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XIX. ON A COLLECTION OF OLIGOCHAETA BELONGING TO THE INDIAN MUSEUM.

By J. STEPHENSON, *M.B., D.Sc. (Lond.), Lieut.-Col. I.M.S.,*
Professor of Zoology, Government College, Lahore.

(Plates XXX—XXXIII).

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INTRODUCTION.

The following paper describes a collection of Oligochaeta belonging to the Indian Museum, which has been accumulating for some time. Contained in the collection were a number of worms from Trivandrum and places in the vicinity, handed over to the Indian Museum by the authorities of the Trivandrum Museum. I have also added a few records of worms that have come into my hands from other sources during the preparation of the paper.

Nineteen forms are described as new, either species or varieties ; and one or two more, which I have not named, may be so also. In addition I have given fairly complete descriptions of a few forms which have only been recorded and described once, and that, perhaps, some time ago.

There is no addition of importance to our knowledge of the distribution of Indian earthworms; indeed this is hardly to be

expected, at any rate from regions represented in the present collection. The genus *Megascolides* appears again in its double distribution, on the one hand S. India, and on the other the E. Himalayas (*cf.* Stephenson, 23). The record of an apparently endemic species of *Pheretima* in S. India represents an extension of the proper range of the genus beyond the limits that have hitherto been assigned to it. New species of *Perionyx* from the E. Himalayas are in accordance with what was to be expected.

The *Glyphidrilus* described below (*G. tuberosus*) is an interesting novelty ; the genus has, however, previously been recorded in India, and its bearing commented on by Michaelsen (14). The new species belongs distinctly to the Further India group, and is not in any way closely related to the African *G. stuhlmanni*.

Artificial introduction must account for the presence of *Dichogaster bolaui* (Mchlsn.) subsp. *palmicola* (Eisen), described by Eisen from the Pacific Coast of America, in the compound of the Museum.

An interesting series of specimens of *Aulophorus* necessitates the fusion of two species, and it is possible that another will sooner or later have to be merged in *A. furcatus*. Some of the specimens were sexually mature, and I give below an account of the appearances ; so far as I know there has hitherto been no description of the genital organs of any species of *Aulophorus*

My best thanks are due to Dr. Annandale for kindly allowing me the opportunity of examining this extensive collection.

Fam. NAIDIDAE.

The determination, from preserved material, of species belonging to the Naididae is liable to be very unsatisfactory. Though the family is particularly fascinating to study in the living condition, spirit specimens are extraordinarily troublesome ; and this is due to several causes. In the first place the setae, on the minute description of which so much depends, cannot be seen as a rule in their whole extent nor in one plane. One can easily, simply by allowing the water to evaporate, cause the coverslip to exercise sufficient pressure on a fresh specimen to flatten it completely ; but this does not answer with preserved material. The only way is to soften the specimen by treatment for some time with solution of potash ; and I once thought that this would prove a method of some value. But I now find that the potash distorts the setae ; and the more, the longer the specimens remain in the solution. According to my observations the setae may actually swell from a thickness of 3μ to as much as 7μ ; and although the length, position of nodulus, and even the general curve of the shaft are more or less maintained, the shape of the terminal prongs is quite unreliable in specimens so treated.

Secondly, the preservation of the setae often leaves much to be desired. It may happen that throughout the whole length of a

specimen not a single dorsal seta is found perfect. In some cases nearly the whole of the dorsal setae may actually be broken off level with the body-wall, scarcely one being left projecting ; so that I was for a time misled, in the examination of one of the present specimens, into thinking that I had before me one of the genera which are without dorsal setae. But even where the ends of the setae of one single segment are alone damaged, it may be difficult or impossible to discriminate, for example, such forms as *Pristina longiseta* from the other species of its genus.

Thirdly, there is frequently more than one species represented in a limited amount of material ; and there is naturally the liability to confusion, especially if some of the specimens are fragmentary. Confusion may easily result if, in order to get a complete description, one specimen is used for the dorsal, another for the anterior ventral, and a third for the posterior ventral setae, according as they happen to be well shown in one or other specimen ; additional specimens have frequently to be taken for a description of the process of budding, or perhaps for the internal organs. It is practically impossible ever to write a complete description from a single specimen.

I thus spent much time over a tube of eight small worms from Bhim Tal. Besides two specimens that I can say nothing definite about, there was one specimen of a *Nais* without eyes ; three of a *Slavina* which I describe shortly below, but which I do not feel justified in naming ; and two of a *Stylaria* which seems to to me to require specific distinction.

Gen. Slavina.

Slavina sp.

(Plate xxx, fig. 1).

Bhim Tal, 4450 ft., Kumaon, W. Himalayas, 2—10-v-1911 (*S. W. Kemp*).
Three specimens, one considerably damaged.

Length 5-5·5 mm., diameter about ·25 mm. Segments 47 or 48, with a small undifferentiated zone at the hinder end. No zone of budding. A considerable amount of debris adherent to the surface.

Prostomium blunt. No eyespots.

The anterior ventral setae are in length 135μ, in thickness 3μ. The proximal prong of the fork is almost equal in length to the distal, but is twice as thick, and this on the whole is much the more massive of the two ; the distal prong is slightly claw-like. The curve of the shaft at its proximal end is slight ; the nodulus is proximal to the middle point of the shaft, the relation between the segments of the shaft proximal and distal to the nodulus respectively being 2 : 3 or 3 : 5. There may be up to four setae per bundle (fig. 1).

Behind the first few segments the ventral setae are not very different from those just described. The length is rather less, 125μ,

and the number in a bundle does not exceed three; but I could not be certain of any other constant distinction.

The dorsal setae begin in segment vi, and the bundles consist of one hair-seta and one needle. The hairs are equal to the diameter of the body in length, that is about 250μ, and taper finely towards the tip; none are specially lengthened, the one on segment vi being in fact rather shorter than that of vii. The needles are straight or perhaps slightly curved at the tip (this last character was only noted in a potash preparation), which is simple; they taper to a point distally, and in length are from 50 to nearly 60μ.

The bodywall contains pigment grains.

Chloragogen cells begin in segment vi; there was a stomachal dilatation in vii in one specimen, but none in another.

The sensory papillae characteristic of *S. appendiculata* are present. They are flat-topped, of some considerable height, often higher than broad, truncated or cylindrical. They are segmentally arranged, several in each segment rather behind its middle, often about at the level of the setal bundles.

Remarks.—If I could be certain that no specially elongated setae had dropped out from segment vi, this would be an extremely well-defined species (I say 'dropped out' because so far as I could see there were no broken stumps on segment vi). It would, I think, be necessary to enlarge the scope of the genus *Slavina*, defining it by the sensory papillae and covering of foreign particles, without reference to the elongated dorsal setae of vi. The papillae and the foreign particles are such peculiar characters that I cannot doubt the close relationship of this form to *S. appendiculata*; and it would be pedantry to remove it to another genus (e.g. *Nais*) or to form a separate genus for its reception, merely because of the absence of specially long setae in a particular segment.

Whether such setae have fallen out or not, I think these specimens are specifically distinct from *S. appendiculata*. Eyespots, which are absent here, are present in *S. appendiculata*, as a rule, at any rate, though perhaps not constantly ["Augenflecke meist vorhanden" Michaelsen, 13; " meist mit 2 Augen," Michaelsen (1); though Piguet (19) apparently allows no exception]. Is it not possible that where eyespots are not present in *S. appendiculata* it is because the individual—on this supposition the former posterior component of a chain—has separated before complete differentiation of the head region?

The stomachal dilatation, here in vii, is in viii in *S. appendiculata* according to Piguet, and it is in viii also in the specimens which I previously distinguished as *S. punjabensis* (20), but which Michaelsen (15) thinks are to be included under *S. appendiculata*. The point of the dorsal needles is expanded at the tip in *S. appendiculata* (Piguet, 17).

I think Michaelsen's statement (13) that the nodulus is *distal* in the ventral setae of *S. appendiculata* is probably a slip.

Gen. **Stylaria.**

Stylaria kempi, sp. nov.

(Plate xxx, fig. 2).

Bhim Tal, 4450 ft., Kumaon, W. Himalayas, 2—10-v-1911 (*S. W. Kemp*). Two specimens.

Length 2·25-4 mm. No eyes. The prostomium forms a long narrow proboscis, in length equal to three times the diameter of the body. $n=25$.

The anterior ventral setae (fig. 2) (segments ii-v) are 120μ in length; the terminal prongs are very unequal, the distal being large, the proximal very short. The nodulus is markedly proximal, the relation between proximal and distal portions of the shaft being 1 : 2. The distal curve of the seta is slight, the shaft being straight almost to its end; there is a slight bending forwards (in the direction towards which the prongs point) of the shaft at the nodulus. The number in a bundle is six or fewer.

The posterior ventral setae (vi backwards) are 96-100μ in length. The proximal prong is perhaps even more rudimentary than in the more anterior setae. The nodulus is still proximal, but not so markedly, the relation of the two parts of the shaft being 2 : 3. There is a slight 'kinking' of the shaft at the nodulus here also. The number in a bundle is six or seven.

The dorsal setae begin in segment vi. In each bundle there is a long hair 450-600μ, *i.e.* twice, three times, or even more than three times as long as the diameter of the body. In addition to the long hair there are others, shorter, equal in length to the diameter of the body or less, 200μ down to 120μ or less, even 80μ. A third component of the dorsal bundles exists in the form of two or three short, fine, and sharp needles, 40μ in length; these do not appear to differ (except in length) from the shortest of the hairs, and may be merely a younger stage of the latter. It is possible also that the shorter hairs are merely a stage in the growth of the long hair; certainly they are much thinner, but then they naturally would be thinner if they represent only the distal portion of the fully formed long seta. There is apparently however only one long hair per bundle, which seems to mark it out as a special structure.

There are no septal glands. The gut may show either a sudden and considerable widening, or only a slight dilatation, in segments viii and ix, taking up both these segments.

Remarks.—The chief difference between this species and the common *S. lacustris* is the absence of eyes in the present case. This would seem to be an absolute distinction, since Piguet (17) states that he has seen hundreds of specimens of *S. lacustris*, but none without eyes.

Piguet also describes a pigmented band encircling the gut (not always marked) in each segment after the sixth in *S. lacustris*; I did not observe this in the present specimens. Michaelsen (13)

would limit the length of the hair setae of *S. lacustris* to, at most, a little more than the diameter of the body.

The present specimens have no resemblance to *S. lomondi*, Martin (8).

Gen. **Pristina.**

Pristina longiseta, Ehrbg.

Aquarium, Elphinstone College, Bombay, 26-ii-1913 (*S. P. Agharkar*). A few small specimens, along with some examples of *Aulophorus* (*v. inf.*).

Pristina aequiseta, Bourne.

Allahabad, Jumna River, 10-i-1909 (*A. D. Imms*). A number of specimens.

The specimens correspond with the *Naidium tentaculatum* of Piguet (17). This author has however (18) more lately united the Swiss species with the *Pristina aequiseta* of Bourne (3). This is not accepted as beyond doubt by Michaelsen (13), who denotes Piguet's species as "*P. tentaculata*, Piguet (? < *P. aequiseta*, Bourne)."

Gen. **Aulophorus.**

The collection under review contains specimens of *Aulophorus* from two localities,—a hot spring at Khed, and an aquarium in Elphinstone College, Bombay. Before assigning them to their position in the genus, I wish to make a few remarks on them, and to indicate the conclusions which it is possible to draw.

In the specimens from Khed, besides the palps, there were three pairs of gills, all about the same size, arising from within the margin of the funnel; the dorsal margin of the funnel projected backwards slightly as an indented prominence, which was apparently not gill-like (pl. xxx, fig. 3). In one specimen examined, however, the dorsalmost of the three gills, though of large size, seemed to be continuous with the margin of the funnel,—to be itself the folded margin, in fact. It may be noted also that in the specimen from which the figure is taken the anterior gill on the right side is almost completely continuous with the margin of the funnel.

In the specimens from Bombay, there are three pairs of gills, decreasing in size anteriorly, all separate from and within the margin of the anal funnel. The dorsal margin of the funnel has the form of a straight edge, without projections, and is not gill-like (this was confirmed by sections). In one specimen however the dorsal lip projects slightly,—according to my original notes, not unlike what is described for *A. stephensoni*, Mchlsn., where there is a gill-like projection on each side (*v. inf.*).

Now let us consider the following series of forms:—

(1) *Aulophorus furcatus.*—Two pairs of gills, with one pair of accessory gills, the latter being the dorso-lateral projecting margin of the funnel; when the funnel is fully

expanded these appear merely as a fold of the margin (*cf.* Stephenson, 24).

(2) The single specimen from Khed, referred to above, in which the anterior of the three pairs of gills are continuous with the margin of the funnel.

(3) The specimen figured (fig. 3), where one of this pair is well within the margin.

(4) The bulk of the specimens from Khed, with three pairs of true gills (*i.e.* all separate from and within the margin).

(5) The Bombay specimens, similar to the last, the dorsal margin of the funnel not gill-like.

(6) The single specimen from Bombay, with three pairs of gills, and projections of the dorsal margin of the funnel.

(7) *Aulophorus stephensoni*, described as having four pairs of gills, the anterior being the smallest, and forming only small projections on the margin; using the recognized terms, there are three pairs of true and one pair accessory gills.

(8) *Aulophorus palustris*, Mchlsn. (11, 22) possessing four pairs of gills, all within the margin of the funnels.

The series is not in absolute strictness one of increasing complexity throughout, since the Khed specimens (2, 3 and 4) have a somewhat projecting and indented dorsal margin, while this is quite straight in 5. But it does show in a striking manner the evolution of successive pairs of gills as differentiations of the margin of the anal funnel.

I think it will be admitted that, with the exception of number 8, the difference between the arrangements of the gills in successive terms is nowhere sufficient to allow us to separate the successive terms as different species or even varieties. No. 6 is almost identical with 7; so is 5 with 6, and moreover comes from the same limited batch of material; both 5 and 6 must therefore be united with 7. The same reasoning obliges us to unite 2, 3 and 4 with 1. But 5 is identical with 4, or even slightly less differentiated, since it wants the slight bifid projection of the dorsal margin of the funnel. From a consideration of the characters of the gills, then, we must conclude that *Aulophorus furcatus*, *A. stephensoni*, and all intermediate forms constitute a single species.

I have said "from a consideration of the characters of the gills." The case would be different if we could differentiate the terms of the series by means of other structures, —for example the setae. I do not think we can. There is a considerable amount of variation to be met with amongst these forms. Recent descriptions of *A. furcatus* have been given by Piguet (19) and myself (24); Piguet finds a stomachal dilatation of the gut in segm. viii, which was absent in my specimens, and there are slight differences in the accounts of the setae. I found that in the Bombay specimens the prongs of the posterior ventral setae were as a rule equal in length, and the distal was about two-thirds as thick as the proximal;

but sometimes the distal was shorter than the proximal, and very fine. The position of the nodulus is known to vary in setae of the same bundle in *A. stephensoni* (21), as well as in *A. furcatus* (24).

I have made a careful comparison of the setal and other characters of all the forms tabulated above; and I have come to the conclusion that the differences, such as they are, cannot be used for purposes of discrimination between them. They are of the same order as the differences of which examples have just been given, and therefore fall within the limits of individual variability.

As to the outlying term of the series, *A. palustris*, the setal and other characters here also allow of no distinction. The gap between it and its next neighbour, in regard to the gills, is however fairly well marked, and it may therefore be allowed for the present to retain the distinction of a separate specific name. *A. stephensoni*, however, must disappear, and it is probable that *A. palustris* will eventually have to follow it.

Aulophorus furcatus (Oken).

(Plate xxx, fig. 3).

Aquarium, Elphinstone College, Bombay, 26-ii-1913 (*S. P. Agharkar*). Several specimens.

Hot spring at Khed, Poona Dist., 31-x-1912 (*S. P. Agharkar*). Numerous specimens.

Some of the specimens from Bombay were sexual, though perhaps not quite fully mature (apparent absence of female funnels). However, the individuals which were examined by sections had already copulated (presence of spermatozoa in the spermathecae).

The clitellum extends from the anterior end of segment v back to the middle of vii (=$2\frac{1}{2}$). This region is not thickened, and is not distinguishable except in sections. I would not say that I definitely identified the testes and ovaries in segments v and vi respectively; there may have been some confusion with the ganglion cells of the ventral nerve cord.

Many developing spermatozoa were free in v. The spermsac, as usual a backwardly directed diverticulum of septum 5/6, extends back to the hinder end of vii.

The male funnels are cup-shaped, near the middle line, close together, indeed apparently continuous with each other. They look upwards and backwards, and are placed in the mouth of the spermsac; thus, though morphologically in v, they appear at first sight to be in vi. The vas deferens runs on septum 5/6 downwards for a short distance, and enters the anterior face of the atrium.

The atrium, in segment vi, is small, subspherical, and in the specimens examined contained ripe spermatozoa. Its wall is comparatively thin; its lining epithelium is cubical, and there is no covering of prominent peritoneal cells. The ejaculatory duct is short and somewhat invaginated upwards into the atrium; a thick cluster of cells surrounds it. The aperture is on segment vi.

The ovisac extends backwards into segment ix; as usual it encloses the spermsac. It was mostly occupied, in the specimens examined, by discrete yolk granules; a cluster of young ova was seen in segment viii, neither at the anterior nor the posterior end of the sac. The female funnel, oviduct, and aperture were not identified.

The spermathecae are ovoid sacs, confined to segment v; their long axis is mainly longitudinal, but directed somewhat downwards as well as backwards; they take up nearly the whole length of the segment in a longitudinal direction. They are thin-walled and, in the examples investigated, contained spermatozoa and granular matter There is no prominent peritoneal investment. The duct leaves the ventral surface of the ampulla; it is narrow, straight, and as long as the ampulla is high. Its lining epithelium is cubical. The aperture is near the anterior border of segment v.

Fam. TUBIFICIDAE.

Gen. **Limnodrilus.**

Limnodrilus sp.

Sona Sar Lake, Kashmir, 12500 ft., no date (*H. S. Bion*). A number of specimens.

The worms showed the first stages in the development of the genital organs. Testes and ovaries were present, but the male ducts and spermathecae were very incomplete. The diagnosis of the genus is suggested by the fact that the dorsal setae are of the same type as the ventral.

Fam. MONILIGASTRIDAE.

Gen. **Drawida.**

Drawida jalpaigurensis, sp. nov.

(Plate xxx, figs. 4, 5).

Mud at edge of R. Tista, Jalpaiguri, base of E. Himalayas, 3-vi-1911 (*N. Annandale* and *S. W. Kemp*). A single specimen, in a poor state of preservation.

External Characters.—Length about 23 mm. (the specimen was much curled up); diameter 2 mm. Colour dark grey, blotchy (? due to state of preservation), the same on both surfaces; the anterior end much lighter, almost white. Segments 106.

Prostomium ? prolobous, relatively large; first segment very short.

Dorsal pores absent.

Setae small very closely paired; $aa < bc$, $dd = \frac{1}{2}$ circumference

Clitellum not certainly distinguishable, perhaps x - xiv =5.

The male apertures are on prominent oval papillae, with their long axis transversely disposed in furrow 10/11. The papillae obliterate the furrow where they lie, and extend in a transverse direction inwards to the line of setae *b*, outwards not much more than halfway from *b* to *c*; in a longitudinal direction they take up half the length of segment xi, and nearly half of x. The apertures themselves lie between the lines *b* and *c*, but nearer to *b*.

The female apertures were not seen.

The spermathecal apertures are in furrow 7/8, between *b* and *c*, but nearer to *c*.

There is a pair of genital papillae anteriorly on segment vii. These are flat-topped and circular, with their anterior margin touching furrow 6/7, they are rather internal to the spermathecal apertures, and therefore their centres are about midway between *b* and *c*.

Internal Anatomy.—Septa 5/6, 6/7, 7/8, 8/9 are all considerably thickened, 9/10 is very thin, and so are the rest. Septa 10/11 and 11/12, in fact, seemed to be defective; no ovarian chamber had been formed and these septa were not recognizable at all dorsal to the gut. But they seem to be present in the ventral part of their segments, and a fringe on one of them perhaps represents the ovary.

The gizzards are four in number, in segments xii-xv, that in xii being smaller than the rest. These gizzards are bands of muscular gut which are separated from each other by thinner and quite soft bands of gut-wall; the bands of one kind are about equal in breadth (antero-posteriorly) to those of the other kind.

The last heart is in segment ix.

The testis-sacs are large, subovoid in shape, attached to septum 9/10, but wholly dependent into segment x, being attached indeed only by a slender neck. The sac of the right side was much posterior to that of the left, being displaced backwards by a bulging of the alimentary tube on that side. The vas deferens runs from the lower and anterior end of the testis-sac downwards, and joins the anterior end of the prostate a little to the inner side of its longitudinal axis; its course is relatively short, since though wavy it is otherwise straight.

