Reg. No. $\frac{2474}{1}$; River Indus, Reg. No. $\frac{2449}{1}$; Barrack River, Silchar Reg. Nos. $\frac{4867}{1}$, $\frac{4872}{1}$, $\frac{4873}{1}$, $\frac{2487}{1}$; Rajputana, Reg. No. $\frac{2494}{1}$; Berhampur, Reg. No. $\frac{2466}{1}$; Dacca, Reg. Nos. $\frac{1497}{1}$ and $\frac{2501}{1}$; Bengal, Reg. No. $\frac{2537}{1}$; Loc. ? (Asiatic Society of Bengal), Reg. No. $\frac{2520}{1}$; Cachar, Reg. No. $\frac{2490}{1}$; E. Cachar, Reg. Nos. $\frac{2547}{1}$, $\frac{2502}{1}$, $\frac{2491}{1}$; Barrack River, Sylhet, Reg. No. $\frac{2487}{1}$; Tezpur, Reg. Nos. $\frac{2503}{1}$ and $\frac{26}{1}$; "West of Ranigunge," Reg. No. $\frac{2377}{1}$; Assam, Reg. No. $\frac{2485}{1}$; Poona, Reg. No. $\frac{5072}{1}$; Karnul, Madras, Reg. No. $\frac{2536}{1}$; Calcutta (J. Wood-Mason) Reg.

No. $\frac{2495}{1}$, also Reg. No. $\frac{4708}{1}$; Seven Tanks, Calcutta, Reg. No. $\frac{2523}{1}$; Arrah, Reg. Nos. $\frac{2517}{1}$ and $\frac{4861}{1}$; Rajmahal, Reg. No. $\frac{2470}{1}$; Hazrapur, Reg. No. $\frac{2498}{1}$; Ranigunge, Reg. No. $\frac{4894}{1}$; Sunderbunds, Reg. No. $\frac{2483}{1}$; Phenchooganj, Central Sylhet (a variety), Reg. No. $\frac{4869}{1}$.

62a. Var. **pinax** (Benson), Hanley and Theobald, Conch. Ind., p. 6, pl. x, fig. 2, = *Unio pinax*, Benson, Ann. Mag. Nat. Hist., 1862, p. 192; Jl. As. Soc. Beng., XXXV, 1866, p. 144.

Loc? (Asiatic Society of Bengal), Reg. No. $\frac{2447}{1}$; Arrah, Reg. No. $\frac{6102}{1}$.

62b. Var. **plagiosoma** (Benson), Hanley and Theobald, Conch. Ind., p. 6, pl. xi, fig. 3, = *Unio plagiosoma*, Benson, Ann. Mag. Nat. Hist., X, p. 191; Jl. As. Soc. Beng., XXXV, 1866, p. 144.

Patna, Reg. No. $\frac{5107}{1}$; Langlai, Assam, Reg. Nos. $\frac{2578}{1}$ and $\frac{2480}{1}$; Alipur, Calcutta (J. Anderson), Reg. No. $\frac{2524}{1}$; Birbhum (J. Wood-Mason), Reg. No. $\frac{2484}{1}$.

62c. Var. **chrysis** (Benson), Ann. Mag. Nat. Hist., Ser. 3, X, p. 189; Hanley and Theobald, Conch. Ind., pl. xli, fig. 3.

Patna, Reg. No. $\frac{2459}{1}$.

62d. Var. **deltae** (Benson), Ann. Mag. Nat. Hist., Ser. 3, X, p. 189; Hanley and Theobald, Conch. Ind., pl. xlii, fig. 2.

Hazrapur, Reg. Nos. $\frac{2505}{1}$ and $\frac{5108}{1}$; Calcutta, Reg. No. $\frac{2461}{1}$.

62e. Var. **irridula** (Benson), Ann. Mag. Nat. Hist., Ser. 3, X, p. 189.

Bengal, Reg. No. $\frac{2451}{1}$; Darnuda, Reg. No. $\frac{6103}{1}$; Manbhoom, Reg. No. $\frac{2451}{1}$; Gunduk (Asiatic Society of Bengal), Reg. No. $\frac{2519}{1}$; Ranigunge, Reg. No. $\frac{2452}{1}$; Patna, Reg. No. $\frac{2453}{1}$.

62f. Var. **assamensis** (Nevill, MS.), var. n.

Shell more convex than the typical form, the dorsal margin is rather less posteriorly angled, the anterior side more rounded and the posterior slightly more nasute.

Hab.—Digong, Reg. No. $\frac{2479}{1}$ [Type]; Assam, Reg. Nos. $\frac{2504}{1}$, $\frac{2511}{1}$ and $\frac{2488}{1}$; Arrah (Asiatic Society of Bengal), Reg. No. $\frac{2546}{1}$; Sylhet, Reg. No. $\frac{2456}{1}$.

63. **Parreysia smaragdites** (Benson), = *Unio smaragdites*, Benson, Ann. Mag. Nat. Hist., 1862, X, p. 190.

Bhamo, Upper Burma (J. Anderson), Reg. Nos. $\frac{2457}{1}$, $\frac{4708}{1}$; Zayleyman Upper Burma (J. Anderson), Reg. No. $\frac{2448}{1}$; Zayleyman, Reg. No. $\frac{5099}{1}$; Loc? (J. Anderson) Reg. No. $\frac{5100}{1}$.