The prostate of the right side, in the single specimen which came under examination, was vertically flattened, with a generally circular outline and small marginal lobulation. On the left side it was much more elongated, and bent on itself with the convexity looking outwards; the ental (remote from external aperture) end was posterior, thicker than the ectal portion, and markedly lobulated,—more so than the ectal part of the gland; the vas deferens here passes from the anterior end along the outer border to end at the middle of the outer surface (fig. 4).

All that can be said of the ovaries and ovarian chamber has been noted when describing the septa.

The spermathecae, in segment vii, are large ovoid sacs full of white flocculent matter, which touch each other in the middle line.

The duct passes downwards behind septum 7/8, and in its course presents a number of coils ; it then pierces the septum close to the bodywall, and immediately joins the posterior face of the atrium. The atrium here appears as a simple projection, sessile on the bodywall ; but from it, rather towards its inner side, there arises a stalked sac, in shape a much elongated ovoid, which rises vertically upwards. The stalk of the sac is about half as thick and half to a third as long as the sac proper. Both atrial swelling and stalked sac are completely contained within segment vii (fig. 5).

Remarks.—In the presence of the free sac just described the present species resembles *D. travancorensis*, Mchlsn. (14) ; from which however it is distinguished by the setal relations, the characters of the male apertures, the situation of the spermathecal apertures, and the relation of the testis-sac to the septum.

Drawida robusta (Bourne) f. **typica**.

Jungle, Coonoor 6000 ft., Nilgiris, June, 1912 (*Capt. Seymour Sewell, I.M.S.*). A single specimen.

External Characters.—Length 136 mm. ; diameter 6 mm. Colour a blotchy brownish grey, lighter at both ends. Body dorsoventrally depressed behind the anterior region ; there are indications of the demarcation of dorsal, ventral, and lateral areas, as in a number of other Moniligastrids (*e.g. Drawida ghatensis, Moniligaster deshayesi* var. *gravelyi, cf.* 25). Segments 176.

Prostomium prolobous ; segments i and ii very narrow.

Dorsal pores absent.

On segments iii - xviii there are a number of minute white papillae arranged in a ring round the segment, and looking like the papillae on which setae are implanted in Perichaetine forms, though they are not quite as regular as these. They are situated in line with the setae in each segment ; they may be met with also behind segment xviii. Similar papillae occur in other Moniligastrids also (*cf.* description of the two species just mentioned), and it would be worth while investigating them histologically in a well preserved specimen; they are not improbably sensory in nature.

The setae are very minute, and very closely paired ; $aa > bc$; dd is distinctly more than half the circumference. No ventral setae are distinguishable in segment ii ; lateral setae in this segment could be seen only on the right side.

Nephridiopores are in the line cd ; there is no alternation in position.

No clitellum was distinguishable.

The male apertures are conspicuous slits with tumid lips in furrow 10/11 ; the middle point of each aperture is between the lines of the ventral and lateral setae, slightly nearer the latter.

The female apertures were doubtfully identified as a slight whitening of furrow 11/12, in the lines of the ventral setae.

The spermathecal apertures appear on separating the lips of furrow 7/8 as slits a little below the level of setae *e*.

Internal Anatomy.—Septum 5/6 (the first) is slightly, 6/7 moderately, 7/8 and 8/9 considerably thickened.

There are four gizzards, in segments xii-xv.

The last heart is in segment ix.

The meganephridia are of the usual type in the family.

The testis-sacs are large, subovoid, asymmetrical. The left projected into both ix and x, but more forwards into ix, where in this specimen it reached septum 8/9; it is not constricted by the septum 9/10 on which it is suspended. The right projected backwards only, reaching and bulging back septum 10/11.

The vas deferens forms a closely packed coil in front of 9/10; if unravelled it would form a tube of considerable length. Its first portion is very fine.

On opening the testis-sac and shelling out the contents the thin transparent sac-wall shows a slight but well-defined circular opacity around the commencement of the vas deferens; this thickening represents the funnel. The testis is a small round mass attached to the wall of the sac just in front of the funnel. Both funnel and testis were anterior in position to the septum on the left side (this sac being the one opened).

The prostate, in x, is a white ovoid mass attached to the parietes by a narrower base. The junction of the vas deferens was not seen distinctly; but the vas seems to go under the peritoneum and some muscular strands in the last part of its course, and to join the base of the prostate at the outer and anterior side of the gland. Exceptionally numerous and definite muscular bands radiate outwards and backwards from the base of the prostate to the bodywall.

The ovarian chamber, limited as usual by septa 10/11 and 11/12, remains unopened in the dissection for opening and displaying the worm, *i.e.* these septa meet and fuse some distance beneath their combined attachment to the dorsal parietes. The chamber contains the nephridia, ovaries and oviducal funnels. The ovaries, not fully developed in the present specimen, appear each as a fringe on the anterior wall of the chamber, and arch upwards on each side towards the middle dorsal line. No egg-sacs were developed in the present specimen.

The spermathecae present a pear-shaped ampulla, which narrows at its outer and lower end to form the duct. This latter forms a long coiled tube in segment viii, which passes downwards behind 7/8 to the junction of the septum with the parietes. Here it joins the atrium, which is partly buried in the bodywall, but when freed forms a finger-like, somewhat curved projecting lobe on each side of the septum.

Remarks.—The original account of this species is by Bourne (2, 4). The above description is fairly complete, and adds a considerable number of details.

Fam. MEGASCOLECIDAE.

Gen. **Pontodrilus.**

Pontodrilus bermudensis, Bedd. f. **ephippiger** (Rosa).

From a rotten palm tree lying in the water, Pamban, Ramnad Dist., 21-ii-103 (*S. W. Kemp*). Several specimens.

Gen. **Megascolides.**

Megascolides tenmalai, Mchlsn. var. **karakulamensis,** var. nov.

(Plate xxx, figs. 6, 7).

Karakulam, 17-x-1911. Two specimens, both incomplete posteriorly.

External Characters.—Length 70 mm. +; breadth 1-1½ mm. Colour a nondescript medium grey, clitellum brownish yellow. Segments 93 +.

Prostomium absent (or invisible).

Dorsal pores small, the first in groove 4/5 (?).

Setae in front of clitellum have the following relations :—taking the interval *ab* as the standard, $aa = 2ab$ ($= 2\frac{1}{2}ab$ near anterior end), $bc = 2ab$, $cd = 1\frac{1}{2}ab$. Behind the clitellum $aa = 2\text{-}2\frac{1}{2}ab$, $bc = 2ab$, $cd = 1\frac{1}{2}ab$ or less. The seta *d* is above the lateral line of the body, *dd* being about ⅓ of the circumference.

The clitellum extends ventrally from xiv-½xvii = 3½, dorsally xiv-xvi = 3. A faint annulation is visible; ventral setae are not discoverable on these segments.

The male pores, on segment xviii, are associated with a pair of irregularly ovoid elevations, longitudinally placed with the anterior ends slightly converging. The posterior ends of these elevations are narrower than the anterior; the male apertures are possibly on the inner margin of the elevation, in a slight indentation where the narrower passes into the broader part; if so, they would be in line with seta *a*. The anterior slightly converging ends of the elevations are thus within *a*; in length the elevations take up about the length of the segment, but slightly transgress groove 17/18 in front and fall short of 18/19 behind (fig. 6).

The female pore or pores are contained within a circular whitish patch on xiv, just behind the groove 13/14. The extent of the patch is less than the interval *aa*.

The spermathecal apertures, small, in 7/8 and 8/9, are in line with *b*.

Internal Anatomy.—Septum 4/5 is very thin, 5/6 thin, 6/7 somewhat thickened, 7/8-10/11 moderately thickened, 11/12 onwards somewhat thickened even as far as 18/19.

The gizzard is in segment v, of moderate size, and rather soft. There are no calcareous glands. The intestine begins in xvii.

The last heart is in xiii.

Beginning from the hinder end of the pharynx, the micronephridia form large tufts in each segment, but there are none on

the bodywall in front of the clitellum,—none visible, at any rate. Behind the clitellum the disposition is quite different; the micronephridia, few and relatively large, are attached to the bodywall; towards the posterior end of the (incomplete) specimen there were about half a dozen nephridia of moderate size on each side in each segment, but no meganephridium.

Testes and funnels are free, in segments x and xi. The vesiculae seminales are two pairs, in xi and xii, on the anterior wall of each segment. Those in xi are very small, those in xii of moderate size.

The prostates are one pair, long, flat and strap-like, with slightly lobed margins, and extending backwards to segment xxi; they look at first sight like small flattened masses of coagulum on the bodywall. The portions of the gland in successive segments are connected only by narrow necks; but each of the quadrangular expansions which occupy the individual segments appeared to be lobular in constitution, and the margins are slightly indented. One gland was sectioned; not more than one duct was visible, which was seen to give off, in one section, a small side branch; but even the single central duct becomes difficult or impossible of distinction some distance down the series.

The prostatic duct begins near the anterior inner angle of the gland, and forms an oval loop, passing first inwards and backwards, then curving round outwards and forwards; it is of equal diameter throughout and is confined to segment xviii. No penial setae were discovered.

Ovaries were present in xiii; funnels were not identified. A couple of small structures in xiv may perhaps represent ovisacs; but the specimen was too small to allow a definite determination of their nature.

The spermathecae (fig. 7) are pyriform sacs, narrowing to form a duct which is not marked off in any way from the lower part of the ampulla. A single diverticulum arises from the middle of the length of the duct; it is narrow and club-shaped, with a simple cavity, and in length is about two-fifths as long as duct and ampulla together. No spermatophores were seen; and there were no glandular appendages round the duct.

Remarks.—The differences of the above specimens from the typical form (Michaelsen, 14) entitle it to rank as a variety. The distinguishing marks are the prostomium, the setal intervals, the smaller extent of the clitellum, the position of the gizzard (here in v), and the absence of glands round the spermatheca. I think the nephridia are also likely to form a distinction; Michaelsen could not see any; they must therefore be very small in the typical form, or else Michaelsen's specimens must have been in a very bad state of preservation,—which however is not stated to have been the case. Even in a badly preserved specimen I think nephridia of the size of those I found would probably have been visible. Michaelsen puts the male pores *on* the swellings in xviii; they seemed to

me to be probably at the inner margin, but I will not say that they might not be at the outer margin with almost equal probability.

Megascolides oneilli, Stephenson var. **monorchis**, var. nov.

Darjiling to Soom, 7000-5000 ft., E. Himalayas, 14-vi-1914 (*F. H. Gravely*). A single specimen.

External Characters.—Length 115 mm., maximum breadth 5 mm. Colour pale buff, somewhat mottled on dorsal surface and towards posterior end. Segments 188; segments iv, v biannular, the rest triannular as far as some distance behind the male pores.

Prostomium prolobous.

Dorsal pores very obvious, from groove 9/10 onwards.

Setae very small, paired. Behind the clitellum the relations, expressed in terms of the distance *ab*, are:— $aa = 3\text{-}4ab$, *bc* is rather less than *aa* and $= 3ab$, $cd = 2ab$ or rather less further back. In front of the clitellum *aa* is rather less, > or $= 2ab$, *bc* = or < $3ab$, *cd* as before $= 2ab$. The interval $dd = \frac{2}{3}$ circumference, or nearly.

The clitellum was indistinguishable.

The male pores are on segment xvii. Ventrally this segment presents a somewhat thickened pad, extending laterally rather beyond *c*, and taking up the whole length of the segment in an antero-posterior direction. The apertures are minute, between the lines of setae *a* and *b*. Secondary furrows are present in front of and behind the apertures, somewhat as in the typical form. Setae *cd* of xvii are present, but *ab* are absent. The anterior two-thirds of the ventral surface of xviii is also thickened, and the ventral setae are absent.

The female apertures are not visible.

The spermathecal apertures are in line with *a*, in grooves 6/7 and 7/8.

Internal Anatomy.—Septum 5/6 is thin, 6/7-9/10 are much strengthened, 10/11 and 11/12 somewhat strengthened, and the next few decreasingly thinner.

The gizzard is large and barrel-shaped, in segment vi, and is preceded by a soft dilated crop-like portion of the oesophagus. Well-marked calcareous glands are present in segments viii-xii; each is kidney-shaped, well set off from the gut, and contained within the curve of the corresponding heart. The intestine begins in xiv; there is a conspicuous typhlosole of a curious appearance, characterized by possessing numerous closely set transverse folds along each side.

The last heart is in xii.

There are large tufts of micronephridia by the side of the crop, but in general the nephridia in the anterior part of the body are minute and scattered. At the posterior end of the body the arrangement is different; meganephridia are present in addition to micronephridia, as very slender and much elongated loops. The meganephridia are not seen in any number on the bodywall on pinning out the animal, since for the most part they remain

attached to the intestine. They have an attachment dorsally to the dorsal vessel, by a connective tissue strand, at about the middle of each segment, and extend downwards nearly as far as the level of seta *b*.

Testes and funnels are free in segment ix, and in this segment only. Vesiculae seminales are present in segments x, xi and xii, on the anterior wall of each segment; those of x were of moderate size, those of xi and xii were small and obviously not fully developed,—indeed the one on the left side of xii was wanting.

The prostate, in the single specimen, was small, tongue-like, and contained mostly in segment xix; passing forwards it becomes the considerably coiled duct, which remains soft and non-muscular, and, keeping the same diameter all the way, ends in segment xvii. The vas deferens joins the gland at its base, where it passes into the duct. From the number of strands which radiate from the neighbourhood of the male aperture to the bodywall this region appears to be very retractile.

Small ovaries were present on both sides.

The spermathecae were small and not fully developed. They were situated in segments vii and viii, opening in 6/7 and 7/8, near the middle line, and appeared as small ovoid sacs, narrowing to a duct, which is scarcely separately distinguishable; there is a single diverticulum which arises from the base of the ampulla, is cylindrical in shape, and about half to two-thirds as long as the ampulla.

No penial setae were discoverable.

Remarks.—The remarkable shifting forwards of the organs in the anterior part of the body occurs here as in the type form (23). The chief differences which mark the present example as distinct are the extra pair of calcareous glands in segment viii, and of seminal vesicles in xii, and especially the presence of only a single pair of testes and funnels. Less important are the differences in the setal arrangement, and in the extent of the dorsal pores.

Through the kindness of Dr. Annandale I was able to re-examine the type form of the species, in order to compare the condition of the nephridia in the hinder part of the body. Here also I found meganephridia of considerable size, which lie, in the dissection, not on the bodywall but on the intestine; the nephridia are attached to the intestine in the immediate neighbourhood of the dorsal vessel; each consists of a series of loops, of which the dorsal are the largest; and thus each nephridium as a whole is stouter dorsally and thins towards its ventral end.

I also took the opportunity of re-examining the type form as regards the prostates. I found that they were much lobulated, indeed cut up to an extreme degree, and nothing could be further from the tubular type. The condition is illustrated in pl. xxx, fig. 8. The difference between the variety and the type form is probably due to the earlier stage of development of the latter.

Gen. **Lampito.**

Lampito mauritii, Kinb.

Trivandrum ; numerous specimens taken on a number of occasions.
Cape Comorin, 7-xi-1911. Several specimens.
Under stones by tank, Museum compound, Calcutta, 9 and 11-iv-1910 (*F. H. Gravely*).
In mud in flower-pots, Ross I., Andamans, 26-iii-1911 (*C. Paiva*). A single specimen.
Siliguri, base of E. Himalayas, 3—4-vi-1911 (*N. Annandale* and *S. W. Kemp*). Three specimens.

Lampito dubius, sp. nov.

(Plate xxxi, fig. 9).

Kurseong, E. Himalayas, 4700 ft., 14—17-iv-1911 (*N. Annandale*). A single specimen.

External Characters.—Length 106 mm., but originally more, as the hinder end was regenerated. Breadth 6 mm. Colour slate blue, slightly lighter on the ventral surface. Segments 94 plus 40 regenerated, and in addition a small undifferentiated zone.

Prostomium epilobous $\frac{1}{2}$; the sides of the tongue, wide apart anteriorly, almost meet behind at an obtuse angle.

Dorsal pores from 6/7.

The setae are disposed in rings, the dorsal break being small, about equal to *2yz*, irregular, or sometimes absent. There is no ventral break, and the ventral setae are smaller and closer together than the dorsal The numbers counted were as follows:—91/v, 88/ix, 69/xii, *ca.* 81/xix, 82/xxvi.

No clitellum was visible.

The male pores are on segment xviii. The midventral portion of the segment is pale in colour and presents a short transverse groove just behind the line of the setae, the setae being on the sloping anterior wall of the groove. In the groove are two small slits, the male pores, close to the midventral line. A few setae in the neighbourhood of the slits appeared to be lost, but none seemed to be transformed.

The female aperture is represented by a slight transverse depression midventrally on xiv, a little in front of the line of the setae, but no opening was distinctly visible.

The spermathecal apertures were indistinct, close together, but slightly wider apart than the male pores, in 7/8 and 8/9. They seemed not to have pierced through to the exterior.

Internal Anatomy.—Septum 4/5 is present, but thin; 5/6, 6/7 and 7/8 are slightly strengthened, 8/9 is moderately thickened, and all succeeding septa down to 15/16 are considerably strengthened. After this the thickness gradually diminishes, but some strengthening is visible as far as 28/29.

The gizzard is large and firm, and takes up two segments, v and vi. There are firm lateral swellings of the oesophagus in segments x to xiii, which when opened present on their inner walls

very numerous and closely set villous processes; the swelling and the processes are both less marked in xiv, but there seems to be no definite posterior limit to this portion of the canal. The intestine begins in xix; the typhlosole in the middle of the body is low, and presents a number of parallel transverse folds.

The last heart is in xiii.

The condition of the nephridia is interesting. On the body-wall, in each of the most anterior segments, are a number of tufts, one on each side, each component of a tuft being a fairly stout coiled micronephridial tube; there are about half a dozen such tubes in each tuft, and all these loops or coils converge and are united at the base of the tuft into what may be compared to the main trunk of a bush. In segment vi, on the right side, the tuft is large, and two loops are considerably longer than the others; in vii the five loops or coils are of various sizes, from long to short; in viii and ix two are much longer than the rest; but this is not so noticeable in the immediately succeeding segments. In xii, of three coils, two are long and one short; in xiii there is a diminishing series of four. After this there is constantly one long loop stretching outwards on the bodywall. In addition, there are a large number of very minute micronephridia scattered further out on the bodywall; but not in the most anterior segments,—that is not in front of about segment x.

In the middle region of the body there is a large meganephridium and a number of small micronephridia on each side in each segment. The latter form a transverse line about the middle of each segment. Each meganephridium (fig. 9) begins as a cluster of funnels, about half a dozen in number, underneath the intestine; they are situated just in front of the posterior septum of the segment. The tubes leading from the funnels pierce the septum in a bunch, and become continuous with the main portion of the nephridium, which is situated as usual in the segment behind the funnels. This portion presents, besides a mass of coiled tubes, the course of which I did not minutely investigate, two considerable loops, which stretch outwards on the bodywall; one stout and conspicuous, and another, which at first escaped my observation, inconspicuous and very thin, but very long; the parallel limbs of which this longer loop is constituted extend very far out on the bodywall, almost to the mid-dorsal line.

The funnels, examined microscopically, show a deeply indented lip on one side of the margin; cilia were seen in various parts of the tube, but I could not distinguish any on the funnel; a mass of disintegrating cells was seen to surround the apertures of the funnels.

Testes and funnels are free in segments x and xi.

Vesiculae seminales are present in segments xi and xii. In xi there is a single sac, attached to the anterior septum of the segment, large, flocculent looking and not lobed, extending quite undivided across the middle line. In xii the sac is small, similar in position, and also continuous across the middle line.

The prostate, situated posterior to the nephridium in xviii, is extraordinarily small. It appears as a small white mass frayed out into a number of finger-like processes laterally; it is almost sessile on the bodywall, and no separate duct is visible.

Ovaries and funnels are present in the usual situation. A curved ridge on each side on the posterior face of 13/14, embracing with its fellow the alimentary tube, may possibly represent an ovisac.

No trace of spermathecae was visible internally.

Remarks.—There is a possibility that the specimen is immature. The absence of spermathecae (though there is an indication of their apertures), small size of prostate, and absence of clitellum seem to point to this; the rest of the sexual apparatus however is well developed, and small size or absence of prostate is not very infrequent (*e.g.* the common *Pheretima heterochaeta*, Michlsn.). The condition of the nephridia however decided me to describe the specimen; one might say that the meganephridia are here caught in the act of dividing up. The mixed mega- and micronephridial condition which results is certainly not that of the known species of *Lampito* however, and the systematic position of the specimen is a little puzzling.

Gen. **Perionyx.**

Perionyx excavatus, E. Perrier.