64. **Parreysia bhamoensis** (Theobald), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 843, = *Unio bhamoensis*, Theobald, Jl. As. Soc. Beng., XLII, 1873, Pt. 2, p. 207, pl. xvii, fig. 1, = *Unio mandalayensis*, Theobald, Jl. As. Soc. Beng., XLII, Pt. 2, p. 208, pl. xvii, fig. 2.

Mandalay, Upper Burma, Reg. Nos. $\frac{5065}{1}$ and (J. Anderson) $\frac{2571}{1}$; Sheinmagah, Upper Burma, Reg. No. $\frac{2569}{1}$; Irrawaddy

River at Sagaing (J Coggin Brown), Reg. Nos. $\frac{47.37}{1} - \frac{38}{1}$; Zayleyman, Upper Burma (J Anderson), Reg. No. $\frac{2570}{1}$.

65. **Parreysia pernodulosa**, sp. n.

Shell small, ovate, dark brown; both valves sculptured anteriorly with coarse, corrugate ridges which become more nodulous and irregular in the median and posterior regions; umbones rather large; dorsal margin rapidly sloping anteriorly, slightly sloping posteriorly; ventral margin somewhat rounded; anterior side rather contracted, sharply rounded; posterior side broad, very gently rounded; cardinal teeth very anteriorly situate, in right valve squarish, bearing two elongate grooves; in left valve large, jagged, split into three portions, between each of which occur two deep notches, the middle portion, or that between the two notches, being by far the smallest: at the base of the anterior portion is situated a smaller, jagged tooth which is obliquely grooved in the centre; lateral teeth in both valves posteriorly, elongately arched, grooved down the whole length; anterior scars very deep; posterior scars elongate, but not well marked; interior of shell pale bluish, nacreous.

Long. 15.5; lat. 20.5 mm.

Hab.—Zayleyman, Upper Burma (J Anderson), Reg. No. $\frac{6104}{1}$ [Type].

66. **Parreysia feddeni** (Theobald), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 843, = *Unio feddeni*, Theobald, Jl. As. Soc. Beng., XLII, Pt. 2, p. 208, pl. xvii, fig. 3; Hanley and Theobald, Cat. L. and F. W. Shells, Brit. Ind., p. 48.

Pem Ganga, Reg. No. $\frac{2516}{1}$ (ex coll. W T. Blanford).

67. **Parreysia daccaensis**, sp. n.

Shell differing from *P. feddeni*, Theobald, in its much larger size, more ponderous form and more elongately ovate shape, it is much darker in colour, being of a dark blackish brown instead of the greenish yellow shade of that species, the shell is much more coarsely, concentrically striate and is also considerably malleated, while *P. feddeni* is almost smooth in texture; the umbones in the present species are, though larger, far less prominent, but the system of hinge teeth is the same.

Long. 47; lat. 76.5, diam. 29 mm.

Hab.—Dacca, Reg. No. $\frac{6105}{1}$ [Type].

68. **Parreysia tavoyensis** (Gould), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 843, = *Unio tavoyensis*, Gould, Proc. Bost. Soc. Nat. Hist., 1843, p. 140; Küster, Conch. Cab. Unio., 1856, p. 166, pl. xlviii, fig. 2, etc., = *Margaron (Unio) tavoyensis*, Lea, Syn., 1870, p. 31, = *Unio savoyensis* Paetel, Conch. Sam., III, 1890, p. 166, = *Unio parma*, Benson, Sowerby, Conch. Icon., XVI, 1868, pl. xcv, fig. 514; Hanley and Theobald, Conch. Ind., p. 61, pl. cliv, fig. 1.

Tavoy, Reg. Nos. $\frac{2566}{1}$, $\frac{4703}{1}$, and $\frac{2543}{1}$; Pegu, Reg. Nos. $\frac{2441}{1}$, $\frac{2567}{1}$, and $\frac{2522}{1}$; Arakan, Reg. No. $\frac{2568}{1}$; Tenasserim, Burma (W T. Blanford), Reg. No. $\frac{2534}{1}$; Mandalay, Reg. No. $\frac{2564}{1}$.

68a. Var. *triembolus* (Benson), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 844,=*Unio triembolus*, Benson, Jl. As. Soc. Beng., XXXV 1855, p. 144; Ann. Mag. Nat. Hist., X, 1862, p. 190; Hanley and Theobald, Conch. Ind., p. 43, pl. cvii, fig. 2,=*Unio houngdaranicus*, Tapparone-Canefri, Ann. Mus. Civ. Genova, VII, 1889, p. 341.

Cachar, Reg. No. $\frac{2455}{1}$; Barrack River, Silchar, Reg. No. $\frac{4866}{1}$; Loc? (Asiatic Society of Bengal), Reg. No. $\frac{2458}{1}$; Calcutta, Reg. No. $\frac{2181}{1}$.

69. *Parreysia rajahensis* (Lea), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 844,=*Unio rajahensis*, Lea, Proc. Am. Phil. Soc., II, 1841, p. 30; Tr. Am. Phil. Soc., VIII, 1842, p. 289, pl. xxiii, fig. 53; Obs., III, 1842, p. 77, pl. xxiii, fig. 53,=*Margaron (Unio) rajahensis*, Lea, Syn., 1852, p. 25; 1870, p. 38,=*Unio indicus*, Sowerby, Conch. Icon., XVI, 1866, pl. xl, fig. 222; Hanley and Theobald, Conch. Ind., p. 43, pl. cvii, fig. 1,=*Margaron (Unio) indicus*, Lea, Syn., 1870, p. 31.