Almora, 5500 ft., Kumaon, 16-ix-1911 (*C. Paiva*). Several specimens.
Under stones or mud by tank, Museum compound, Calcutta, 8-iv-1910 (*F. H. Gravely*). Three specimens.
In leaves of water plants, Sahasar Dhara, near Dehra Dun, 6-iv-1914 (*Prof. S. R. Kashyap*). A single specimen.
Painsur, above Lohba, 8000 ft., 23-iv-1914 (*Col. Tytler*). Several specimens. (Doubtful, immature).

Perionyx pulvinatus, sp. nov.

(Plate xxxi, figs. 10, 11).

Near Ghoom, 7000 ft., E. Himalayas, 16-iv-1911 (*N. Annandale*). Six specimens.

External Characters.—Length 57 mm., maximum breadth 3·5 mm. Dorsally the colour is in general a deep brown with darker median stripe, but is lighter over and in front of the genital region; ventral surface pale. Body dorso-ventrally compressed, except the most anterior segments; ventral surface flat, indeed rather concave; posterior end tapering. Segments 126.

Prostomium well-marked, epilobous $\frac{1}{2}$, tongue delimited by a groove behind; prostomium and first two segments marked by a median dorsal groove.

Dorsal pores exist from furrow 5/6.

The setal ring shows a small and irregular dorsal break; $zz = 2\text{-}3yz$. The neighbouring intersetal distances are also irregular. The ring is unbroken ventrally; and the setae are much closer ventrally than dorsally. All the setae are small and difficult to count. The following numbers were met with: 56/vi, 54/ix, 50/xii,

48/xix; but these figures must not be considered as anything more than approximate.

The clitellum covers xiii—½xix = 6½. It is rather indefinite, and setae and dorsal pores are present.

A conspicuous depression on the ventral surface, rectangular with rounded corners, takes up the whole length of segment xviii and neighbouring parts of xvii and xix; the breadth of the depression is slightly greater than its length. Within this depression are two large oval cushions, touching each other in the middle line, and taking up nearly the whole of the depression,—but in such a way as to leave deep transverse hollows in front and behind, while laterally their margins merge into the margin of the general depression. The apertures are anterior and internal to the middle point of each cushion, and hence are in front of the line of setae of the segment (fig. 10). In one specimen the cushions were not situated in a depression; in another the cushions were fused with each other in the middle line, and there was considerable tumidity around the apertures.

The female aperture is single, and is situated on segment xiv between the line of the setae and the anterior limiting furrow.

The spermathecal apertures are large, in 7/8 and 8/9, about one-half of the circumference apart, and opposite the tenth seta on each side.

Internal Anatomy.—No septa are notably thickened; 7/8 is perhaps slightly so.

There is a very rudimentary gizzard in segment vi; its walls are soft and not much thickened. The oesophagus is rather bulged, and its walls have apparently a lamellate structure, in segments ix and x. The intestine begins in xv.

The last heart is in xii.

The excretory system is meganephric.

Testes and funnels are free in segments x and xi.

The seminal vesicle in segment xi is a single large lobed mass in the middle line. The second vesicle is double in segment xii, but the pair of which it is composed fuse together incompletely in xiii, and completely in xiv and xv, so that in these segments there is a single median vesicle only.

The prostates are of moderate size, lobed, of the *Pheretima* type, and occupying on each side segments xviii and xix. The duct is stout, and beginning at the middle of the gland forms a loop with its convexity forwards. The duct is bound down to the bodywall by a number of muscular bands; its first part is the broadest.

The ovaries and funnels have the usual situation.

The spermathecae (fig. 11) present an irregularly shaped ampulla with a nodular surface; its form might very roughly be called pyramidal. The duct is extraordinarily wide,—almost as wide as the ampulla; in length it is also equal to the ampulla. There is no diverticulum.

There are no penial setae.

Perionyx pincerna, sp. nov.

(Plate xxxi, figs. 12, 13).

Near Ghoom, 7000 ft., E. Himalayas, 16-iv-1911 (*N. Annandale*). A single specimen.

External Characters.—Length 45 mm.; breadth 3 mm. Colour a light brownish grey. Body cylindrical, not flattened; posterior end blunt and squarish, so much so as to give the idea of mutilation without time for subsequent repair. Segments 88.

The prostomium is epilobous $\frac{1}{4}$, the short tongue being broad and delimited by a groove behind.

The first dorsal pore is in furrow 4/5.

The setae are in rings; the dorsal break is small and irregular,—on the average less than *2yz*. In front of the clitellum the ventral break is absent, or small and irregular; behind the clitellum it is small and variable. The setae are set closer together ventrally than dorsally, but there is no apparent difference in the size of the ventral and dorsal setae, nor any marked difference in different parts of the body. The numbers counted were: 47/v, 57/ix, 60/xii, 50/xx.

No clitellum was distinguishable.

On segment xviii is a transversely elongated oval ventral depression, the margin of which being more sunk than the centre constitutes a moat around the central area; surrounding the whole is a very thick whitish lip, which, though not much raised above the general surface, extends as far as to embrace the posterior half of xvii and the anterior half of xix. The actual apertures are scarcely visible, but may be in line with setae *c* or *d*. A few penial setae are visible as blackened points in the neighbourhood of the male pores (fig. 12).

The female aperture is not visible.

The spermathecal apertures are small slits near the middle line, about one-tenth of the circumference apart, in furrows 6/7 and 7/8.

Internal Anatomy.—Septa 5/6 to 9/10 are slightly thickened.

The gizzard, in segment v, is in some degree rudimentary; it is of moderate size, but its walls are quite soft and thin. The intestine begins in xviii.

The last heart is in segment xii.

The meganephridia show no alternation in the position of their pores.

Testes and funnels are free in segments x and xi.

The vesiculae seminales, in xi and xii, are single in each segment, situated in the middle line, semicircular in shape, and arching over the dorsal vessel and intestine. They are attached to the anterior septum of the respective segments.

The prostates are small lobed masses confined to segment xviii. The duct is narrow, of the same diameter throughout, not shining nor resistant, and passes, with a slight wavy course, almost directly inwards.

The ovaries and their funnels have the usual position.

The spermathecae, in vii and viii, are simple oval sacs sessile by one of their extremities on the bodywall, and without distinguishable duct.

The penial setae (fig. 13) are of very simple form. The tip is blunt and very slightly curved, and the proximal end of the shaft is bent at an obtuse angle; otherwise the shaft is straight. There are faint sculpturings near the tip,—fine points, forming irregular and much broken circles round the terminal portion of the shaft; there are about a dozen such circles in all. In length the setae are ·63 mm., and in diameter at the middle of the shaft 24μ.

Remarks.—The species which the present form most resembles is *Perionyx aborensis*, Stephenson (23). Besides minor differences, the fusion of the vesiculae seminales, and the presence of penial setae in the present specimen, suffice to distinguish the two.

Perionyx inornatus, sp. nov.

(Plate xxxi, fig. 14).

Sandakphu, Darjiling district, 12000 ft., E. Himalayas, 14-iv-1910 (*C. W. Beebe*). A single specimen.

External Characters.—Length 96 mm.; breadth 5 mm. Colour yellowish brown. Segments 124. The specimen was not easy to examine, owing perhaps to the method of preservation, which besides contracting it had rendered it hard and brittle.

Prostomium apparently proepilobous.

Dorsal pores from furrow 6/7.

The setal rings show no ventral break, nor any dorsal break in front of the genital region; behind this, however, there is a small and irregular dorsal break. The setae are set closer together ventrally than dorsally. The following numbers were counted:—56/v, 70/ix, 75/xii, 83/xix.

No clitellum was distinguishable.

There is no apparent modification of the skin over the region of the male apertures. On segment xviii there is present a median shallow depression, with shelving sides, oval in shape with its long axis transverse. The whole extent of the depression is about one-ninth of the circumference, and the small male apertures are on its sides, about in line with the setal interval *de*.

The female apertures were not seen.

The spermathecal pores are near the middle line in furrows 6/7 and 7/8; the distance between them is about equal to that between the male pores.

Internal Anatomy.—Septum 5/6 is thin, 6/7 and 7/8 slightly, 8/9 and 9/10 moderately thickened, 10/11, 11/12, and 12/13 again slightly thickened.

The gizzard is in segment v, of squarish outline and considerable size, but soft and with comparatively thin walls, *i.e.* in some degree rudimentary. The intestine begins in xiv.

The last hearts are in xii.

The excretory system is meganephric.

Testes and funnels are free in segments x and xi.

The vesiculae seminales, in xi and xii, are single in each segment, large and conspicuous, placed dorsally over the alimentary tube and dorsal vessel.

The prostate, small and confined to segment xviii, is of the *Pheretima* type. The duct is soft, white, comparatively narrow and of the same diameter throughout; it has a straight course, passing transversely inwards.

Ovaries and funnels have the usual situation.

The spermathecae, in segments vii and viii, are simple small sacs of ovoid form. The duct is short and stout and not marked off from the ampulla. There is no diverticulum.

The penial setae (fig. 14) are in length 92 mm., in thickness at the middle of the shaft 30μ. The point is blunt, the shaft is straight and without any proximal bend; the tip is ornamented with about fourteen rows of very minute sculpturings.

Remarks.—The present species shows a certain amount of similarity to the last, from which however it is distinguished by its greater size, more numerous setae, and the characters of the male genital area. The paucity of external markings is remarkable.

Perionyx parvulus, sp. nov.

(Plate xxxi, fig. 15).

Near Ghoom, E. Himalayas, *ca.* 7000 ft., 16-iv-1911 (*N. Annandale*).
A single specimen.

External Characters.—Length 23 mm., maximum breadth 2 mm. Colour dorsally a light brown with slight purplish tinge, clitellum rather paler; ventrally a pale grey. Segments 75.

Prostomium relatively large and prominent, epilobous $\frac{2}{3}$.

Dorsal pores from furrow 4/5.

The setal rings show a small dorsal break, equal to or less than 2*yz*. The ventral break is very small,—little more than the ordinary distance between two setae. No setae are specially enlarged, and there are no considerable differences among the intersetal intervals. Near the middle of the body the number is about 40 per segment.

The clitellum, distinguishable only by its colour and only on the dorsal surface, extends over xiv—xvii. There is some modification of segment xiii also.

The male apertures, transverse and slit-like, are on segment xviii, with their centres opposite the interval *cd*. The lips of the apertures have a slightly whiter appearance. The interval between the slits is rather greater than the length of each slit. The setae of xviii begin with *f* or *g* outside the region of the slits.

The female aperture is single, between the setal row and the anterior margin of segment xiv.

The spermathecal apertures are small, in 7/8 and 8/9; six setae intervene, so that the distance between them is about equal to that between the male pores.

Internal Anatomy.—No septa are notably thickened.

A soft, small and very rudimentary gizzard is present in segment vi. The sides of the oesophagus are much swollen out in xiii, and to a less degree in xii; the swellings are not set off from the alimentary tube, and their cavity is in free communication with the lumen. The intestine begins in xv.

The last heart is in segment xii.

The excretory system is meganephric.

The male funnels are present in segments x and xi; testes, present in xi, were not certainly identified in x. The vesiculae seminales depend from the anterior wall of their segments into xi and xii. They are large flocculent-looking masses, squarish and not lobed, each meeting its fellow dorsally in the middle line, but not fusing there.

The prostate is a compact-looking mass, confined to segment xviii and causing septum 17/18 to bulge forwards. Its inner face can be separated into lobes. The duct arises in a hilus, forms a small loop with its convexity upwards (in the position of the dissection), and then passes inwards to its aperture; it is of the same diameter throughout and rather soft.

The ovaries and their funnels have the usual situation.

The spermathecae, lying in segments viii and ix, are small and extremely simple in form; they are cylindrical with a rounded internal end, without any distinct duct, and without diverticulum.

The penial setae (fig. 15) are small, in length ·525 mm., and in breadth at the middle of the shaft 14μ. The shaft is straight and tapers towards the tip; the tip itself however is blunt and squarish. Near the tip are a number of relatively stout short spines, arranged in rings, of which there are about five.

Perionyx fulvus, sp. nov.

(Plate xxxi, fig. 16).

Calcutta, 3-viii-1910 (*R. D. Banerjee*). A single specimen, incomplete posteriorly.

External Characters.—Length 106 mm. (+), diameter 3·75mm. Colour yellowish brown, almost unpigmented, anterior segments with a darker, slightly bluish tinge dorsally; a median dark dorsal stripe along whole length. Segments 139 (+).

Prostomium epilobous $\frac{1}{2}$, tongue partly cut off behind by an inturning of the sides.

Dorsal pores from groove 4/5; an indication of a rudimentary pore in 3/4.

The setal ring presents a small and rather irreguiar dorsal break, on an average less than *2yz*. There is an irregular small ventral break in the anterior part of the body (less than *2ab*), but none at all posteriorly. The setae are closer together ventrally than dorsally. The following numbers were counted:—48/v, 55/ix, 52/xii, 53/xix, 55/xxv.

The clitellum, not very distinct, extends over xiii - xvii = 5; the body is rather narrower here.

The male apertures, not very close together on segment xviii, are situated on small porophores which are slightly depressed and turned inwards towards each other, so that the apertures point (in the normal position) inwards as well as downwards. The papillae are separated from each other by a small median groove, and are bounded in front and behind by transverse grooves, but are not delimited from the general surface at their outer border.

The female pore is a conspicuous round aperture on segment xiv, midway between the row of setae and the anterior border of the segment.

The spermathecal apertures, in furrows 7/8 and 8/9, are close together near the middle line. The grooves are obliterated at the situation of the pores, which are level with the general surface.

Internal Anatomy.—Septum 4/5 is extremely thin, 5/6 and 6/7 are thin, 7/8 and 8/9 slightly thickened, and the rest thin.

The gizzard, in segment vi, is small, rather square in shape, soft, and rudimentary. Moderately large kidney-shaped calcareous glands are present in xiii, in xi and xii there are lateral enlargements of the oesophagus which are not set off from the tube. The intestine begins in xvi.

The last heart is in xii.

The excretory system consists of meganephridia, the openings of which do not alternate.

Testes and large male funnels are free in segments x and xi. Vesiculae seminales are present in xi and xii; the sacs in xi are large and meet dorsally but do not unite; those in xii are united and prolonged backwards through xiii.

The prostates, in segment xviii, are rather small, compact and squarish masses, not cut up into lobes. The soft short duct lies curled up in a hollow on the inner and under side of the gland; it becomes broader towards its ectal end.

The ovaries and funnels occupy the usual situation.

The spermathecae are considerable sacs, of an irregular ovoid shape, with, in cases, small wart-like projections. The duct is short and stout, and there is no diverticulum.

The penial setae (fig. 16) are in length ·83 mm., in breadth 20μ at the middle of the shaft, and 18μ nearer the distal end. The shaft is almost straight, the tip slightly curved and pointed. The distal end is ornamented with about twelve rings of narrow, comparatively long spines.

Perionyx sp.

(Plate xxxi, figs. 17, 18).

Peradeniya, Ceylon, 26-vi-1910 (*E. S. J.*). A single specimen.

External Characters.—Length 8 mm., maximum diameter 1 mm. According to a note in the tube, the ground colour of the living worm was whitish, and each segment was girdled with a broad

dark reddish-brown and black band. In the preserved condition the ground colour was still whitish, and the bands were of a dark purple; in width the bands were the equivalent of more than the middle third of each segment; they were less distinct ventrally, especially behind the genital region. The setae were indicated by whitish points in the dark rings. Segments 30, but the specimen had previously been mutilated at the hinder end.

Prostomium epilobous $\frac{1}{2}$, with curved posterior border.

The dorsal pores begin from furrow 4/5.

The setae are in unbroken rings; I was unable to count them, but found them set closer together ventrally than dorsally.

No clitellum was visible, nor was it, later, distinguishable in sections.

The male genital area, on segment xviii, is a clean-cut oval with its longer axis transverse, which occupies the whole length of the segment. The apertures appear as black points on considerable rounded papillae which project upwards slightly from the floor of the oval depression; these papillae are almost confluent, being divided from each other only by a slight longitudinal depression in the middle line. The depth of the oval is therefore greatest in two transverse lines within its anterior and posterior boundaries respectively (fig. 17).

The female aperture was not distinguishable.

Spermathecal apertures were made out near the middle line as minute white points in the furrows from 5/6 to 8/9; but sections subsequently showed them to be seven pairs in all, beginning in 2/3.

Internal Anatomy.—This was investigated by means of sections.

The pigment of the bodywall appears as an opaque darkish green in the stained sections; it is disposed as a ring in each segment in the deeper portion of the circular muscular coat, and altogether superficial to the longitudinal fibres.

The first septum is 4/5; that and the following one are thin; the rest are all of the same thickness, none being specially thickened.

The septal gland cells extend back into segment vii.

There is no trace of a gizzard. The oesophagus extends from the pharynx to the intestine as a straight, almost perfectly cylindrical tube, without segmental swellings, widening very gently however in xii, xiii, and xiv before suddenly dilating to form the intestine in segment xv. The internal surface of the oesophagus is somewhat more papillose in xiv than elsewhere, without however forming lamelliform folds or calcareous glands.

The last heart is in xii.

The excretory system is meganephridial.

Testes and funnels are free in segments x and xi, enveloped in masses of developing spermatozoa which fill up the whole of the two segments.

The vesiculae seminales, in xii, attached to the posterior face of septum 11/12, are paired, and come near but do not touch each other in the middorsal line.

The prostates, compact in form, are confined to xviii. The duct is stout and very muscular, and passes from the middle of the gland downwards and then inwards.

The ovaries and their funnels have the usual position.

The spermathecae are seven pairs, the first opening in furrow 2/3 and the last in 8/9. The ampulla is ovoid, the first of the series is ·2 mm. long, and some subsequent ones ·25 mm. The duct is short and comparatively stout,—half the length and half the thickness of the ampulla. The diverticula are either one or two in number, globular, in diameter ·06 to ·12 mm., and attached by short stalks to the junction of ampulla and duct.

The penial setae (fig. 18), in length ·27 mm. or possibly as much as ·3 mm., and in breadth 7μ near the base, are absolutely straight and rod-like; and taper very gradually along the shaft, more suddenly at the tip, which is bluntly pointed. There is an ornamentation of fine spines at the distal end.

Remarks.—This is a particularly well-marked species, by reason of the bands of pigment and the extraordinarily large number of spermathecae. It is possible however that it has already been described. Michaelsen (10) has given an account of a form which he has named *P. ceylonensis*, also from Peradeniya in Ceylon. Unfortunately I am for the present unable to obtain his paper, so that I am quite in the dark as to whether this species is or is not the same as his. Should it ultimately turn out to be the same, a second and independent description of this interesting little worm will perhaps not be altogether without value.

Gen. **Notoscolex.**

Notoscolex gravelyi, sp. nov.

(Plate xxxi, fig. 19; pl. xxxii, fig. 20).

Lady Blake's Drive, Kandy, Ceylon, 22-v-1915 (*F. H. Gravely*). A single specimen.

External Characters.—Length 29 mm., maximum breadth 1·75 mm. Colour a dirty brown (white in life according to a note accompanying the specimen). Segments 110.

Prostomium epilobous $\frac{1}{2}$, tongue broad, cut off behind.

The first dorsal pore apparently in furrow 9/10.

The setae are widely paired. In the anterior part of the body $ab = \frac{3}{8}aa = \frac{3}{5}bc = cd$, and dd is equal to half the circumference. Posteriorly ab and cd are a little greater relatively to aa and bc, and cd may be rather greater than ab. At the hinder end $aa = bc = cd$ or almost so (*i.e.* the lateral setae are no longer paired); ab is about $\frac{2}{3}aa$, and dd considerably less than half the circumference.

The clitellum extends over xiv-xvi = 3.

The male apertures are situated on segment xviii in line with setae b, on slightly raised transversely oval areas which extend

inwards to *a*, but not outwards to a corresponding distance outside *b*.

The female apertures are apparently paired, in a minute whitish groove equal in length to the interval *aa* and situated just in front of the level of the setae.

The spermathecal apertures were not seen externally. From the dissection they were found to lie in furrows 7/8 and 8/9, a little ventral to the line of setae *c*.

A pair of small papillae on segment xvii in front of the male pores may quite possibly be artefacts.

Internal Anatomy.—Septum 5/6 is apparently present, but very thin; 6/7 is very thin; 7/8 is still thin, though thicker; 8/9 is slightly strengthened, 9/10 moderately so; a number of succeeding segments are moderately or slightly strengthened, as far as 13/14, but it is difficult to be precise as regards these degrees in so small a worm.

The gizzard, in segment vi, is large, barrel-shaped, and firm. The oesophagus is much bulged laterally in xv and xvi, but there are no separate calcareous glands. The intestine begins in xix.

The last hearts are in xiii.