Nerbudda River, Reg. No. $\frac{2173}{1}$; Poona, Reg. No. $\frac{1512}{1}$; Nerbudda R. (W. Theobald), Reg. No. $\frac{4712}{1}$; Nerbudda R., Reg. No. $\frac{2513}{1}$, (W. T. Blanford); "from the soil of the Ran Kach," Reg. No. $\frac{5052}{1}$; from 130 miles S. W. of Sepree, Reg. No. $\frac{5153}{1}$; Sahibgunge, Reg. No. $\frac{2471}{1}$.

70. *Parreysia corbis* (Hanley), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 845,=*Unio corbis*, Benson in Hanley's Rec. Biv. Shells, 1856, pl. xxiii, fig. 43; Hanley and Theobald, Conch. Ind., p. 22, pl. xlv, fig. 10,=*Margaron (Unio) corbis*, Lea, Syn., 1870, p. 50.

Assam, Reg. No. $\frac{5223}{1}$.

71. *Parreysia burmanus* (Blanford), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 845,=*Unio burmanus*, Blanford, Proc. Zool. Soc., London, 1869, p. 450,=*Unio birmanus*, Hanley and Theobald, Conch. Ind., p. 19, pl. xlii, fig. 11.

Bhamo, Reg. Nos. $\frac{5232}{1}$ [Type], $\frac{2518}{1}$, $\frac{1565}{1}$, $\frac{2540}{1}$ (J. Anderson), $\frac{4709}{1}$.

72. *Parreysia sikkimensis* (Lea), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 845,=*Unio sikkimensis*, Lea, Proc. Ac. Nat. Sci. Philad., III, 1859, p. 151; Jl. Acad. Nat. Sci., IV, 1859, p. 251; Obs., VII, 1860, p. 69, pl. xxxix, fig. 131,=*Margaron (Unio) sikkimensis*, Lea, Syn., 1870, p. 64.

Sikkim, Reg. No. $\frac{2427}{1}$; Sibsagar, Assam, Reg. Nos. $\frac{2503}{1}$ and $\frac{4713}{1}$ (S. E. Peal.); Siliguri, Reg. No. $\frac{5102}{1}$; Namtsik, Dihing, Reg. No. $\frac{5070}{1}$; Cachar, Reg. No. $\frac{2492}{1}$.

73. *Parreysia gowhattensis* (Theobald), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 845,=*Unio gowhattensis*, Theobald, Jl. As. Soc. Beng., XLII, 1873, Pt. 2, p. 208, pl. xvii, fig. 4.

Gowhatty (=Gauhati), Assam (Museum Collector), Reg. No. $\frac{4716}{1}$; Gowhatty, Reg. Nos. $\frac{2475}{1}$ and $\frac{2558}{1}$.

74. *Parreysia annandalei*, sp. n.

Shell oval, convex, moderately solid, coarsely concentrically ribbed, covered with a thin, smooth, brownish-olivaceous periostracum; umbones rather small, not prominent; dorsal margin arched; ventral margin considerably rounded; anterior side slightly produced and rather sharply rounded; posterior side very bluntly sub-rostrate; cardinal teeth two in each valve, somewhat anteriorly situate, rather coarse, corrugated; lateral teeth strong, curved; anterior scars rather small, very deeply excavated; posterior scars also small, ovate, deeply impressed; interior of shell whitish, iridescent.

Long. 29, lat. 41, diam. 20 mm.

Hab.—Gowhatty, Reg. No. $\frac{2490}{1}$ [Type].

75. *Parreysia perconvexa*, sp. n.

Shell ovate, slightly curved, very convex, solid, but much eroded, where intact covered with a dark blackish brown periostracum; umbones moderately large; dorsal margin sloping in an anterior direction; ventral margin slightly curved posteriorly; anterior side gently rounded; posterior side slightly and very bluntly produced, rounded; cardinal teeth very anteriorly situate with upper surface multi-ridged and supported in each valve by an enormous column-like callus thickening of the shell; lateral teeth coarse, rather short, curved; anterior muscular scars of great depth; posterior scars subcircular, well impressed; interior of shell very pale greenish white.

Long. 37, lat. 55, diam. 33 mm.

Hab.—Nangyong Lake, Reg. No. $\frac{5069}{1}$ [Type].

Gen. *Lamellidens*, Simpson, 1900.

Subgen. *Lamellidens*, Simpson, 1900.

76. *Lamellidens marginalis* (Lamarck), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 854, = *Unio marginalis*, Lamarck, An. sans Vert., VI, 1819, p. 79; Deshayes, Enc. Méth., II, 1827, p. 151, pl. ccxlvii, fig. 1, = *Die breite Mahler-Muschel aus Grönland*, Schröter, Flusse., 1779, p. 181, pl. ix, fig. 1, = ? *Unio groenlandicus*, Mörch, Am. Jl. Conch., IV, 1868, p. 38, = ? *Unio testudinarius*, Spengler, Skriv. Selsk. Nat., III, 1793, p. 65, = ? *Unio truncatus*, Spengler, Skriv. Selsk. Nat., III, 1793, p. 65 = *Margarita (Unio) marginalis*, Lea, Syn., 1836, p. 37; 1838, p. 24, = *Margaron (Unio) marginalis*, Lea, Syn., 1852, p. 38; 1870, p. 60, = *Unio anodontina*, Lamarck, An. sans Vert., VI, 1819, p. 80, = *Unio anodontinus*, Küster, Conch. Cab. Unio., 1861, p. 240, pl. lxxx, fig. 15, = *Symphynota bilineata*, Lea, Tr. Am. Phil. Soc., IV, 1831, p. 98, pl. xi, fig. 19; Obs. I, 1834, p. 108, pl. xi, fig. 19, = *Margarita (Unio) bilineatus*, Lea, Syn., 1836, p. 38; 1838, p. 25, = *Unio bilineatus*, Hanley, Test. Moll., 1842, p. 207; Biv. Shells, 1843, p. 207, pl. xxi, fig. 30, = *Margaron (Unio) bilineatus*, Lea, Syn., 1852, p. 38; 1870, p. 61, = ? *Unio evanescens*, Mousson, Moll. Java., 1849, p. 91, pl. xvii, fig. 2.

Singbhoom, Reg. No. $\frac{4880}{1}$; Chittagong, Reg. No. $\frac{4877}{1}$; Arrah Reg. No. $\frac{4898}{1}$; Burma, Reg. No. $\frac{2563}{1}$; Hazrapur, Reg. No. $\frac{4879}{1}$; Rangoon, Reg. No. $\frac{5106}{1}$; Bhamo, Upper Burma (J. Anderson), Reg. No. $\frac{2535}{1}$; Tank near Bangalore, Reg. No. $\frac{5012}{1}$; Tezpur, Reg. No. $\frac{2539}{1}$; Dacca, Reg. No. $\frac{4891}{1}$; Toungoo, Burma, Reg. No. $\frac{2437}{1}$; Bhagalpur (Capt. Sherwill), Reg. No. $\frac{4876}{1}$; "a stream two miles north of Guddur, Madras Presidency" (G. H. Tipper), Reg. Nos. $\frac{5110}{1}$, $\frac{5115}{1}$; "from the little 'nuddy' at Barod, S. W. of Sepree, about 130 miles," Reg. Nos. $\frac{5039}{1}$, $\frac{5021}{1}$; "from a jheel near Rohri, Sind," Reg. No. $\frac{4988}{1}$; Irrigation Channels, Seistan, Reg. Nos. $\frac{3241}{1}$ and $\frac{4814}{1}$; Poona, Reg. Nos. $\frac{5098}{1}$ and $\frac{5073}{1}$; Karnul District, Madras, Reg. Nos. $\frac{5047}{1}$ and $\frac{5038}{1}$; Calcutta, Reg. Nos. $\frac{4887}{1}$, $\frac{4886}{1}$ (distorted specimens), $\frac{4896}{1}$ (very young specimens); Belgachia, Calcutta (N. Annandale), Reg. Nos. $\frac{4730}{1}$, $\frac{4732}{1}$; Loc? (Indian Tanks), Reg. Nos. $\frac{4720}{1}$ and $\frac{5109}{1}$; Patna, Reg. No. $\frac{4900}{1}$; Bandar-daha, Berhampur, Bengal (B. L. Chaudhuri), Reg. No. $\frac{5234}{1}$; Silcuri, Reg. No. $\frac{4864}{1}$; Barrack River, Silchar, Reg. No. $\frac{5047}{1}$; E. Cachar, Reg. No. $\frac{4899}{1}$; Igatpuri, Western Ghats (Museum Collector), young specimens, Reg. No. $\frac{4794}{1}$; Putna, Mirzapur District, U. P. (R. Hodgart), Reg. No. $\frac{4750}{1}$.

76a. Var. *obesus* (Hanley and Theobald), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 855, = *Unio marginalis* var. *obesa*, Hanley and Theobald, Conch. Ind., p. 20, pl. xliii, fig. 3, = ?*Unio corrianus*, Sowerby, Conch. Icon., XVI, 1868, pl. lxxvii, fig. 41.

Chittagong, Reg. No. $\frac{5034}{1}$; Silchar, Cachar, Reg. No. $\frac{4881}{1}$; Toungoo, Burma, Reg. No. $\frac{2526}{1}$.

76b. Var. ¹*tricolor* (Hanley and Theobald), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 855, = *Unio tricolor*, Küster, Conch. Cab. Unio., 1856, p. 156, pl. xlv, fig. 1, = *Unio marginalis* var. *tricolor*, Hanley and Theobald, Conch. Ind., p. 20, pl. xliii, fig. 5.

Shuaygoomyo, Reg. No. $\frac{2333}{1}$; Manbhoom, Reg. No. $\frac{4893}{1}$.

76c. Var. *candaharicus* (Hutton), = *Lamellidens marginalis* var. *candaharicus* (Hanley and Theobald), in Simpson's Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 855, = *Unio marginalis* var. *candaharica*, Hanley and Theobald, Conch. Ind., p. 20, pl. xliii, fig. 4, = *Unio marginalis* var. *kandaharica*, Hutton, in Theobald's Cat. L. and F. W. Shells, Brit. Ind., p. 46, = *Unio candaharicus*, Hutton, Jl. As. Soc. Beng., XVIII, Pt. 2, 1850, p. 660.