The excretory system shows a mixed condition. In and in front of the prostatic segment, as far as segment x, bushy tufts of micronephridia, of relatively considerable length, are implanted ventrally in each segment, one on each side by the side of the alimentary canal; in ix the tuft is implanted on the anterior face of 9/10 or at least is adherent to it; in viii none were seen; but there are very large tufts on each side behind the pharynx, on a level with the anterior end of the gizzard.

Behind the prostate mega- and micronephridia coexist. The first meganephridium is in xx; thence backwards the meganephridia are prominent structures, appearing as elongated loops in each segment, and so continue through and behind the middle of the body. Towards the posterior end they become less conspicuous, and the micronephridia, which have accompanied them throughout, become more numerous and relatively more prominent. About twenty segments from the end the meganephridium becomes indistinguishable, or only doubtfully distinguishable, from the micronephridia. The nephridia cover the bodywall on each side from the level of *b* to above *d*, or rather more than one-third of the half-circumference.

The small testes and moderate-sized funnels are free in segments x and xi.

The vesiculae seminales are small, racemose in form, and situated on the anterior septa of segments xi and xii.

The prostate is small and confined to segment xviii; it is compact in form and only slightly lobed on the surface; possibly, in the single specimen available, it is not fully developed. The duct begins in the middle of the gland as from a hilus; it is comparatively long, shining, with a rather bent or wavy course, and passes transversely inwards.

The ovaries are large, in xiii. A pair of relatively considerable ovisacs are present in xiv, attached to septum 13/14 along a curved line on each side of the alimentary canal.

The spermathecae (fig. 19) are two pairs, which pierce the bodywall in a rather lateral position in 7/8 and 8/9. The ampulla is elongated, of a rather irregular ovoid shape, and narrowing without any distinct demarcation to become the duct, half as long and half as wide as the ampulla itself. The diverticulum is implanted at the junction of ampulla and duct, and has the form of an ovoid sac with a stalk as long as itself. The whole diverticulum including the stalk is about one-third the length of the main ampulla.

The penial setae (fig. 20) are in length ·9 mm., and in thickness 7 μ; thus they are relatively very narrow. They have a gently undulating shape, but the proximal half is fairly straight, the curves being mainly in the distal portion. The tip is pointed; the end may taper gradually, or there may be a slight bulbous swelling just above the extreme point. There is no ornamentation, but there is a curious series of minor irregularities all along the distal portion of the shaft, which are illustrated in fig. 20.

Remarks.—Notoscolex is a micronephridial genus; the presence of a species with a mixture of mega- and micronephridia is however perhaps not more anomalous than the presence of similar species in the genus *Megascolex* (*cf.* descriptions of several such species in Stephenson, **25**). *Perionyx* also, a typically meganephridial genus, contains a species with the mixed condition (*P. annulatus*, Stephenson, **23**). The present species is near *N. sarasinorum*, of which it may even be the direct ancestor. I at first thought of putting it in *Woodwardia*,— a genus with perichaetine setae, meganephridia, and *Pheretima* prostates; and it may indeed represent a connecting link between the two genera. It is usual, however, to derive *Notoscolex* from *Megascolides* by increased breaking up of the nephridia and development of a lobed prostate (*Pheretima*-prostate) out of the tubular prostate of the latter genus. But there is no reason, as far as I can see, why some of the genera of Megascolecinae should not be polyphyletic;— *e.g.* *Megascolex* itself may be derived both from *Notoscolex* by the multiplication of setae, and from *Lampito* (and so ultimately, perhaps, from the *Perionychella* forms of *Perionyx*) by the breaking up of the nephridia; such a double origin appears to be hinted at by Michaelsen (**12**).

It may be remarked that if *Lampito* is a valid genus, separated from its allies on account of the mixed mega- and micronephridial condition, the present species might also lay some claim to generic distinction.

Gen. **Megascolex.**

Megascolex ratus, Cogn.

Trivandrum, 1911. A number of specimens on several different occasions.

A few notes may be added to supplement the original description (5)

The prostomium was proepilobous in some specimens.

In front of the clitellum the ventral break in the setal ring was small, equal to *2ab* or *3ab*, and the ventral setae were numerous and closely set at slightly irregular intervals; the dorsal break was irregular, and both it and the intersetal distances on the dorsal side were greater than the corresponding intervals on the ventral side. Behind the clitellum *aa* is very regular, and equal approximately to *2ab*; the dorsal break is about the same size as the ventral, and is also pretty regular.

The clitellum includes $\frac{1}{3}$ of xiii and $\frac{2}{3}$ of xix = 6. Dorsally the greater part of xiii is discoloured, and xix is not included ventrally,—indeed in the midventral region xvii and xviii also want the purple colour which distinguishes the clitellum in general. Setae are distinguishable ventrally in xvi, xvii and xix, and less easily in xv and xiv; there are two or three on xviii between the male pores.

The most conspicuous genital markings were a pair of concave sucker-like discs, circular and sharply delimited, in 16/17, the interval between them being equal to the diameter of one of the discs. In addition there were smaller eye-like markings in 19/20, 20/21 and 21/22, circular, flat, not raised, with dark centre and lighter periphery; they may be surrounded by a slight groove. The interval between those of a pair is small, = *aa* only; in an antero-posterior direction they take up the posterior and anterior thirds of the segments bordering the grooves on which they lie. In some specimens these markings were only present on 19/20 and 20/21. In one specimen there were similar markings on 14/15 and 15 16 also.

The large firm barrel-shaped gizzard I find to be in segment v, though the septa in this region are not easy to distinguish. The first well-marked septum is 4/5, a stout sheet of tissue behind the pharynx, convex backwards; 7/8 is also thickened; and between the two there is certainly one extremely tenuous septum (6/7), as well as, in front of this, an extremely fine membrane around the gizzard,—a delicate bag in which the gizzard is contained, which is probably septum 5/6.

Megascolex konkanensis, Fedarb.

Trivandrum, 1911; numerous specimens taken on several occasions.

Out of a large number of examples a very few showed the full development of the male genital field. This I should describe as follows:—

On the flattened ventral surface of segment xviii are two large shallow depressions, oval in shape, with clean-cut margins and slightly prominent lips; the lips approach each other in the midventral line, where they are separated only by a median groove. The breadth of segment xviii is increased by the presence of these depressions; they encroach slightly on xix, and more on xvii; the axis of the oval is a little oblique, being directed forwards and

inwards. Across each oval passes a transverse ridge, at a level between a third and a quarter of the length of the oval from its posterior margin; the floor of the oval is thus formed of two declivities, an anterior longer and gently sloping, and a posterior shorter and steeper. The male aperture is probably on the ridge.

Megascolex cingulatus (Schmarda).

(Plate xxxii, fig. 21).

Lady Blake's Drive, Kandy, Ceylon, 29-v-1910 (*F. H. Gravely*). A single specimen.

In length the specimen was 53 mm., originally more, the hinder end having been mutilated and showing signs of commencing regeneration; the diameter was 3 mm.

Calcareous glands were present in segments x—xiii.

Seminal vesicles were present in segments x, xi and xii; there were none in xiii, and those in xii were not grape-like.

The spermathecae (fig. 21) are characteristic. The ampulla is soft, slightly lobed and somewhat pyramidal in shape. The duct consists of two portions, an ectal (nearer the external aperture) which is exceptionally stout, flattened, and slightly constricted below its middle; and an ental, a shining cylindrical tube, lying underneath the ampulla in the natural position of the parts; it begins at the rounded apex of the ampulla, after emerging from underneath which it dilates to form the much stouter ectal portion already mentioned. There is a single diverticulum, implanted above the constriction in the ectal portion of the tube; this is elongated, pear-shaped or club-shaped, and extends from its attachment to the base of the ampulla, against which it rests; the diverticulum, like the duct, is firm, shining and muscular. From it near its attachment originate two small stalked secondary diverticula, with one, three or four minute grape-like chambers each.

Megascolex insignis, Mchlsn.

(Plate xxxii, fig. 22).

Karakulam, 17-x-1911. Several specimens.

The dorsal pores begin from furrow 5/6 or 6/7.

The ventral break in the setal ring was found to be equal to 3*ab*. The number of setae counted was:—*ca.* 34/vi, *ca.* 34/viii, 38/xii, 34/xix, 29/xxii.

The male apertures are contained in a pair of slightly sunken darker coloured conical depressions; surrounding the depressions on the outer sides are a pair of slightly raised whitish semicircular curved lines.

The gizzard appeared to me to be in segment vi.

Ovisacs were present in segment xiv.

The spermatheca (fig. 22) differs in some respects from the original description by Michaelsen (14); a comparison of the figures will render description unnecessary.

Megascolex trivandranus, sp. nov.

(Plate xxxii, figs. 25, 26).

Trivandrum, 1911. Two specimens, taken at different times.

External Characters.—Length 72 mm., diameter 2 mm. Colour in general an equable grey, with darker middorsal line; clitellum a reddish brown. Segments 136.

Prostomium epilobous $\frac{1}{3}$ to $\frac{1}{2}$.

Dorsal pores from furrow 5/6.

The dorsal break in the setal rings is equal to 2-3*yz*. Ventrally *aa*=3*ab*, or it may be 4*ab* behind the clitellum. The intersetal distances increase towards the sides, *ab* being distinctly the smallest. The numbers were :—36/v, 43/ix, 41/xii, 34/xix, and 29 in the middle of the body.

The clitellum extends over approximately xiv—xvii = 4, or ventrally $\frac{1}{2}$xiii—$\frac{1}{2}$xvii. Setae are easily distinguishable and dorsal pores are well marked.

The male apertures are borne on small porophores on segment xviii; these are situated in *bc* or *c*, at the ends of a transversely elongated depression, which, deepest at its ends, is slightly curved with its convexity forwards. The depression is surrounded by a well marked whitish lip all round; in longitudinal extent the depression with its lips takes up the whole of segment xviii (fig. 25). In the second specimen the transverse depression was practically divided into two, its median portion being but little below the level of the general surface.

The female area is a white oval patch on xiv, in which the actual apertures could not be discriminated. In breadth it extends over the interval *bb*, in length it takes up not quite the whole of the length of the segment.

The spermathecal apertures, in furrows 7/8 and 8/9, are situated on minute papillae just external to the line of setae *b*.

Internal Anatomy.—Septa 4/5, 5/6, 6/7 are very thin; 7/8 is slightly thickened, the succeeding ones up to 11/12 moderately, thence up to 15/16 progressively less so.

The gizzard, of which one-third is contained in segment v and the rest in vi, is subspherical with a flattened anterior end. The oesophagus is segmentally swollen and dark in colour (*i.e.* vascular) in segments ix-xiv. The intestine begins in xvi.

The last heart is in xiii.

Behind the clitellum the micronephridia are arranged in a transverse row or band, just behind the septum in each segment, which does not attain the middorsal region. In segments xiv to xvi the arrangement is similar, but the individual nephridia are very considerably larger, with much more numerous coils; in

xii the row is very short and consists of one or two large tufts only. In front of the clitellum there are no nephridia on the body-wall; but in each segment by the side of the alimentary canal there is a considerable stalked tuft with numerous branches. The first tuft of the series is a large one connected with the hinder angle of the pharynx.

The male funnels are free in segments x and xi; testes were not identified.

The seminal vesicles depend from septa 10/11 and 11/12 into segments xi and xii. They are racemose and not large; those in xii however are larger than the anterior pair.

The prostates, small and confined to segment xviii, are of the *Pheretima*-type, and are made up of small closely compacted lobules. The relatively stout duct passes transversely inwards; it is thinner at its ental end and gradually widens.

The ovaries are in xiii, and in xiv there are small structures which may be minute ovisacs, or possibly only nephridial tufts.

The spermathecal ampulla is smooth, regularly ovoid, and of an opaque white colour. The duct is relatively stout, half as broad and two-thirds as long as the ampulla. There is a very long diverticulum, two-thirds as long as ampulla and duct combined; it is a coiled and twisted tube which takes origin from the termination of the duct and at its free end is dilated into a small spherical chamber with a simple cavity (fig. 26).

There are no penial setae.

Megascolex pentagonalis, sp. nov.

(Plate xxxii, figs. 23, 24).

Trivandrum, 24-vi-1911. A single specimen, incomplete posteriorly.

External Characters.—Length 108 mm.+, diameter 3 mm. Colour a uniform medium grey. Segments 94+; vii, viii and ix with three or four secondary annuli.

The anterior end of the animal is truncated, not tapering; the prostomium is seen on looking at the animal from the front; it is small and triangular, the pointed posterior angle being directed upwards.

The first dorsal pore is in furrow 5/6.

The ventral setal interval is equal to *2ab* (in front of the clitellum), or $2\frac{1}{2}ab$ (behind it). The ventral setae are in fairly definite longitudinal lines; those on viii and ix are remarkably small. The dorsal setae are not in definite lines, and the dorsal break is large; thus it is 4—5*yz* in front of the clitellum, 6*yz* or even 8*yz* posteriorly. The numbers were:—14/v, 16/x, 6+8/xii, 7+6/xix, 9+10/xxii, further back 10+10 or 10+12; at the posterior end of the (incomplete) specimen there were 32, all setae were at irregular intervals, and the dorsal break was much smaller, =2*yz* only.

The clitellum is not definitely limited; it appears to extend over xiv—$\frac{1}{4}$xvii=$3\frac{1}{4}$.

On segment xviii is a thickened area, of the shape of an irregular pentagon with its base forwards and its lateral angles produced outwards. This area is surrounded by a moat-like channel, deepest posteriorly where the margin of the pentagon overhangs; the pentagon itself is marked by a ⊥-shaped depression. The male apertures are under the overhanging posterior borders of the area, near its lateral angles, and in line with setae *b*. The transverse extent of the thickened area with the surrounding moat is equal to the interval *cc*; in a longitudinal direction it occupies the anterior two-thirds of segment xviii (fig. 23).

The female apertures are perhaps represented by two small whitish dots in line with the setae of xiv in such a position that *a* ♀ = ♀ ♀ = ♀ *a*.

The spermathecal apertures, in 7/8 and 8/9, are small pores in line with setae *b*.

Internal Anatomy.—The first distinguishable septum is 5/6, which is thin; septa 6/7—10/11 are considerably thickened, the next few moderately so, after which they are diminishingly thickened as far back as 16/17: the rest are thin.

The gizzard, in segment v, is of fair size, firm and barrel-shaped. There are no calcareous glands. The intestine begins in xvi.

The last heart is in segment xiii.

The micronephridia are present as large tufts in the anterior segments from v to the clitellum, especially in from v to ix; there are few or none on the bodywall in front of the clitellum, but the inner surface of the parietes in segments xiv, xv, xvi and part of xvii is thickly covered with micronephridia ventrally and laterally. They are scattered and fairly numerous on the bodywall behind the prostate.

Testes and funnels are free in x and xi.

Vesiculae seminales are attached to the anterior walls of segments xi and xii. Those in xi are small, those in xii moderate in size; all are much cut up into small lobes.

The prostates, long, flat and much divided up, lie on the bodywall in segments xvii to xx. The duct, with a sinuous or curled course, passes backwards and inwards from its origin on the inner margin of the gland at about the level of septum 17/18; its first part is the thinnest.

The ovaries and their funnels have the usual situation.

The spermathecae (fig. 24) are of a general sausage-shaped form, bent inwards towards their free (posterior) end, and slightly dilated at the extremity. The duct is short and moderately stout, half as thick as the ampulla. There is a single diverticulum, which arises from the duct close to its junction with the ampulla; it is of an elongated club shape, and more than half as long as the ampulla, reaching about as far as the bend in the latter.

There are no penial setae.

Remarks.—The present species seems to be related to *M. travancorensis*, Mchlsn. (14). But though the characters of the male area in the latter are variable, it does not seem possible to reduce the condition in the present specimen to the same type. One has here, as so often, to regret that the form is represented by only a single specimen.

Megascolex pumilio, sp. nov.

Trivandrum, 11-ii-1911. Two mature specimens, one immature, and one fragment.

External Characters.—Length 54 mm., maximum diameter 1⅓ mm. Colour an equable grey, clitellum a marked reddish brown. Segments 109.

Prostomium epilobous ⅓, tongue not delimited behind.

Dorsal pores begin from furrow 5/6.

For the greater part of the body there are twelve setae per segment. In front of the clitellum these are arranged in three pairs, the intervals *bc* and *de* being rather greater than *ab*, *cd* and *ef*. The setae *a* are in regular rows, one on each side, and the same is the case with *z*; the setae *b* form regular rows for the greater part of the length of the body, but *c* does so only in the anterior part; the row *y* is irregular. The dorsal interval is considerable; in front of the clitellum *zz* (or *ff*) is equal to about 4*yz* (or *ef*), behind the clitellum to about 3*yz*.

The number twelve persists till near the hinder end of the body; but there 16, 17 and 18 are found, irregularly arranged and not in pairs.

The clitellum extends over segments xiv—xvi=3; the situation of the setae is shown by white dots on the brown-red background.

The ventral surface of segment xviii shows a transversely elongated thickened patch, extending from beyond the line *b* on the one side to a corresponding point on the other. The male apertures are only faintly indicated in or just outside *b*.

A small white patch, circular and midventral, in the line of the setae of xiv, represents the female aperture.

The spermathecal apertures are faintly indicated in the furrows 7/8 and 8/9, in line with setae *b*.

Internal Anatomy.—The anterior portion of the animal was cut into sections of 12μ diameter.

Septum 4/5 is very thin, 5/6 thin, 6/7 somewhat thickened, 7/8, 8/9 and 9/10 considerably so; from 10/11 to 14/15 they become progressively thinner again.

The gizzard, in segment v, is of moderate size and thick-walled. The oesophagus, narrow in segment vi, is bulged segmentally from vii to xiv; there are no separate calcareous glands, but the epithelium is raised into villous processes or folds which extend inwards towards the centre of the lumen. The intestine begins in xv.

The last heart is apparently in xiii.

The excretory system is micronephridial; the very large tufts in segment v, by the side of the anterior end of the gizzard, are a conspicuous feature.

Testes and funnels are free in x and xi. Seminal vesicles are present in ix and xii.

The prostates, of the *Pheretima*-type, are relatively large, occupying segments xviii to xxi. They are most bulky in xviii and xix, thinner and dorsally situated in xx and xxi. The duct is relatively stout and sharply curved

The ovaries and their funnels are in segment xiii; the oviducts unite before debouching externally.

The spermathecae, in segments viii and ix, have an ovoid ampulla of relatively considerable size. The duct is not sharply demarcated; it is as long as and nearly half as thick as the ampulla, and has a slightly curved course, forwards or forwards and then downwards to the exterior. The single diverticulum is club-shaped; it originates from the upper end of the duct just below the ampulla; it is about half as broad as the ampulla, and reaches dorsalwards nearly as far as the latter.

Gen. **Pheretima**.

Pheretima posthuma (L. Vaill.).

Lucknow, 15-x-1910 (*Md. Mohsin Khan*). Several specimens.
Same place, 1916 (*L. Harnarinjan Das*). Several specimens.
Kalka, base of Simla Hills, 2400 ft., 19-vii-1911 (*Museum Collector*). Several specimens.
Under stones or mud by tank, Museum compound, Calcutta, 8-iv-1910 (*F. H. Gravely*). A single specimen.

Pheretima heterochaeta (Mchlsn.).

Darjiling district, 1000-3000 ft., v-vi-1912. A number of specimens. (*Carmichael Collection*).
Darjiling, *ca.* 6000 ft., iv-1914. Several specimens (*Same Collection*).
Singla, Darjiling district, 1500 ft., v-1914. Three specimens. (*Same Collection*).
Darjiling, *ca.* 7000 ft., 12-vi-1914 (*F. H. Gravely*). A single specimen
Soom, Darjiling district, 4000-5000 ft., 16-vi-1914 (*F. H. Gravely*). Three specimens.
Kurseong, 4700 ft., E. Himalayas, 25-iii-1910 (*F. H. Gravely*). A single specimen.
Same place, 14—17-iv-1911 (*N. Annandale*). Two specimens.

Pheretima hawayana (Rosa) f. **typica.**

Kurseong, 4500 ft., E. Himalayas, 26-iii-1910 (*F. H. Gravely*). Two specimens.

Pheretima houlleti (E. Perr.).

Rawal Pindi, N. Punjab, xii-1915 (*L. Raghunath Sahai*). Two specimens.

Pheretima bicincta (E. Perr.).

Trivandrum, i-vii-1911. A single specimen.

Pheretima feae (Rosa).

Kawkareik, Amherst District, Lower Burma, 19—20-xi-1911 (*F. H. Gravely*). A single specimen.

A glandular collar has previously been described round the oesophagus in segment x. This was seen to be a flange-like structure behind the gizzard, against which it rests; since the flange is set rather obliquely, the appearance is not unlike that of a cup and saucer. Microscopically the collar was found to be composed of follicles of blood-glands like those described by Beddard (1) behind the pharynx in certain species of *Pheretima* and other genera.