Kandahar (Hutton), Reg. No. $\frac{4901}{1}$; Kandahar, Reg. No. $\frac{4723}{1}$.

76d. Var. *thwaitesi*, Lea, = *Lamellidens thwaitesi*, Lea, in Simpson's Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 856, = *Unio thwaitesi*, Lea, Proc. Ac. Nat. Sci., Philad., III, 1859, p. 152; Jl. Acad. Nat. Sci., Philad., IV, 1860, p. 246, pl. xxxvii, fig. 125, = *Margaron (Unio) thwaitesi*, Lea, Syn., 1870, p. 41, = *Unio conso-brinus*, Hanley and Theobald, Conch. Icon., p. 19, pl. xli, fig. 7.

Ceylon, Reg. Nos. $\frac{5043}{1}$, $\frac{4718}{1}$; Colombo, Reg. No. $\frac{4984}{1}$.

76e. Var. **consobrinus**, Lea,=*Lamellidens consobrinus*, Lea, in Simpson's Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 856,=*Unio consobrinus*, Lea, Proc. Ac. Nat. Sci., Philad., III, 1859, p. 331; Jl. Ac. Nat. Sci., Philad., 1860, p. 272, pl. xlv, fig. 152; Obs., VII, 1860, p. 90, pl. xlv, fig. 152,=*Margaron (Unio) consobrinus*, Lea, Syn., 1870, p. 46,=*Unio corbeti*, Deschamps, Bull. Soc. Zool. Fr., XVII, 1892, p. 68, fig.

Assam, Reg. No. $\frac{4895}{1}$; Poona, Reg. No. $\frac{1085}{1}$; Dacca, Reg. No. $\frac{4892}{1}$.

76f. Var. **lamellatus**, Lea,=*Lamellidens lamellatus*, Lea, in Simpson's Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 856,=*Unio lamellatus*, Lea, Tr. Am. Phil. Soc., VI, 1838, p. 19, pl. vi, fig. 16; Obs., II, 1838, p. 19, pl. vi, fig. 16,=*Margarita (Unio) lamellatus*, Lea, Syn., 1836, p. 26; 1838, p. 20,=*Margaron (Unio) lamellatus*, Lea, Syn., 1852, p. 29; 1870, p. 46,=*Unio layardii*, Lea, Proc. Ac. Sci., Philad., III, 1859, p. 153; Jl. Ac. Nat. Sci., Philad., IV, 1860, p. 243, pl. xxxvi, fig. 22,=*Margaron (Unio) layardii*, Lea, Syn., 1870, p. 46.

Upper Burma, Reg. No. $\frac{2441}{1}$; Calcutta, Reg. No. $\frac{1285}{1}$; Mandalay, Reg. Nos. $\frac{1721}{1}$ and $\frac{2549}{1}$; Pegu, Reg. No. $\frac{2359}{1}$; Bharno (J. Anderson), Reg. No. $\frac{2525}{1}$; Matale, Ceylon, Reg. No. $\frac{1080}{1}$.

After a careful examination of a long series of this shell the author is unable to consider it other than a mere variety of *L. marginalis*.

76g. Var. **scutum**, Sowerby,=*Lamellidens scutum*, Sowerby, in Simpson's Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 857,=*Unio scutum*, Sowerby, Conch. Icon., 1868, XVI, pl. xciv, fig. 510; Hanley and Theobald, Conch. Ind. p. 22, pl. xlvi, fig. 1.

Tenasserim, Burma, Reg. No. $\frac{1986}{1}$; Rangoon (N. Annandale), Reg. No. $\frac{1781}{1}$.

76h. Var. **corrianus**, Lea,=*Lamellidens corrianus*, Lea, in Simpson's Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 857,=*Unio corrianus*, Lea, Tr. Am. Phil. Soc., VI, 1834, p. 65, pl. ix, fig. 25; Obs., I, 1834, p. 177, pl. ix, fig. 25,=*Margarita (Unio) corrianus*, Lea, Syn., 1836, p. 38; 1838, p. 25,=*Margaron (Unio) corrianus*, Lea, Syn., 1852, p. 38; 1870, p. 61.

Sibsagar, Assam (S. E. Peel), Reg. No. $\frac{4989}{1}$; Calcutta, Reg. Nos. $\frac{4884}{1}$, $\frac{4941}{1}$, $\frac{4897}{1}$ and $\frac{1719}{1}$; Pegu (W. T. Blanford), Reg. Nos. $\frac{1888}{1}$ and $\frac{2530}{1}$; Balagunge, Central Sylhet, Reg. No. $\frac{4865}{1}$; Burma, Reg. No. $\frac{2527}{1}$; Zayleyman, Upper Burma (J. Anderson), Reg. No. $\frac{4875}{1}$; Madras, Reg. No. $\frac{5000}{1}$; Berhampur, Murshidabad District, Bengal (S. W. Kemp), Reg. No. $\frac{5055}{1}$; Sambalpur, Reg. No. $\frac{4992}{1}$.

76i. Var. **generosus**, Gould,=*Lamellidens generosus* (Gould) in Simpson's Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 857,=*Unio generosus*, Gould, Proc. Bost. Soc. Nat. Hist., 1847, p. 220; Hanley and Theobald, Conch. Ind., p. 22, pl. xlvi, fig. 4,=*Unio generosus* var. *angustior*, Hanley and Theobald, Conch. Ind.,

p. 22, pl. xlvi, fig. 7, = *Margarona* (*Unio*) *generosus*, Lea, Syn., 1870, p. 29, = ? *Unio lamellatus*, Sowerby Conch. Icon., XVI, 1868, pl. xciv, fig. 511.

Myadong, Upper Burma (J. Anderson), Reg. No. $\frac{2531}{1}$; Mandalay (N. Annandale), Reg. Nos. $\frac{1725}{1}$ — $\frac{29}{1}$; Bhamo (J. Coggin Brown), Reg. No. $\frac{4736}{1}$.

76j. Var. *jenkinsianus* (Benson), = *Lamellidens jenkinsianus*, (Benson) in Simpson's Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 857, = *Unio jenkinsianus*, Benson, Ann. Mag. Nat. Hist., Ser. 3, X, p. 185; Hanley and Theobald, Conch. Ind., pl. xli, fig. 4.

Upper Assam, Reg. No. $\frac{2116}{1}$; Sylhet, Reg. No. $\frac{5037}{1}$; Upper Bramaputra (F. Stoliczka), Reg. No. $\frac{4873}{1}$; Bhagalpur (Capt. Sherwill), Reg. No. $\frac{1878}{1}$.

76k. Var. *zonatus*, Deshayes, = *Unio zonatus*, Deshayes, Enc. Méth. Vers., II, p. 587; Hanley and Theobald, Conch. Ind., pl. xliv, fig. 2.

Rangoon, Reg. No. $\frac{5066}{1}$.

76l. Var. *sublamellatus* (Nevill, MS.) var. n.

An elongate, somewhat rostrate form, having the hinge teeth rather less developed.

Hab.—Burma (W. Theobald), Reg. No. $\frac{4711}{1}$ [Type].

76m. Var. *sawaddyensis* (Nevill, MS.) var. n.

Shell much more ovate and convex than the typical form, having the dorsal margin more arched and posteriorly ascending, the ventral margin and anterior side more rounded, and the posterior side produced and roundedly rostrate.

Hab.—Sawaddy River (Asiatic Society of Bengal), Reg. No. $\frac{2541}{1}$ [Type]; Bhamo (J. Anderson), Reg. No. $\frac{4704}{1}$; Sawaddy, Tengling Stream (J. Anderson), Reg. Nos. $\frac{2528}{1}$ and $\frac{2529}{1}$; Shuay-goomya, Upper Burma (J. Anderson), Reg. No. $\frac{2532}{1}$; Mandalay, Upper Burma (N. Annandale), Reg. Nos. $\frac{1720}{1}$ — $\frac{21}{1}$.

77. *Lamellidens narainporensis*, sp. n.

Shell cuneate, moderately convex, posteriorly rostrate, dark reddish brown, covered, towards the margins, with a finely laminiferous periostracum, marked with concentric lines of growth, bearing two carinae on each valve running from the umbones in a dorsally posterior direction; umbones small, not prominent, somewhat coarsely corrugated; dorsal margin very gently arched; ventral margin scarcely rounded in the anterior and median regions, slightly curved posteriorly; anterior side abruptly rounded; posterior side sloping above, then angled and very abruptly descending; cardinal tooth in left valve obtusely triangular, erect, absent in right valve; lateral teeth anteriorly short, deeply grooved and projecting in right valve, erect and jagged in the left, posteriorly moderately elongate and bifurcated in both valves; anterior scars rather circular, deep; posterior scars lightly impressed; interior of shell pale flesh colour shading to iridescent bluish white, very minutely granulate.

Long. 35, lat. 84 mm.

Hab.—Narainpore Bhil, Murshidabad District, Bengal (C. J. Robertson Milne), Reg. No. $\frac{5056}{1}$ [Type].

78. **Lamellidens nongyangensis**, sp. n.

Shell very elongately ovate, inflated, covered with a blackish brown, finely laminiferous periostracum, concentrically marked with rather coarse lines of growth; dorsal margin anteriorly somewhat straight, posteriorly arched above, sloping and slightly excavated below; ventral margin scarcely rounded; anterior side abruptly descending; posterior side rostrate, obtusely rounded; cardinal teeth very anteriorly situate, triangular, erect lateral teeth elongate, also erect, terminating posteriorly in an abrupt slope; anterior scars deeply marked; posterior scars lightly impressed; interior of shell flesh-coloured shading to bluish, iridescent, minutely pitted and granulate.

Long. 45, lat. 94 mm.

Hab.—Nongyang Lake, South of Patkai, Reg. No. $\frac{5068}{1}$ [Type].

79. **Lamellidens phenchooganjensis**, sp. n.

Shell very elongately ovate, posteriorly obtusely rostrate, dark blackish brown, sculptured with fine concentric striae, crossed, especially in the anterior median region, by fine, slightly distant, transverse, radiate striae, thus presenting a minutely wrinkled appearance; umbones flattened, much eroded; dorsal margin anteriorly gently sloping, posteriorly more rapidly sloping in a slight curve; ventral margin scarcely rounded; anterior side angled above, gently rounded below; posterior side produced, angularly rounded; hinge teeth very elongate, somewhat fine; anterior scars ovate, moderately impressed; posterior scars roughly triangular, not well impressed; interior of shell shading from pale brown to bluish, nacreous, marked, especially towards the anterior ventral region, with very shallow radiate furrows.