Pheretima lignicola, Stephenson.

Thingannyinaung to Myawadi, Lower Burma, *ca.* 900 ft., 24—26-xi-1911 (*F. H. Gravely*). A single specimen.

Here also in segment x, behind the pharynx, there was found a ring-like or collar-like thickening of the oesophageal wall, soft and of an opaque yellow colour. On teasing a small portion and examining it microscopically this was, as in *P. feae*, found to consist of follicles of blood-glands.

Pheretima trivandrana, sp. nov.

(Plate xxxii, fig. 27; pl. xxxiii, figs. 28, 29).

Trivandrum, 23-vi-1911. A single specimen.

External Characters.—Length 70 mm., maximum diameter 3 mm. Colour an equable grey. Segments 100.

Prostomium epilobous $\frac{1}{2}$, tongue broad, not delimited behind.

The first dorsal pore is in furrow 8/9.

In the first ten segments there is no dorsal break in the continuity of the setal rings, but behind this there is a small interruption ($zz = 2yz$). The ventral break is also small ($aa = ca.\ 1\frac{1}{2}ab$), and in some of the anterior segments, v to vii, is altogether absent. The setae of segments ii-ix are rather enlarged, those on x rather small. The following numbers were counted:—28/v, 46/ix, 52/xii, 52/xix, and 54 in the middle of the body.

The clitellum was not distinguishable, except perhaps by the smaller size of the setae of segments xiv-xvi.

The male apertures, on segment xviii, are fairly conspicuous pores in line with setae *g*. They are situated towards the inner side of, but well within, a pair of circular thickened areas, somewhat raised in their centres. The pores are slightly more than a quarter of the circumference apart, and four (right side) or five setae (left side) intervene between the pore and the midventral line.

The female apertures were just indicated, situated in a pair of slight whitish thickenings immediately internal to setae *a* of segment xiv.

The spermathecal apertures are three pairs, in furrows 6/7, 7/8, and 8/9, situated well to the sides, about two-fifths of the circumference apart. The last is about opposite seta *i* or *k* of ix, the first opposite seta *e* of vi.

Internal Anatomy.—Segment x is remarkably smooth on the inside; the bodywall is thinner here, and without nephridia.

Septum 4/5 is thin, 5/6 somewhat thickened, 6/7 and 7/8 moderately so; 8/9 and 9/10 are absent; 10/11, 11/12 and 12/13 are moderately thickened, 13/14 and 14/15 slightly so.

The blood-glands in segment vi are very conspicuous. The gizzard, ovoid and well developed, is in the middle of the space between septa 7/8 and 10/11. The oesophagus is bulged laterally behind the gizzard in the portion corresponding to segment x, and also in segments xi, xii and xiii. The intestine begins in xv. Intestinal diverticula, originating in xxvii, extend forwards through xxvi and xxv.

The last heart is in segment xiii.

The excretory system is micronephridial; there are the usual large tufts by the side of and behind the pharynx in segments v and vi.

The testes and funnels are contained in testis-sacs in segments x and xi, which probably communicate with their fellows across the middle line.

The seminal vesicles are attached to the anterior walls of segments xi and xii respectively; they are lobed masses which do not meet dorsally over the intestine.

The prostates (fig. 27), small glands in xvii and xviii, are cut up into numerous small lobules. The duct begins as a small soft tube which immediately swells and becomes firm and shining; it takes a much curved course, describing almost a complete circle, and increasing in diameter as it does so; at its broad ectal end it joins the outer margin of a soft white cushion on which it lies.

The female organs have the usual situation.

The laterally situated spermathecae (fig. 28) have a characteristic form. The ampulla is relatively small, ovoid or pear-shaped. The duct is extremely stout, much longer than the ampulla and almost straight. The diverticula are of two kinds. One is thin and finger-like, originating from the extreme base, or perhaps more properly from the bodywall close to the base of the duct, and approximately half the length of the duct. The second kind arises from the middle of the length of the duct; it consists of an irregular pear-shaped chamber presenting about five lobules, and a stalk which is half as stout as the main duct; the whole, stalk and chamber together, are nearly as long as the main ampulla and duct above the point where the stalk of the diverticulum is attached. Lastly, in one out of the six spermathecae another diverticulum, of the second kind, but much smaller than the one

just described, was present; its termination presented only two lobules and it was inserted into the main duct just below the ampulla. Microscopically, after clearing, the first kind of diverticulum was found to be a simple tube, with the cavity wider at the free end. The second kind consists of several (three or four) elongated and irregular chambers, tightly bound together by connective tissue (fig. 29).

Pheretima kuchingensis, sp. nov.

(Plate xxxiii, fig. 30).

Kuching, Sarawak, 29-vii-1910 (*C. W. Beebe*). Two specimens, in bad condition.

External Characters.—Length 136 mm., diameter 4·5 mm. It is impossible to say what the original colour may have been; the clitellum is a medium brown. It would be impossible to estimate the segments without stripping off the whole of the cuticle and counting the setal rings.

Prostomium ?

Dorsal pores begin from furrow 12/13.

The dorsal break in the setal rings is equal to about *2yz* anteriorly and $1\frac{1}{2}yz$ behind the clitellum. The ventral break is practically absent,—not more than $1\frac{1}{4}ab$. The setae of segments iv to ix are enlarged, especially those of v, vi and vii. Ventrally the setae are closer set than laterally and dorsally. The numbers counted were:—35/v, 42/ix, 40/xii, 46/xix, 46/xxvi.

The clitellum extends over segments xiv—xvi=3. It is smooth, without visible setae or dorsal pores.

The male apertures are situated in the setal ring of segment xviii, on moderately large round dark-coloured papillae. They are in line with setae *h* of the adjoining segments, and ten setae intervene between the pores.

There appears to be a single female pore in the setal ring of xiv.

The spermathecal apertures are four pairs, small, in grooves 5/6—8/9; they are about the same distance apart as the male pores, and are in line with the setal interval *fg*.

Internal Anatomy.—Septum 4/5 is somewhat thickened, 5/6, 6/7 and 7/8 apparently considerably strengthened, 8/9 is thin and 9/10 absent; 10/11—13/14 are all somewhat thickened.

The gizzard, large and barrel-shaped, is in segment viii. The intestine begins in xv. Elongated diverticula originate in xxvii; tapering and showing a few constrictions, they reach forwards to xxiv.

The last heart is in xiii.

The micronephridia were mostly indistinguishable, but a dense fur was present on the inner side of the bodywall in segments xv, xvi and part of xiv.

Ovoid testis-sacs are present in segments x and xi, smaller in the former, larger in the latter. Those of the same segment appear

to be separate from each other,—at least the opaque masses within them are separate, but the walls of the sacs are too delicate and transparent to be followed in the present specimen.

The seminal vesicles, three pairs in segments xi, xii and xiii, are attached to the anterior walls of the segments. Those in xi are deeply incised, and have an appendage, separate from the rest of the sac, which extends nearly to the middorsal line; those in xii, also incised, extend nearly to the middorsal line by a narrow and tapering dorsal lobe; those in xiii are quite small.

The prostates are rather small, occupying segment xviii only (right side) or xviii and xvii (left side). They are made up of small and closely adpressed lobules. The duct is short and almost straight; there is no copulatory pouch,—at least none is distinguishable in the present specimen, though it is possible that one might have been visible in a fresh or a well-preserved specimen.

The spermathecal ampulla is pear-shaped, and becomes continuous with the duct at its broader end. The duct is half the length of the ampulla, and is half as broad also,—rather narrower where it pierces the bodywall; it appears broader than it is however, since it is covered with a considerable fur of micronephridia. The single diverticulum is tubular with a spherical or ovoid dilatation at its free extremity; it is half the length of the ampulla, and is attached to the upper end of the duct near the base of the ampulla; in one case there was present a small excrescence at the base of the terminal dilatation, where the latter passes into the stalk (fig. 30).

Gen. **Octochaetus**.

Octochaetus fermori, Mchlsn.

Karaikulam, 17-x-1911. A number of specimens.

In a previous paper I recorded the presence of a second pair of ovaries in this species (24); I even went so far as to state that microscopic examination confirmed the ovarian nature of the structures. After an examination of a specimen of the present batch of material, however, I believe the structures to be ovisacs; no doubt, in my previous examples, they contained ova, and not being on the look-out for ovisacs in a species belonging to the present genus, I interpreted the mass of ova wrongly.

Octochaetus surensi, Mchlsn.

(Plate xxxiii, fig. 31).

Barkul, 0-1000 ft., Orissa, 1—3-viii-1914 (*F. H. Gravely*). Two specimens, one injured anteriorly.

I give a description of some of the features of the present specimens, in order to supplement Michaelsen's account (14).

External Characters.—Length 90 mm., diameter 3·5 mm. Colour dark purplish brown along a middorsal strip, rapidly fading off laterally, so that the sides as well as the ventral surface are unpig-

mented,—over the greater part of the body at least; the clitellum is brown all round; and in front of the clitellum also the pigmentation extends on to the lateral aspects of the body. A slightly lighter band, very narrow, at the middle of each segment, corresponds to the zone of the setae.

Segments 171; vii to x more or less distinctly triannular, xi and xii quadriannular dorsally.

Prostomium epilobous $\frac{3}{4}$, the sides of the tongue parallel, the tongue not cut off behind.

No dorsal pores are to be seen in front of the anterior border of the clitellum; the first one seems to be in this situation, *i.e.* in 12/13, but all are small.

The ventral setae are paired, the dorsal less closely so. The ratios between the various intervals may be expressed as follows:—in front of the clitellum $ab = \frac{2}{5}aa = \frac{1}{2}$ to $\frac{2}{3}bc =$ approximately $\frac{1}{2}cd$; behind the clitellum $ab = \frac{2}{5}aa$ approximately, $= \frac{2}{3}bc = \frac{1}{2}cd$; in the middle of the body $ab = \frac{1}{3}aa =$ rather more than $\frac{1}{2}bc =$ nearly $\frac{1}{2}cd$. The interval dd is about $\frac{4}{7}$ of the circumference.

The clitellum extends over xiii—$\frac{1}{2}$xvii = $4\frac{1}{2}$ above, but apparently only to $\frac{1}{2}$xvi = $3\frac{1}{2}$ below.

A male area is distinguishable, constituted by the flattened ventral surface of segments xvii—xx, quadrilateral in shape with rounded corners. The prostatic pores, on xvii and xix, are small, with slightly tumid margins; they are united on each side by straight, very narrow,—indeed linear grooves, and across the middle line by broad grooves with shelving anterior and posterior walls; these transverse grooves are continued outwards in a more or less definite manner beyond the situation of the prostatic pores for a short distance. In the second specimen the longitudinal seminal grooves are rather bowed outwards. The male pores are not visible. The situation of the grooves and prostatic pores is between *a* and *b*.

The female apertures, on the anterior part of segment xiv, are paired, and contained in a small transverse groove surrounded by a whiter area. The pores themselves are slightly internal to the line *a*.

The ventral surface of segments viii and ix is rather irregularly thickened and glandular in appearance. No setae are visible, but corresponding to the position of setae *a* or between *a* and *b* there are small white and slightly elevated points, the spermathecal apertures.

Internal Anatomy.—Only a few points need be noticed. The first septum is 5/6, which is moderately thickened; the next is 8/9, thin and displaced backwards to about the position of furrow 9/10, septum 9/10 itself, moderately thickened, is midway between furrows 9/10 and 10/11; the remaining septa are in the normal positions, 10/11 being moderately thickened, 11/12 considerably thickened and 12/3 slightly so; the rest are thin.

The gizzard is large, between septa 5/6 and 8/9; morphologically it is in segment vii, since the two vascular commissures close

together behind it are those corresponding to vii and viii, and the one at its anterior end belongs to segment vi. Its walls show a curious condition; the whole of its anterior end is thick and very firm, and so is its ventral wall, but the rest of its dorsal and lateral walls and its posterior end are thin, soft and slightly baggy; the same condition was found to be present in a second specimen also.

The spermathecae (fig. 31) are mushroom-like, or somewhat pyramidal with much rounded angles. The duct is very broad at its origin,—about one-third as broad as the ampulla,—but becomes much narrower at its ectal opening; it is rather shorter than the ampulla. The diverticulum arises from the uppermost portion of the duct by a short and narrow stalk, which bears a rounded cauliflower-like mass, composed of a large number of indistinct chambers; the breadth of the mass is about equal to that of the upper end of the duct.

Testis-sacs are present, as Michaelsen (14) suspected, but they are of peculiar form; they are constituted by an extremely delicate membrane, which covers in the whole of the contents of the respective segments,—stretching from one septum to the next and including dorsal vessel and alimentary canal as well as sperm masses and the male organs. I did not see the testes in segment xi, and the funnels of xi appeared to be distinctly smaller than those of x.

Octochaetus barkudensis, sp. nov.

(Plate xxxiii, figs. 32, 33).

Barkuda Island, Chilka Lake, Ganjam District, Madras Pres., 17-vii-1914. (*Chilka Survey*). Two specimens, one not fully mature.

External Characters.—Length 43 mm., diameter 1·5 mm. Colour brown. Segments 140, the last few very short.

In one specimen the prostomium was tanylobous; in the other epilobous $\frac{1}{2}$, pointed behind, the angle being continued as a median groove back to the first furrow (1/2).

I could not see any dorsal pores in front of the clitellum.

The setae are paired; their relations may be expressed as follows:—behind the clitellum $ab = \frac{1}{4}aa$, $= \frac{1}{3}bc$, $= \frac{1}{2}cd$ or nearly; near the posterior end $ab = \frac{1}{3}aa$, $= \frac{1}{2}bc$, and is somewhat less than cd. In front of the clitellum the setae are difficult to see, but the relations appear to be much as they are near the posterior end. The seta d is a little below the lateral line of the body.

The clitellum includes two-thirds of xiii and two-thirds of xvii, $= 4\frac{1}{3}$; it is smoother than the neighbouring segments, but there is little difference of tint.

On segment xviii are two approximately rectangular cushions which take up the whole length of the segment, and meet in the middle line where they are separated by a slight groove. The seminal grooves cross the somewhat indefinitely limited outer ends of the cushions, passing between the prostatic apertures on xvii and xix, in line with setae b.

The female apertures appear to be indicated by a transverse depression on the anterior part of segment xiv, which is bounded along its anterior margin by furrow 13/14.

The spermathecal apertures are apparently indicated by slight whitish marks on segments viii and ix, in front of and between *a* and *b*.

Internal Anatomy.—The first septum appears to be 4/5, which is somewhat thickened: no more are visible till 8/9, which is slightly thickened; 9/10, 10/11 and 11/12 are considerably, 12/13 somewhat and 13/14 slightly thickened.

The gizzard, in front of septum 8/9, is subspherical, firm and well-developed. A single pair of calcareous glands is present, taking up segments xv and xvi; they are thus of considerable size. The intestine begins in xvii.

The last heart is in xii.

The excretory system is micronephridial.

Testes and funnels are free, embedded in sperm masses in segments x and xi; the funnels appear to be of relatively large size.

The vesiculae seminales are two pairs. Those in segment ix, attached to septum 9/10, are flattened, with their edges cut up into lobes; those in xii, depending from septum 11/12, are of considerable size.

The prostates, in xvii and xix, are tubular, the tube forming only a few coils and maintaining the same appearance and diameter throughout.

The ovaries are situated in segment xiii; there is a pair of ovisacs in xiv.

The spermathecae are two pairs, one opening at the level of septum 8/9, the other opposite the middle of the gizzard, and so probably at the level of the absent septum 7/8. The ampulla is of moderate size, and very irregular, more or less ovoid in shape; a prolongation of one end forms a short and narrow stalk. A small stalked rounded diverticulum arises (in three out of the four) from the middle part or from the lower end of the duct; in one case it seemed to be a mere bulging of one side of the duct.

The penial setae are in length ·58 mm., in breadth 10μ at the middle, 12μ nearer the base. The shaft is slightly curved, the distal end has a somewhat sinuous outline, and the tip is pointed. The ornamentation consists of a number of relatively large spines near but not extending quite to the tip (fig. 32).

The copulatory setae (fig. 33) in segment viii (no sacs or setae were seen in segment ix) are ·52 mm. long and 17μ broad. They are not much modified; the shaft is slightly curved along most of its extent, more so at its proximal end than elsewhere. The distal end is pointed, and slightly bulbous close to the tip; above (proximal to) the bulbous portion the lateral aspects of the seta are marked by a number,—more than a dozen,—of serrations; the appearance is that of a lateral flange or seam cut up into teeth.

Gen. **Eutyphoeus.**

Eutyphoeus nicholsoni (Bedd.).

Mowaie, Bara Banki, United Provinces, 11-iv-1910 (*Mohd. Mohsin Khan*). Four specimens.
Same place and collector, 11—12-x-1910. A number of specimens.

Eutyphoeus bastianus, Mchlsn.

Mowaie, Bara Banki, United Provinces, 15-iv-1910 (*Mohd. Mohsin Khan*). A number of specimens.
Same place and collector, 11—12-x-1910. A number of specimens.
Dehra Dun, in a tank, under water, no date (*S. Maulik*). A single specimen.

Eutyphoeus waltoni, Mchlsn.

Tollygunge, nr. Calcutta, 30-vii-1912 (*N. Annandale* and *F. H. Gravely*). Two specimens.
Siripur, Saran, Bihar, 27-ix-1910 (*R. Hodgart*). Three specimens.

Eutyphoeus incommodus, (Bedd.)

Rawal Pindi, N. Punjab, Dec. 1915 (*L. Raghunath Sahai*). Four specimens.

Eutyphoeus annandalei, Mchlsn. var. **fulgidus**, var. nov.

(Plate xxxiii, fig. 34).

Anwarganj, Cawnpore District, 1—13-x-1911 (*J. W. Caunter*). Nine specimens, one being immature.

External Characters.—Length 56 mm., maximum diameter 4 mm. Unpigmented, clitellum a light brownish grey. Segments 164; a number of preclitellar segments multiannulate.

Prostomium tanylobous, the tongue narrow with parallel sides. There is also a transverse groove which cuts off the main portion of the prostomium from the tongue.

The first dorsal pore is in groove 11/12.

The setae are paired. In front of the clitellum *ab* is equal to *cd*, and is equal to $\frac{2}{5}aa$ and to $\frac{1}{2}$ or $\frac{2}{3}bc$; behind the clitellum *ab* is rather less than *cd*, and equal to $\frac{2}{7}aa$ and nearly $\frac{1}{2}bc$.

The clitellum is saddle-shaped, or at least much less marked over a longitudinal midventral strip. It includes two-thirds of segment xiii and one third of xviii, or five segments in all.

The male apertures are situated on conical and extremely prominent porophores; these almost penis-like projections take up the length of segment xvii. The orifice forms a transverse slit on the summit, with its centre in the line *b* or opposite the interval *ab*.

The female apertures are small, each situated in front of one of the setae *a* of segment xiv; they are thus separated from each other by a moderate interval.

The spermathecal apertures are one pair, in furrow 7/8, between *b* and *c* though rather nearer to *b*.

Genital markings are present in or rather just in front of furrows 13/14, 14/15, and 15/16; in some cases there was an additional pair in relation to furrow 16/17. These are small, oval or almost circular slightly raised areas, with a somewhat darker centre. They take up approximately a space corresponding to the interval *ab*, but may slightly overstep these limits on one or other side.

Internal Anatomy.—Septum 4/5 is thin, 5/6 is moderately thickened; then two septa are missing; 8/9 is thin, 9/10 and 10/11 considerably thickened, and the following ones thin. Septa 9/10—11/12 are crowded together.

The gizzard, subspherical and moderately firm, is in the interval between septa 5/6 and 8/9. Calcareous glands, in segment xii, are not separated off, and are only discovered on opening the oesophagus; the oesophagus is also slightly swollen in segment xiv. The intestine begins in xv.

The last heart is in xiii. The dorsal vessel is continued forwards over the gizzard to the pharynx; the hearts of segments vii and viii are close together behind the gizzard and in front of septum 8/9; the next commissure is at the anterior end of the gizzard, and the next after that in front of 5/6. The missing septa and the exact morphological position of the gizzard can thus be established.

The excretory system is micronephridial. Behind and on the clitellum there is a single row of relatively large tufts, about seven in number on each side, transversely disposed in each segment; these are set closer together ventrally than on the other regions of the bodywall. On some of the anteclitellar segments the tufts are more numerous; and in segment iii the bodywall is densely covered with micronephridial tubules; there are however no large tufts such as are commonly met with by the side of the pharynx and gizzard.

Testes and funnels are present in segments x and xi; there appears to be no marked difference in size between those of the two segments; those in x are not rudimentary, as they were in Michaelsen's specimens of the type form and would have been passed without comment if met with elsewhere.

Vesiculae seminales are present in segments ix and xii; those of ix are soft lobulated masses of moderate size, those of xii are large, and on one side extend back through segments xiii and xiv, though on the other they merely cause a considerable bulging back of septum 12/13. The conditions in this region are primitive as compared with most species of the genus; septum 11/12 is not absent, and the corresponding heart is not bound down to the alimentary canal by dense connective tissue.

The prostates and their ducts form a continuous tube on each side, beginning behind in segment xix; each tube is of the same diameter throughout, the glandular part being soft and white, the terminal portion more glistening. The vas deferens passes back on the outer side of the termination of the prostatic duct, and then swells into a pouch behind it.

The spermathecae are one pair. The ampulla is large, globular, and sessile on the bodywall, without duct. A complete circle of relatively large, round, oval, or somewhat irregular diverticula surround the base of the ampulla; in one specimen these were eight in number on either side and each was attached by a stalk to the base of the ampulla; in another the diverticula, fifteen in number, were not separable, being bound together by fibrous tissue at their contiguous margins, and so appearing as a continuous ring lobed peripherally.

The penial setae (fig. 34) are 9 mm. long and 17μ broad at the middle of the shaft. The shaft shows a slight curvature, rather more marked towards the free end; the tip is bluntly pointed. The ornamentation consists of a number of extremely fine sculpturings,—short transverse rows of fine points, near the tip and over the distal part of the shaft.

Remarks.—The variety may be distinguished from the typical form by the greater number of the genital markings, the much shorter prostates, and especially the complete ring of diverticula at the base of the spermathecal ampulla. The penial setae are not known in the typical form.

Gen. **Eudichogaster.**

Eudichogaster bengalensis, Mchlsn.

Bed of the Chitartala (branch of the Mahanadi), near Kenduapatna, Cuttack, 25-iii-1910 (*B. L. Chaudhuri*). A number of specimens.

I subjoin a few notes in order to supplement the original description by Michaelsen (14).

The first dorsal pore I found to be in furrow 11/12.

The penial setae, in length ·7 to ·8 mm., and in diameter 16μ, have a slightly bowed shaft and a tapering, rather more strongly curved blunt tip; the extremity is blunt. Near the distal end are a number of fine spines, rather irregularly arranged in about half a dozen transverse rows, and scattered spines are continued for some little distance along the shaft. The end could not be described as claw-like; all the spines are very small, and there was no circle of larger spines round the tip, as is described and figured by Michaelsen.

The spermathecal duct was not sharply set off from the ampulla, and the ducts of the two diverticula did not, in the specimen examined, join together before entering the main duct.

The calcareous glands are of interest in connection with the definition and position of the genus. The bulgings of the oesophagus in segments x—xiii are thin-walled and not at all set off from the lateral walls of the oesophagus; they are not calcareous glands any more than the similar part of the tube in, for example, *Pheretima posthuma* is a series of calcareous glands. On opening this part of the tube through its whole length all four segments

were seen to present low lamellar transverse folds projecting into the lumen from the ventral wall, the dorsal half of the wall being almost or quite smooth, and in the two hinder segments (xii and xiii) slightly constricted off from the ventral by a lateral fold. Along all four segments there is a large and very conspicuous longitudinal midventral projection into the lumen; in a transverse section this would appear bilobed, spreading out on each side of a narrow median attachment, as if it were a ventrally situated typhlosole. The annular intersegmental constrictions of the oesophagus are thickened, as seen from the inside, and present a number of nodular projections.

The nephridia have a similar interest. In the anterior segments these are present as villous tufts, or as an aggregate of three or four coils, within the cone-like septa. On passing back, larger nephridia soon make their appearance, more laterally placed in the segment; the first of these occurs in segment xiii, and is not of any considerable size. From here onwards the more ventral nephridia, covered by the intestine in the normal condition, appear as two compact coils; the dorsal nephridia, of considerable size behind the prostate, are thin and flat, and occupy the lateral third of the bodywall on each side; there are also a few smaller coils near the middorsal line (? normally one per segment).

In the posterior third of the body, about 30 to 40 segments from the hinder end, there are two considerable nephridia on each side per segment; the dorsal of the two seems to be usually the longer, the ventral the more bushy; there is also on the bodywall a fur of very minute micronephridia. Between the thirtieth and twentieth segment from the end these minute nephridia become fewer, and after the twentieth they have almost gone. The dorsal nephridium has become relatively smaller, and the ventral larger; the latter is now a stoutish tube which forms only one or a few twisted loops; its calibre is much greater than that of the dorsal nephridium. The smaller nephridia could not be distinguished.

I succeeded in finding a funnel on one of these stout ventral nephridia (from the twenty-second segment, counting from the posterior end); it was formed of a rosette of cells, all the same size, evenly surrounding a small circular aperture; a narrow but quite short portion of the tube succeeds, which soon widens to form the stout tube of which nearly the whole nephridium consists. I did not find funnels in the nephridia from the region behind the clitellum.

Eudichogaster sp.

From base of leaves of tall palm tree, Museum compound, Calcutta, 28-vii-1909. A single specimen.

The condition of the worm did not permit of a satisfactory examination, and mention is made of it only because of its peculiar habitat.

Gen. **Dichogaster.**

Dichogaster malayana (Horst).

(Plate xxxiii, figs. 35, 36).

Neyyatinkara, Travancore, 28-vi-1911. Two specimens.

Since the original description (7) of this species is short, and indeed omits mention of some organs or systems altogether, I give an account of the specimens in the present collection.

External Characters.—Length 30 mm., maximum diameter 1·5 mm. Colour grey with dark clitellum. Segments 92.

Prostomium proepilobous, hinder margin projecting backwards as an angular process into segment I; segment I partly divided in the midventral line by a median fissure leading backwards from the margin of the mouth.

The dorsal pores begin from furrow 5/6.

The setae are closely paired and all ventrally situated. The relations may be expressed thus :—$aa = bc = 3ab = 3cd$.

The clitellum extends from segments xiii to xx inclusive. It is brown in colour, lighter along a midventral strip, and sharply marked off by a constriction at both ends.

The prostatic apertures, on segments xvii and xix, are minute dots between the lines of setae *a* and *b* (? in line with *a*). The seminal grooves are straight, with only a slightly wavy course. The male pores were not visible. There are indications of slight transverse grooves between the prostatic pores of the same segment, and thus a rectangular figure is outlined on the male area.

The female aperture is perhaps in line with the setae of segment xiv, single and midventral (?).

The spermathecal apertures are in furrows 7/8 and 8/9, opposite the interval *ab*.

Internal Anatomy.—One specimen was dissected and the other sectioned.

The first septum probably represents 4/5; it is attached at the level of groove 4/5 below, but at that of 3/4 above. The next is septum 7/8, which envelopes the gizzard. Septa 10/11 to 12/13 are slightly thickened.

The oesophagus is bulged in an annular fashion in front of the gizzards. The gizzards, in segments vi and vii, are not well divided from each other; no septum is attached between them, and the separation is evidenced (apart from the examination of longitudinal sections) only by the wall of the thickened tube yielding under manipulation at a level corresponding to the line between the two. In sections however the muscular coat is easily seen to be interrupted for a narrow space. The oesophagus is continued, straight and fairly narrow, scarcely bulging at all, as far as segment xv, where it dilates somewhat. Calcareous glands, all of about the same size, are present in xv, xvi and xvii.

The micronephridia are present behind the clitellum in four rows on each side; each is a flat plate-like organ, subcircular in shape or rectangular with rounded corners. The rows nearly touch each other, and each organ being in longitudinal extent equal to about the length of a segment, the bodywall is pretty completely lined by them,—probably entirely so in the natural condition of the parts. The lowest row on each side is smaller than the others, and there is occasionally a fifth, still more ventral; if so it is also small.

In the clitellar region the nephridia have more the ordinary form of twisted tubes. More anteriorly some are seen in the neighbourhood of the spermathecae, but none are visible, in the dissection, on the bodywall; they may be seen in sections in the male genital segments.

Testes and funnels are free in segments x and xi.

The seminal vesicles are in segments x and xi; in the dissected specimen none were present in xii. In the sectioned specimen a visicle was present on the right side in xii; it was of racemose form, composed of small rounded masses, each stalked and attached to a stem which in turn was implanted on septum 11/12; the whole, though not of large size (smaller than those in the segments in front), was still a conspicuous feature in the anatomy.

The prostates are tubular, in segments xvii and xix. That in xvii lies behind the calcareous gland, that in xix behind the bulging of the intestine, in the respective segments. They are vertically placed by the side of the alimentary tube, and the muscular duct is directed inwards from the lower end of the gland.

The spermathecae (fig. 35) are contained in segments vii and viii. The ampulla is rather small, ovoid in shape, and divided from the duct by a marked constriction. The duct is at least of the same size as the ampulla, pear-shaped and narrowing gradually to the aperture; the interior of the duct is occupied by a gelatinous-looking non-staining mass. A minute tag-like diverticulum is present in some, but not, apparently, in all; it arises from the duct on its anterior face at about the middle of its length.

The penial setae (fig. 36) are of several types. (1) A slender form 3·5μ in thickness, with straight shaft and thin flattened oar-like extremity; the width of the flattened end is 6μ. (2) A form which also presents a narrow shaft and expanded tip; but the expanded portion is one-sided only; length ·28 mm., thickness at middle of shaft 4μ. (3) A stout variety, breadth 7μ, shaft straight in its proximal, gently curved in its distal portion; the distal end presents a few blunt projections on its sides and on the concavity of the curve. (4) A mixed type combining the tip of the second and the stout shaft of the third variety; the shaft shows a gentle, almost even curve, and tapers towards its free end; the extreme point is furnished with a wing-like expansion on one side only; length across the bend ·3 mm., thickness at middle 6μ, at proximal end 7μ.

Dichogastar affinis (Mchlsn.)

Trivandrum, 20-vi-1911. Several specimens.

The species has previously been recorded by me from Ceylon (22). I stated that in the single specimen available for examination the organs of the anterior part of the body were displaced one segment forwards as compared with the normal condition. It is possible however that this may have been apparent only, and due to the small size and retraction of the first segment.

Dichogaster bolaui (Mchlsn.) subsp **palmicola** (Eisen).

Datar Hill, nr. Junagadh, Kathiawar, 1-xii-1912 (*S. P. Agharkar*). A single specimen.
From base of leaves of tall palm tree, Museum compound, Calcutta, 28-vii-1908. Two specimens.
From crown of palm tree, same place, 4-1-1911. Two specimens.
From base of leaf found on so-called Sago palm, Museum compound, Calcutta, 9-vii-1914. Several specimens.

It is interesting to find this Pacific subspecies in Calcutta, where it is also "palmicolous." The specimens show a few departures from the condition as originally described.

The size is one of the most marked of these differences, Eisen (6) attributing to this form a length of 55—60 mm., while the present specimens varied only between 16 and 21 mm.

The dorsal pores began in all in furrow 5/6.

The two gizzards are in segments vii and viii; but as in *D. malayana* septum 7/8 is absent.

The nephridia are in four rows.

The penial setae are of two types :—(1) Length ·34 mm., diameter 7μ ; the shaft has a very slight $\int$-shaped curve, and the tip is tapering, sharp and hooked. A few spines, not always confined to the concave side, stand off from the surface near the tip; these spines were about eight in number in one of the Kathiawar specimens, but were few (only about four) or entirely absent in one from Calcutta. (2) Length ·32 mm., thickness near base 6μ, near tip only about 2·5μ ; the shaft shows a slight $\int$-shaped curve ; the tip is expanded to form a flat oval spatula- or oar-like blade about 4·5μ wide. There was no hint of a forking such as stated by Eisen for his specimens.

Gen. **Ocnerodrilus.**

Ocnerodrilus (Ocnerodrilus) occidentalis, Eisen.

Under flower-pots, Ross I., Andamans, 26-iii-1911 (*C. Paiva*). A number of specimens.

Fam. GLOSSOSCOLECIDAE.

Gen. **Pontoscolex.**

Pontoscolex corethrurus (Fr. Müll.)

Trivandrum. Several occasions in 1911. Numerous specimens.
Vellany, 8-vi-1911. Numerous specimens.
Neyyatinkara, Travancore, 7-vii-1911 (*Shunker Narayan*). A number of specimens.
In mud in flower-pots, Ross I., Andamans, 26-iii-1911 (*C. Paiva*). Several specimens.

Gen. **Glyphidrilus.**

Glyphidrilus annandalei, Mchlsn.

Trivandrum, 23-ix-1901. Numerous specimens.
Jaithy Field, Trivandrum, 5-ix-1906. Numerous specimens.
Trivandrum, 6-iii-1911. Numerous specimens.
Vellany, 29-ii-1911. Numerous specimens, but only one mature.
Neyyatinkara, Travancore, 7-vii-1911 (*Shunker Narayan*). Numerous specimens.

The limits of the clitellum are indefinite; taking it as marked out by the brick-red colour, it extends from xiii to xxxix in one specimen of which a complete examination was made.

There appeared to be an ovisac in segment xiv.

The setae are widely paired; the relations are simple:—$ab = cd = \frac{1}{2}aa$; *bc* is rather greater than *aa*; $dd = aa$, and both *c* and *d* are on the dorsal surface. Towards the posterior end the setae of a pair are closer together:—$ab = cd = \frac{2}{5}aa = \frac{1}{3}bc$; $dd = 4cd$ and so is considerably greater than *aa*.

Glyphidrilus tuberosus, sp. nov.

(Plate xxxiii, fig. 37).

Kenduapatna Canal, Cuttack, 24-iii-1910 (*B. L. Chaudhuri*). Two specimens.
Ponds at Pubhans, Cuttack, 28-iii-1910 (*B. L. Chaudhuri*). Several specimens.
Mud at edge of River Tista, Jalpaiguri, 3-vi-1911 (*N. Annandale* and *S. W. Kemp*). Two specimens, immature.

External Characters.—Length estimated at 60 mm.; the specimen, which was considerably curled, broke on the first slight effort at straightening it. Breadth 2·5 mm. average, 3 mm. maximum. Colour a light brown, rather blotchy. Segments 221, all very short behind the clitellum. Behind the clitellum the dorsal surface is concave, and the ventral surface also flat or concave; hence a transverse section would be four-sided,—more especially towards the hinder end of the body, where all four surfaces are flat or concave. At the posterior end the dorsal surface is the most extensive, and is considerably broader than the ventral, so that the sides converge downwards. The anus is dorso-terminal.

The prostomium is prolobous or ? zygolobous. The demarcation between the prostomium and the first segment is a shallow transverse valley rather than a definite fissure or groove.

In front of the clitellum the setae are widely paired and rather irregular; *ab* is approximately equal to *cd*, and is half *aa* or less; *aa* is rather less than *bc*; *d* is dorsally situated, and *dd* is greater than either *aa* or *bc*. Behind the clitellum the setae are more regular, and are set at the angles of the transverse section; $aa = bc = 2ab = 2cd$; *dd* is the greatest interval, and is equal to $3cd$ or nearly so.

The clitellum extends from segment xiv, xv or xvi to xxviii or xxix (or xxx dorsally).

The genital markings are of two kinds, a series of small papillae, and certain cauliflower-like excrescences.

The papillae occur in three sets,—an anterior, on segments x to xii, a middle, on segments xvii to xix or on xviii and xix, and a posterior, on xxiv to xxviii. They are small, white, rounded elevations on the hinder parts of the segments to which they belong; sometimes, where the segments are short and swollen, they appear on the anterior wall of the intersegmental groove,—they may indeed be almost hidden in the groove.

In the anterior set, there is a single midventral papilla on segment x, a midventral and others more laterally placed on xi and xii. The full number of the lateral papillae here appears to be two on each side, symmetrically placed, one between *a* and *b*, the other outside *b*; some may be less definite than others, or one may be missing.

The middle series of papillae (fig. 37) consists of a pair on segment xvii,—one on each side near the middle line, internal to *a*; a similar pair, with or without one more laterally placed (outside *b*), on xviii; and six on xix, *viz.*, a pair near the middle line, as above, one on each side between *a* and *b*, and one on each side outside *b*. There may be no papillae on xvii.

In the posterior group also six, in the positions just described, appears to be the full number; but any one or more may be absent in one or other segment, so that the number may dwindle to one only (*e.g.* in segment xxviii in fig. 37, where the single papilla is one of the median pair).

The cauliflower-like outgrowths (fig. 37) are also variable; they may be described in a specimen in which they were well-marked. Extending ventro-laterally on the left side over segments xx to xxiii and partly on to xxiv also is a longitudinal crest or ridge, narrow from side to side, uneven, folded and notched; this ridge is well-marked only in the extent indicated, but it is continued forwards very faintly, inclining slightly dorsalwards, as far as xv or xiv. On the right side the ridge in segments xx to xxiii has grown out into a foliating tumour-like mass of numerous soft irregular closely apposed papillae; the ventral surface of the mass is flat and of triangular shape, the apex of the triangle extending inwards to the line *a*; as seen from the dorsal surface the mass is also triangu-

lar and similar in appearance to what has just been described, but the separate papillae are not so well marked. Another papillose excrescence occurs dorsally on the left side on segment xxiv ; this is a similar patch of soft closely set papillae, taking up the length of the segment, but much broader in a transverse direction, extending indeed from the middorsal line nearly to the lateral line of the body. Some of the specimens, perhaps not fully mature, showed the lateral ridges but no cauliflower-like excrescences.

Internal Anatomy.—Septum 4/5 is thin, 5/6 slightly and 6/7 somewhat thickened; 7/8 is moderately thickened, and is the strongest of the series; 8/9 to 11/12 are less thickened again, and 12/13 only slightly so.

The degree of development of the gizzard varies in the two or three specimens dissected. In the first, though of moderate size, it was soft, thin-walled and vertically flattened,—*i.e.* in considerable degree rudimentary; in a second the wall was of moderate thickness, though the organ was still flattened dorso-ventrally; in a third the gizzard was well developed and fairly firm, and cylindrical in shape. The last-mentioned specimen would have been passed without comment in an ordinary way; but the firmness of the gizzard was in part deceptive, as on opening it it was found to be full of earth. The gizzard is contained in segment vii; in the last instance it extended also into the hinder part of vi.

There are no calcareous glands. The intestine begins in segment xv.

The last heart is in xi.

Testes and funnels are present in segments x and xi (testes not identified in xi).

The vesiculae seminales are four pairs, in segments ix to xii. Those in ix, on the anterior face of septum 9/10, are large and smooth ; those in x, on the anterior face of 10/11 are smaller, and only slightly cut up into lobes; those in xi, on the posterior face of 10/11, are of the same size as the last, regularly ovoid and not lobed; the last pair, attached to the posterior surface of 11/12, are large, lobed and meet each other dorsally above the alimentary canal.

The ovaries occupy their usual position. Ovisacs are present in segment xiv; they were much flattened against the posterior face of septum 13/14 (being empty), but were of considerable vertical and transverse extent.

The spermathecae are situated in segments xiv and xv. They are small subspherical or somewhat irregular sacs, each with a short thin duct as a stalk, and without diverticula. The duct runs forwards towards the anterior boundary of the segment, and therefore debouches into the groove 13/14 or 14/15 as the case may be; at least the attachment to the parietes is nearer the anterior than the posterior septum of the segment. In number there are either three or four on each side in each segment,—three in both segments on the right side, four in the anterior and three in the posterior on the left side. The two externally placed sacs are in line

with setae *a* and *b*, the third is between *b* and *c*, and the fourth in line with *c*. Each spermatheca is about large enough to fill out the longitudinal extent of a segment.

Fam. LUMBRICIDAE.

Gen. **Helodrilus.**

Helodrilus (Bimastus) parvus (Eisen).

Edge of small stream, Barogh, Simla Hills, 5000 ft., 10-v-1910 (*N. Annandale*). Two specimens
Kasauli, Simla Hills, 6000 ft., Aug. and Sept., 1915 (*Baini Prashad*). Numerous specimens.

Helodrilus (Bimastus) constrictus (Rosa).

Darjiling, *ca.* 6000 ft., April 1914 (*Carmichael collection*). Three specimens, one immature.

The clitellum begins on segment xxvi, but it extends behind so as to include xxxii,—the whole of it dorsally, and a half and two-thirds of it ventrally.

Pigmentation is wanting; and there are no papillae in the regions of setae *ab* of xvi.

The agreement is therefore not very close, but it hardly seems worth while making a new species or variety for these specimens.

Helodrilus (Bimastus) eiseni (Levins.)

Painsur, above Lohba, 8000 ft., 23-iv-1914 (*Col. Tytler*). A single specimen, not fully mature.

The identification is not absolutely certain; the species has been recorded from Kumaon district.

Helodrilus(Eisenia) foetida (Sav.)