Long. 42, lat. 86 mm.

Hab.—Phenchooganj, Central Sylhet, Reg. No. $\frac{4868}{1}$ [Type].

80. **Lamellidens mainwaringi** (Nevill, MS.) sp. n.

Shell rather small, cuneate, covered with a finely laminiferous periostracum; both valves marked with rather fine, concentric and finer, transverse, radiate, scratch-like striae; dorsal margin anteriorly gradually sloping, posteriorly arched and more rapidly descending; ventral margin somewhat straight; anterior side rounded; posterior side angled above and below, somewhat obliquely and obtusely rostrate; hinge-teeth well developed, moderately short; anterior adductor scar deeply impressed, posterior scar somewhat roughly triangular, well impressed; interior of shell bluish iridescent, rather granulate.

Long. 25.5, lat. 50 mm.

Hab.—Siliguri, Reg. Nos. $\frac{5016}{1}$ [Type], $\frac{3861}{1}$, $\frac{5102}{1}$; Namtsik, Dihang, Reg. No. $\frac{5070}{1}$.

Genus *Trapezoideus*, Simpson, 1900.

81. *Trapezoideus foliaceus* (Gould), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 858,=*Unio foliaceus*, Gould, Proc. Bost. Nat. Hist. Soc., I, 1843, p. 141,=*Unio foliaceus*, Catlow and Reeve, Conch. Nom., 1845, p. 59; Hanley and Theobald, Conch. Ind., p. 19, pl. xlii, fig. 3,=*Margaron (Unio) foliaceus*, Lea, Syn., 1852, p. 39; 1870, p. 62,=*Unio peguensis*, Anthony, Am. Jl. Conch., I, 1865, p. 351, pl. xxv, fig. 2; Sowerby, Conch. Icon., XVI, 1868, pl. xcv, fig. 519,=*Margaron (Unio) peguensis*, Lea, Syn., 1870, p. 51.

Bhamo (J. Anderson), Reg. No. $\frac{47.07}{1}$; Pegu (W. T. Blanford), Reg. No. $\frac{257.6}{1}$; Pegu, Reg. No. $\frac{50.26}{1}$.

81a. Var. *zayleymanensis* (Nevill, MS.), var. n.

Shell thinner and smaller than the typical form, more produced anteriorly and much more obtuse posteriorly, the slight curve in the ventral margin is also absent.

Hab.—Bhamo (J. Anderson), Reg. No. $\frac{257.5}{1}$ [Type]; also from Bhamo, Reg. No. $\frac{257.2}{1}$; Zayleyman (J. Anderson), Reg. No. $\frac{257.4}{1}$.

82. *Trapezoideus misellus* (Morelet), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 859,=*Unio misellus*, Morelet, Jl. de Conch. XIII, 1865, p. 21; Ser. Conch., IV, 1875, p. 341, pl. xiv, fig. 2,=*Unio siamensis*, Lea, Proc. Ac. Nat. Sci., Philad., X, 1866, p. 133, Jl. Ac. Nat. Sci., Philad., VI, 1868, p. 279, pl. xxxviii, fig. 93; Obs., XII, 1869, p. 39, pl. xxxviii, fig. 93,=*Margaron (Unio) siamensis*, Lea, Syn., 1870, p. 57.

Tenasserim, Lower Burma, Reg. No. $\frac{507.4}{1}$; Irrawaddy River at Sagaing (J. Coggin Brown), Reg. Nos. $\frac{47.39}{1}$ — $\frac{48.1}{1}$.

82a. Var. *subclathratus*, von Martens, Arch. für Naturg., p. 44, pl. vi, fig. 3.

Sheinmagah, Shwebo Dist., Burma, Reg. No. $\frac{386.4}{1}$.

83. *Trapezoideus pallegoixi* (Sowerby), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 859,=*Anodon pallegoixi*, Sowerby, Conch. Icon., XVII, 1867, pl. xvii, fig. 17,=*Anodonia pallegoixi*, Clessin, Conch. Cab. Ano., 1876, p. 210, pl. lxiv, fig. 6.

Siam, Reg. No. $\frac{500.1}{1}$.

84. *Trapezoideus exolescens* (Gould), Simpson, Syn. Naiades, Proc. U.S. Nat. Mus., XXII, p. 859,=*Unio exolescens*, Gould, Proc. Bost. Soc. Nat. Hist., 1843, p. 141; Hanley and Theobald, Conch. Ind., p. 43, pl. cvii, fig. 5,=*Margaron (Unio) exolescens*, Lea, Syn., 1852, p. 32; 1870, p. 51.

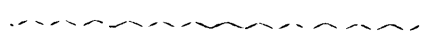
Bhamo, Reg. No. $\frac{386.5}{1}$.

Genus *Arconaia*, Conrad, 1865.