Simla, W. Himalayas, 7000 ft., 9-v-1910 (*N. Annandale*). Four specimens.
Same place and collector. 12—13-v-1913. A single specimen.

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EXPLANATION OF PLATE XXX.

FIG. 1.—Ventral seta of *Slavina* sp. × 500.

,, 2.—Ventral seta from second segment of *Stylaria kempi*; × 540.

,, 3.—Hinder end of *Aulophorus furcatus* (specimen from Khed).

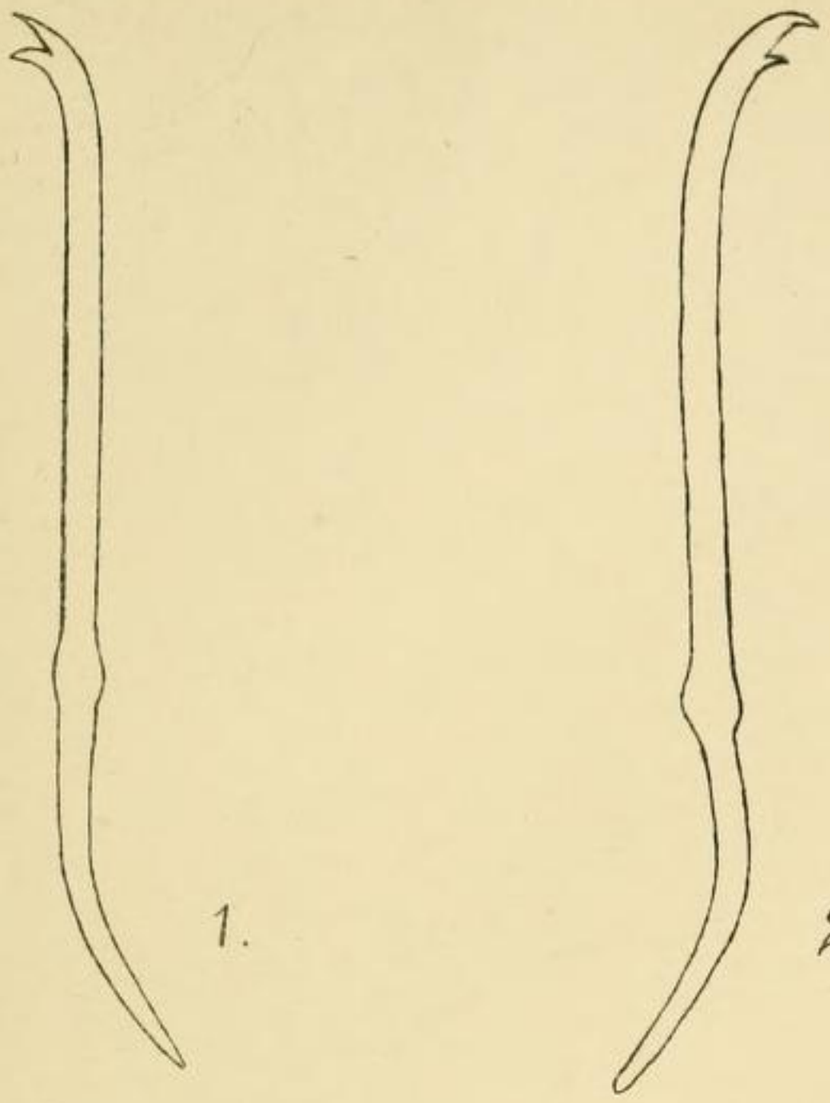
,, 4.—*Drawida jalpaigurensis*; prostate of left side.

,, 5.—The same; diagrammatic sketch to show relation of parts near spermathecal aperture; *a.*, atrium; *at. s.*, atrial sac; *d.*, spermathecal duct; *s.*, septum 7/8.

,, 6.—*Megascolides tenmalai* var. *karakulamensis*; male area.

,, 7.—The same; spermatheca.

,, 8.—*Megascolides oneilli f. typica*; prostate.



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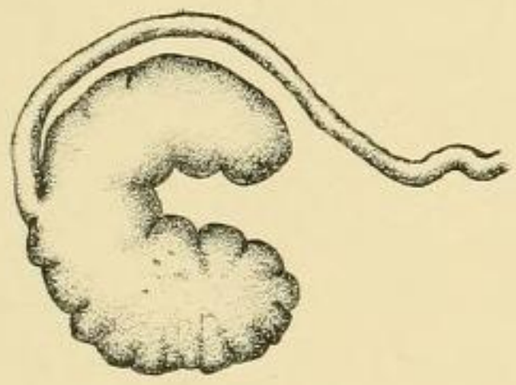

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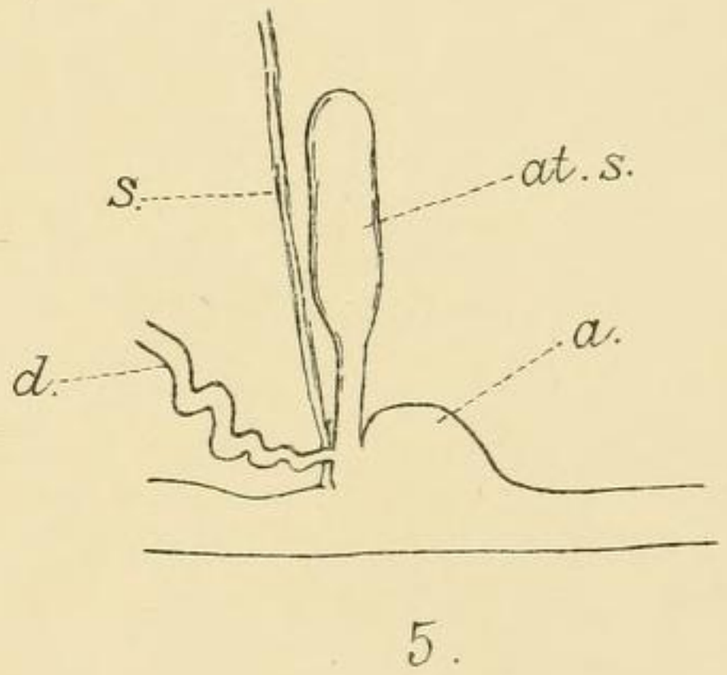

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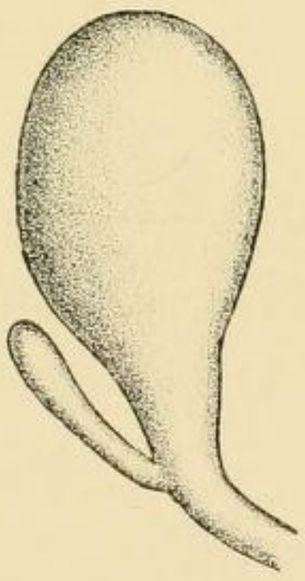

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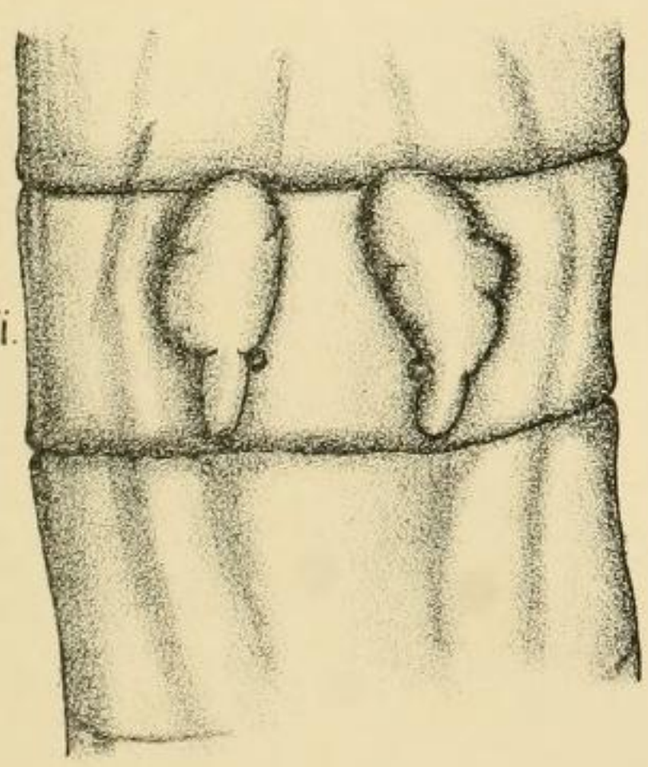

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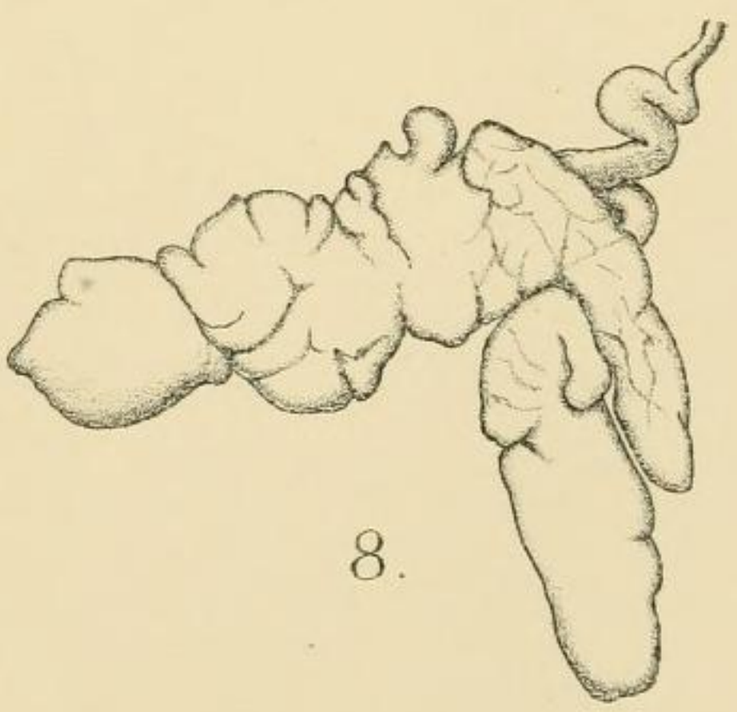

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J.S. del.

A.Chowdhary, lith.

INDIAN OLIGOCHAETA.

EXPLANATION OF PLATE XXXI.

FIG. 9.—*Lampito dubius*; meganephridium from middle of body, to show the general relations of the parts, the funnels, stout and slender loops; *a.*, stout loop; *b.*, slender loop; *f.*, funnels.

,, 10.—*Perionyx pulvinatus*; region of male pores.

,, 11.—The same; spermatheca.

,, 12.—*Perionyx pincerna*; region of male pores.

,, 13.—The same; penial seta.

,, 14.—*Perionyx inornatus*; penial seta.

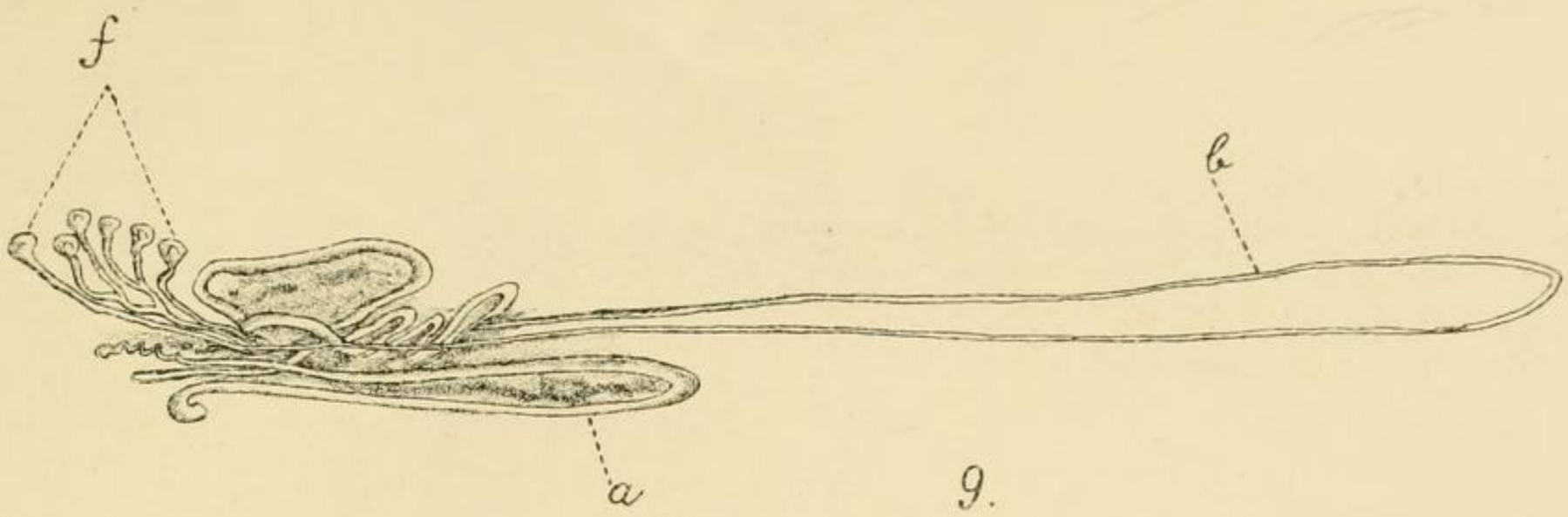
,, 15.—*Perionyx parvulus*; penial seta.

,, 16.—*Perionyx fulvus*; penial seta.

,, 17.—*Perionyx* sp.; male genital area.

,, 18.—The same; penial seta.

,, 19.—*Notoscolex gravelyi*; spermatheca.



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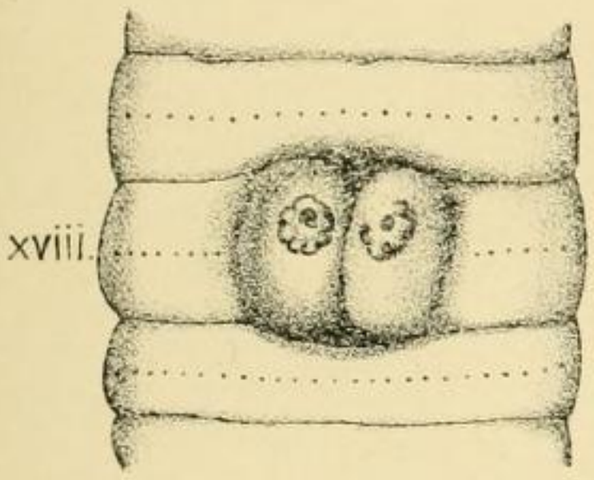

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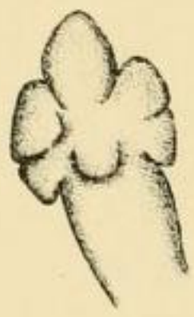

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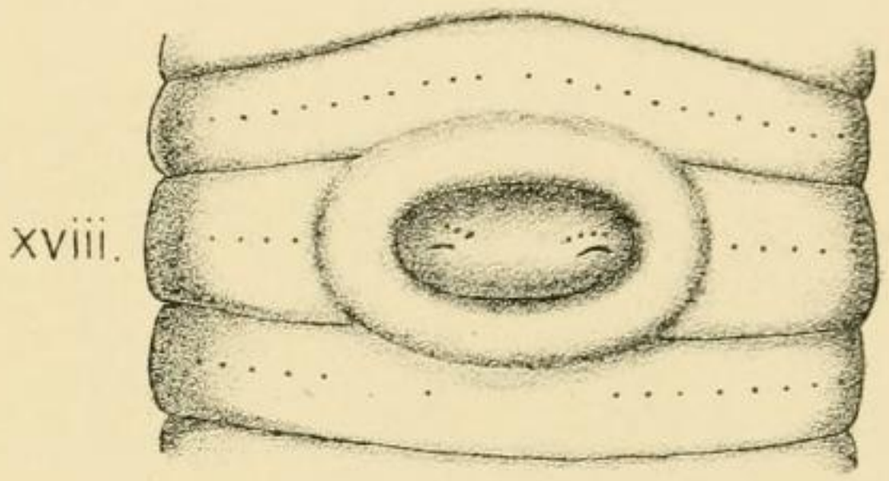

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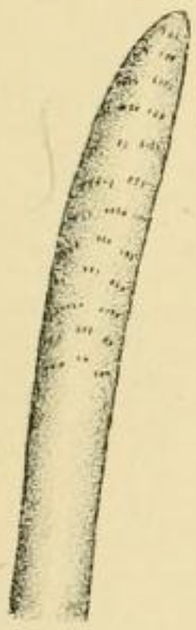

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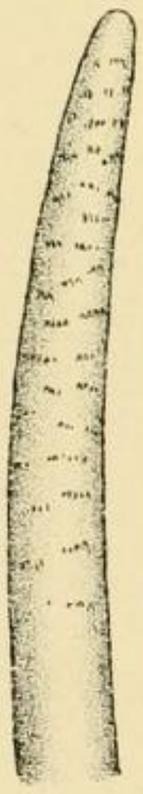

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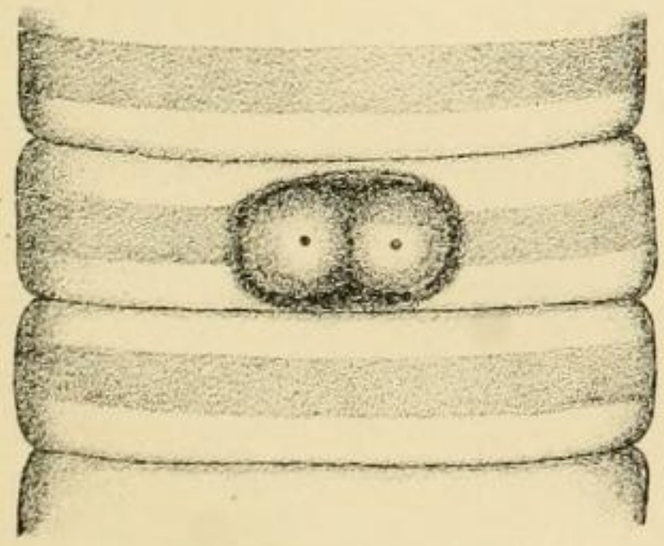

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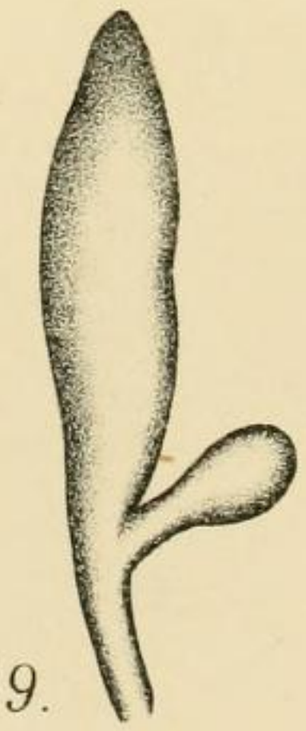

19.

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INDIAN OLIGOCHAETA.

EXPLANATION OF PLATE XXXII.

FIG. 20.—*Notoscolex gravelyi*; penial seta. *a*, slightly magnified, to show the general form; *b*, highly magnified, the distal end only.

,, 21.—*Megascolex cingulatus*; spermatheca. *a*, the whole spermatheca, the dotted lines showing the course of the duct behind the ampulla; *b*, diverticulum only, from another organ, showing a different condition of the secondary diverticula, rather more highly magnified.

,, 22.—*Megascolex insignis*; spermatheca.

,, 23.—*Megascolex pentagonalis*; male genital area. ♂ points to position of male aperture.

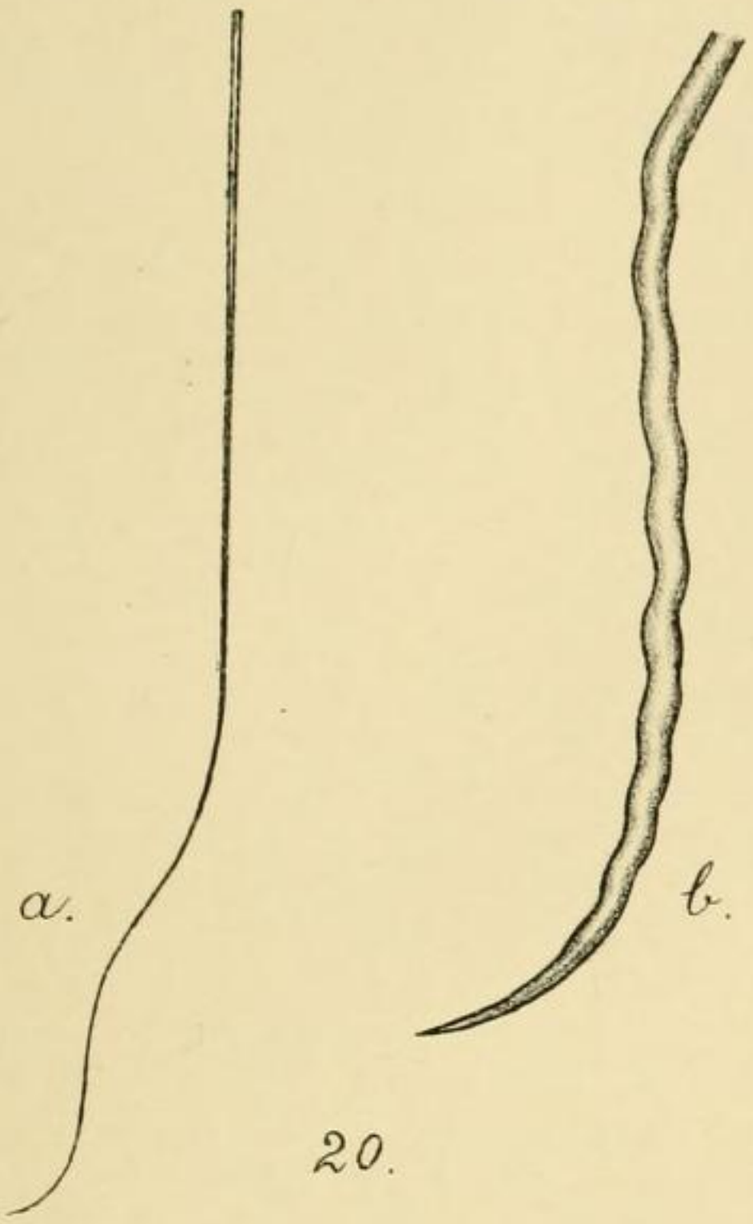
,, 24.—The same; spermatheca.

,, 25.—*Megascolex trivandranus*; male genital area.

,, 26.—The same; spermatheca.

,, 27.—*Pheretima trivandrana*; prostate.

Plate XXXII.



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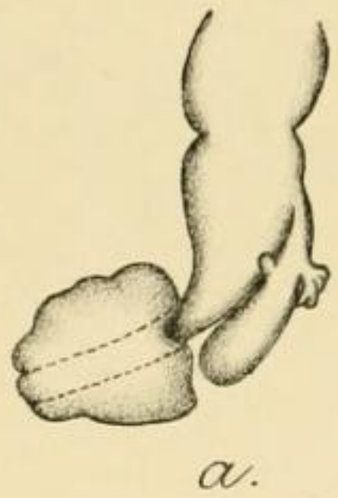

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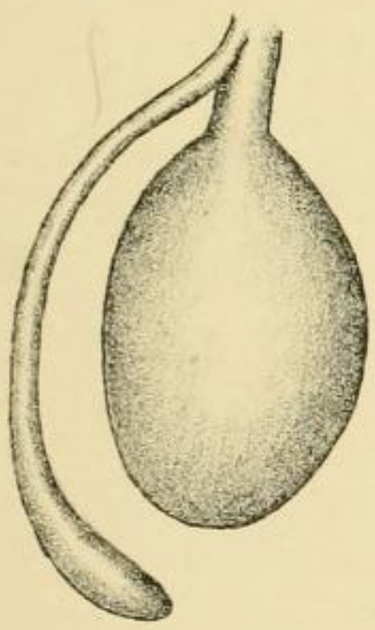

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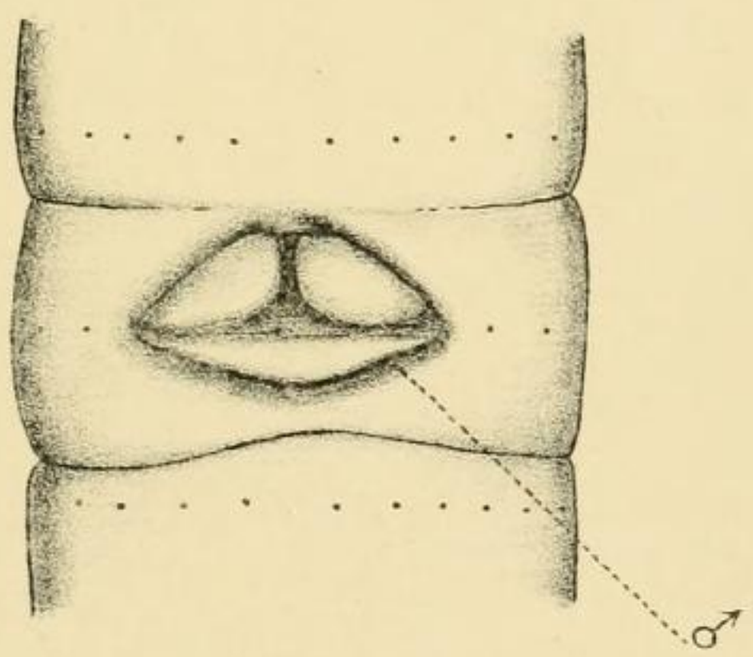

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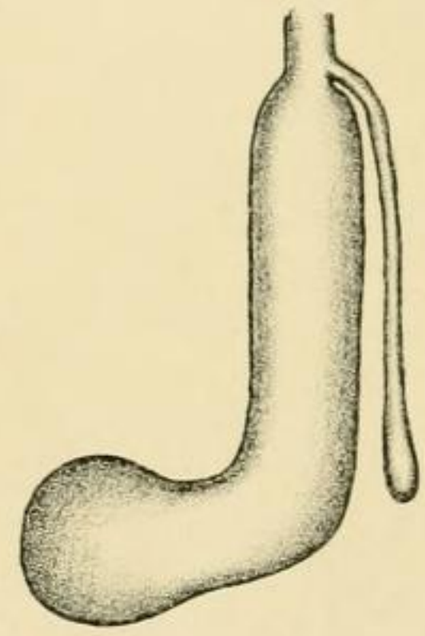

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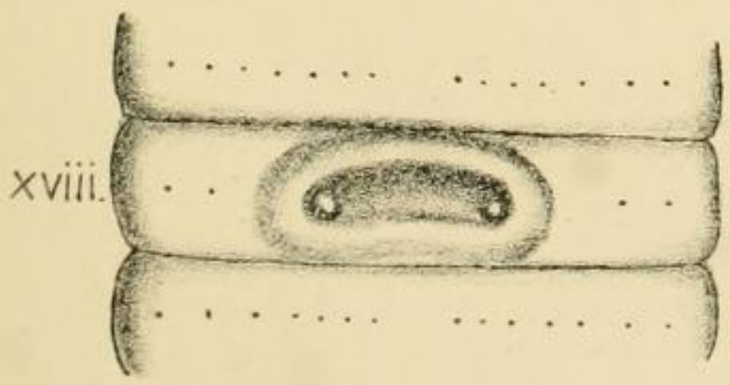

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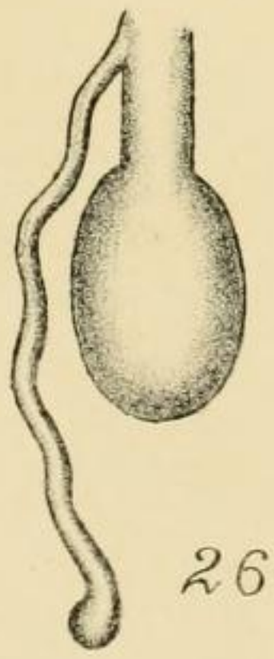

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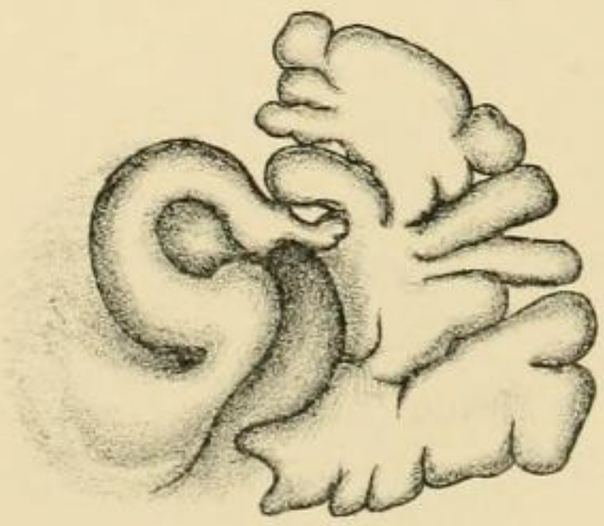

27.

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EXPLANATION OF PLATE XXXIII.

FIG. 28.—*Pheretima trivandrana*; spermatheca.

,, 29.—The same; spermatheca viewed under the low power after clearing, to show the chambers in the diverticulum.

,, 30.—*Pheretima kuchingensis*; spermatheca. *a*, the whole organ, showing the micronephridia covering the duct; *b*, diverticulum of another organ, showing a small secondary diverticulum.

,, 31.—*Octochaetus surensis*; spermatheca.

,, 32.—*Octochaetus barkudensis*; penial seta.

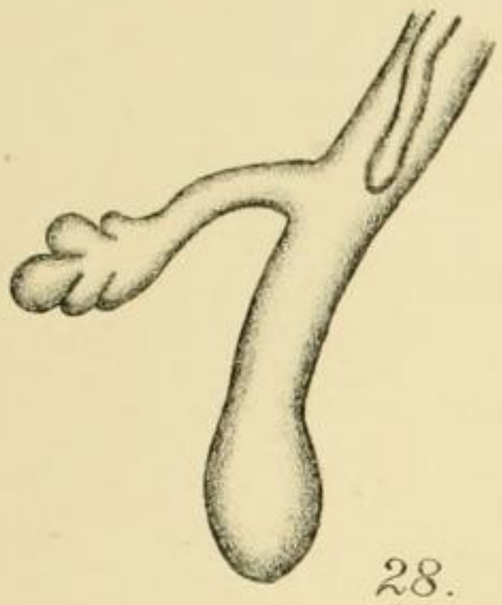
,, 33.—The same; copulatory seta.

,, 34.—*Eutyphoeus annandalei* var. *fulgidus*; penial seta.

,, 35.—*Dichogaster malayana*; spermatheca seen by transparency after clearing.

,, 36.—The same; penial setae. *a*, *b*, the two types numbered 1 and 3 in the text; *c* (2 in text) resembles *a* except that the thin expansion is one-sided only.

,, 37. *Glyphidrilus tuberosus*; segments xviii to xxviii from the ventral surface, showing the papillae in this region, with the ventro-lateral ridge on one side and the cauliflower-like excrescence on the other.



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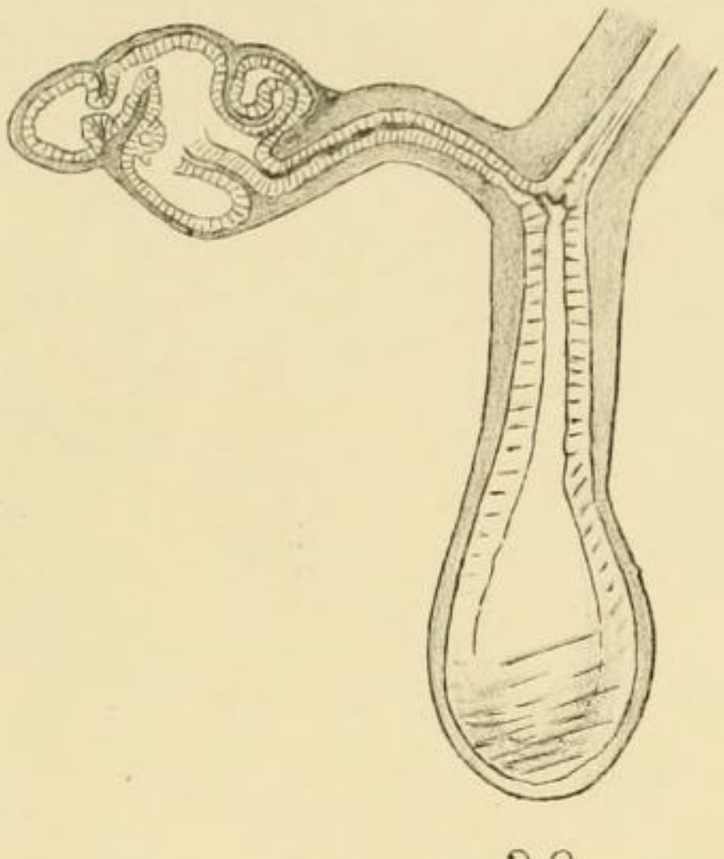

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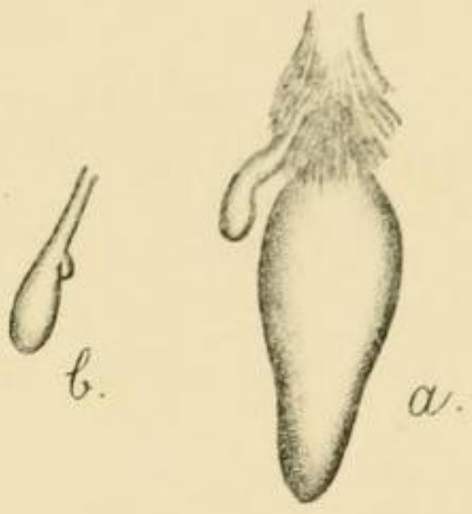

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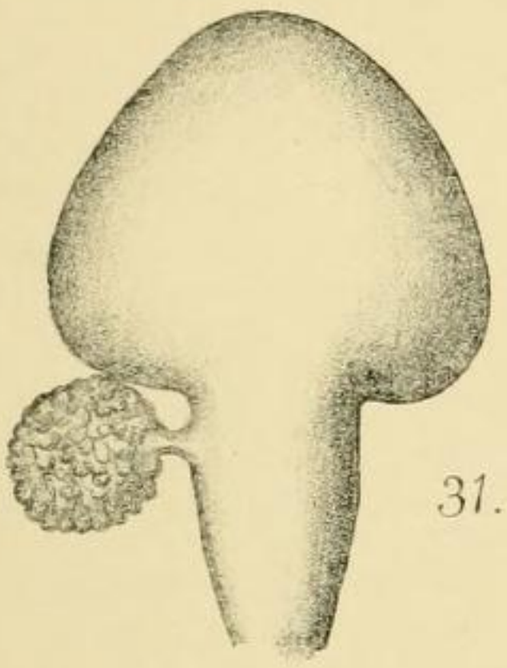

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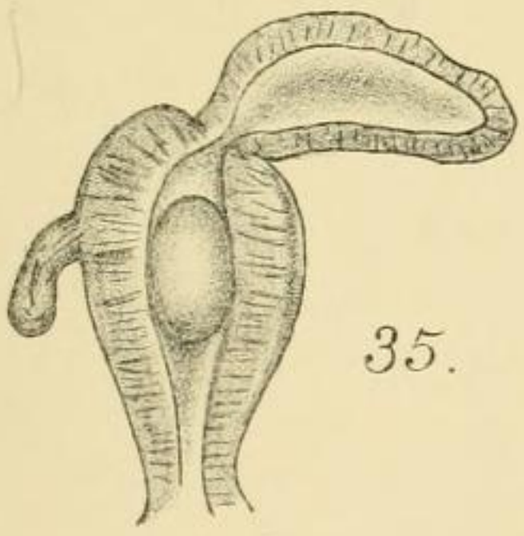

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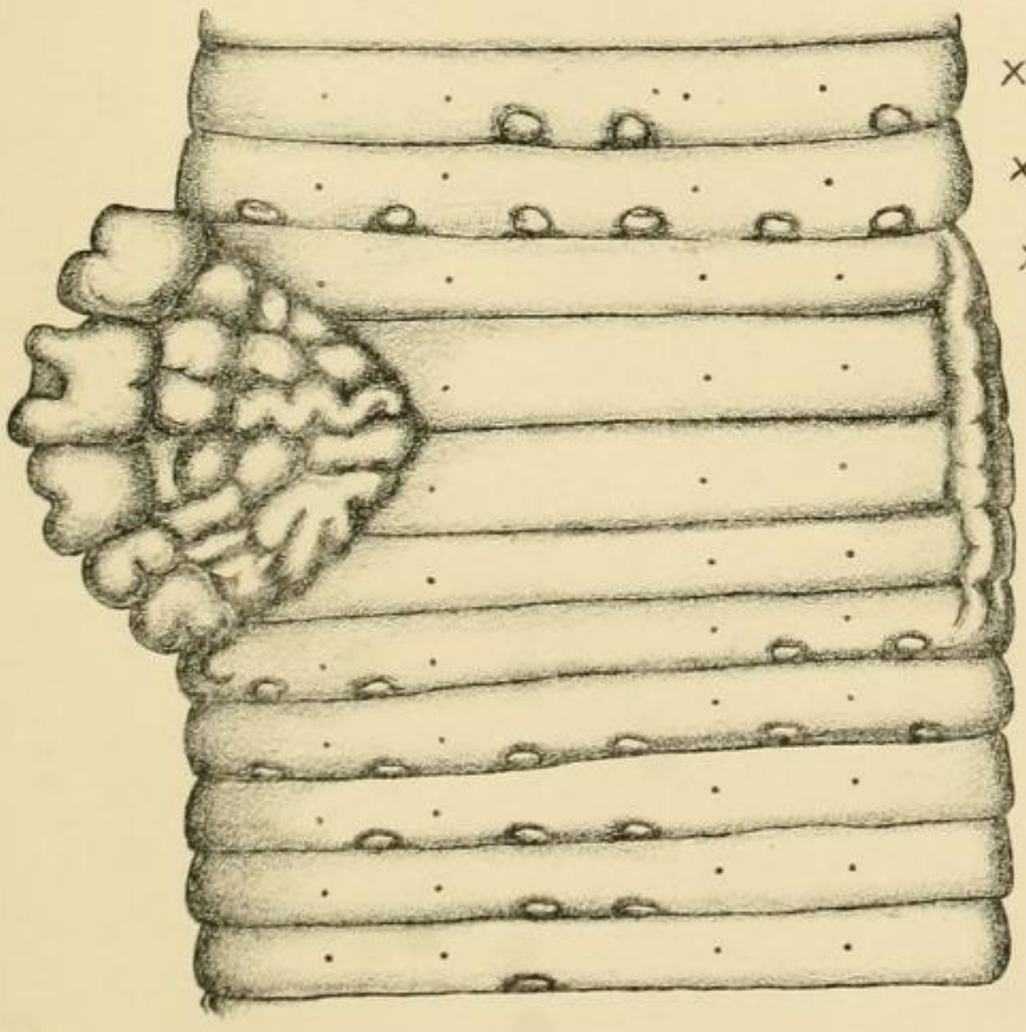

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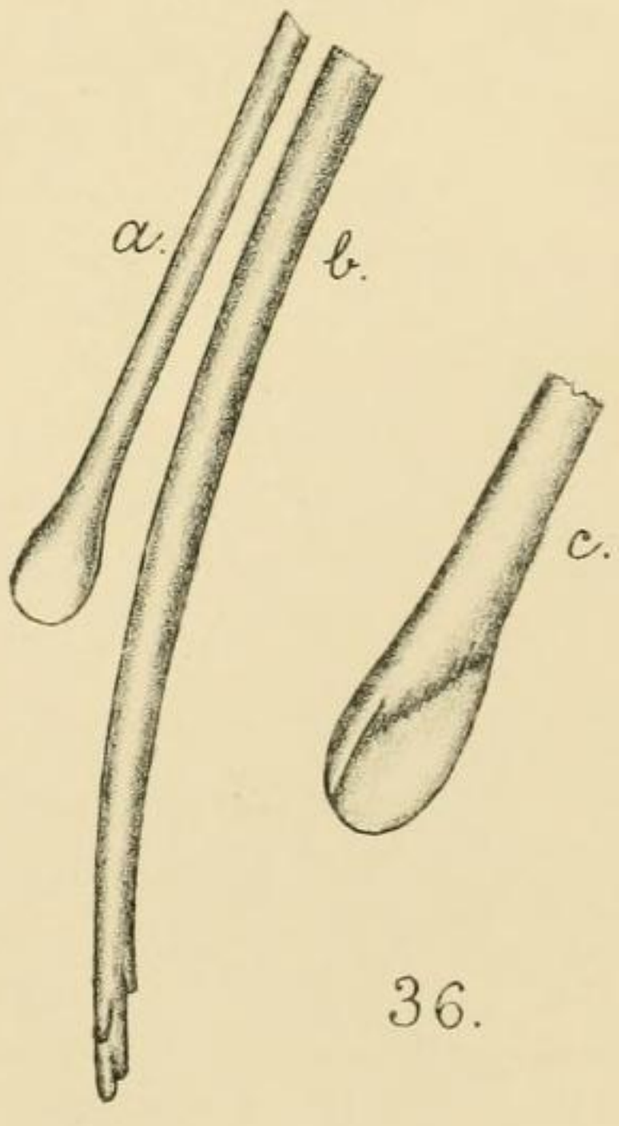

36.

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