85. *Arconaia lanceolata* (Lea), Simpson, Syn. Naiades, Proc. U. S. Nat. Mus., XXII, p. 860,=*Triquetra lanceolata*, Lea, Proc. Ac. Nat. Sci., Philad., VIII, 1856, p. 79,=*Hyria lanceolata*, Lea,

Proc. Ac. Nat. Sci., Philad., 1856, p. 300,=*Arconaia lanceolata*, Conrad, Am. Jl. Conch., I, 1865, p. 234,=*Triquetra contorta*, Lea, Proc. Ac. Nat. Sci., Philad., VIII, 1856, p. 300; Obs., VI, 1857, p. 39, pl. xxxiii, fig. 33,=*Hyria contorta*, Sowerby, Conch. Icon., XVII, 1869, pl. i, figs. 2a, 2b,=*Margaron (Triquetra) contorta*, Lea, Syn., 1870, p. 26,=*Unio contortus*, Heude, Conch. Fluv. Nank., 1877, pl. xv, fig. 31.

Lake Tungling, China, Reg. No. 4975





5.



6.



3.



4.



1.



2.

1, 2, *Unio modiola*.

3, 4, *Nodularia (Nodularia) pecten*.

5, 6, *Unio pennsylvanicus*.

MISCELLANEA.

GENERAL.

MALARIA MORTALITY IN THE FRINGE AREA OF CALCUTTA.—On p. 98 of Mr. C. A. Paiva's "Materials for a Survey of the Mosquitoes of Calcutta" (Rec. Ind. Mus., vii, 1912, pp. 93—98) it is stated that, as far as Calcutta is concerned, malaria is most common in the fringe area. Dr. Pearse, Calcutta Health Officer, writes informing us that, so far as can be judged from the death-rate per 1,000 from the disease, this had just ceased to be the case when the survey was instituted. He attributes the improvement largely to the drainage scheme commenced in 1909, and observes that "since 1908 the fringe area has compared very favourably with the eastern and southern wards of the city." Mr. Paiva tells me, moreover, that his record of adult malaria-carrying mosquitoes from this area is based on specimens collected prior to the initiation of the mosquito survey.

F. H. GRAVELY.

INSECTS.

ON THE LARVAL HABITS OF *Toxorhynchites immisericors*.—In Mr. Brunetti's supplementary Catalogue of Oriental Culicidæ (Rec. Ind. Mus., vol. iv, No. x) I find a statement attributed to me with which I am not entirely in agreement.

On page 436, under *Toxorhynchites immisericors*, I am represented as asserting that "the larvæ prey first upon those of their own race before proceeding to devour those of other species," and again "Mr. E. E. Green thought it eats its own species first."

I was puzzled, for some time, to understand how or where I could have said anything to give rise to this impression, until—on looking through my early paper on the life history of this insect ('Spolia Zeylanica,' vol. ii, pp. 159 to 164)—I found the following sentences:—"Confirmation of the supposed carnivorous habit was soon forthcoming: firstly, by the rapid disappearance of most of the young larvæ while the remainder waxed fat; and secondly, by the detection of one larva in the act of devouring a comrade the same size as itself."

"Though well supplied

with *Culex* larvæ, the young *Toxorhynchites* continued to prey upon each other until but a single survivor remained in each vessel. Having a habit of backing blindly about in the water, they sooner or later come within reach of the jaws of their companions."

As these remarks appear to be susceptible of an interpretation that was never intended by their author, I should like to take this opportunity of explaining them more fully.

With regard to the earlier paragraph, until their carnivorous proclivities had been definitely proved, the newly-hatched larvæ were crowded together in a single vessel, without those of any other species. They had therefore no choice but to devour each other—or starve.

In the second paragraph, I thought that the concluding sentence sufficiently explained the disappearance of the *Toxorhynchites* in spite of the presence of other *Culex* larvæ.

My experience was certainly not that of Mr. Paiva, who found "that the larva will devour that of any other species, if present, before attacking those of its own kind."

I do not, for a moment, suppose that *Toxorhynchites* larvæ prefer to feed upon members of their own species; but I am equally doubtful of their preference for those of other species. I am inclined to believe that it is a matter of complete indifference to them and that the choice of prey is guided simply by opportunity. Their jaws instinctively close upon any wriggling creature that comes within reach—be it one of their own or an alien race. The more sluggish habit of the *Toxorhynchites* renders it a more easy prey, especially when combined with its habit of backing about on the surface of the water.

The fact remains that, in any restricted collection of water—such as the cup of a broken bamboo stem, it is seldom that more than a single fully-developed *Toxorhynchites* larva can be found, amongst a crowd of other Culicid larvæ.

E. ERNEST GREEN.

PERADENIYA, 15th May, 1912.

CRUSTACEA.

EAST ASIATIC SPECIES OF *Apus*.—When writing my notes on this subject (Rec. Ind. Mus., vi, 1911, p. 357) I was unable to give any references to *Apus granarius*, Simon. For the following I am indebted to Dr. W. T. Calman:—

Apus granarius, Simon, Ann. Soc. entom. France, ii, 1886, p. 446, and G. O. Sars, Ann. Mus. Zool. St. Petersburg, vi, 1901, p. 133, pl. i, pl. ii, figs. 1—12.

The species was first described from specimens found in the neighbourhood of Peking, while the examples subsequently examined by Sars were obtained at several localities in Eastern Mongolia.

I have recently had opportunity of consulting Packard's full description of *Apus himalayanus* (Hayden's Ann. Rep. U. S. Geol. Survey for 1873, Washington, 1874, p. 327, pl. xvi, figs. 5, 5a), but I am still not convinced that the form is really distinct from *A. cancriformis*.

STANLEY KEMP.

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