

XXXIV. OLIGOCHAETA FROM MANIPUR,
THE LACCADIVE ISLANDS, MYSORE,
AND OTHER PARTS OF
INDIA.

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(Plate XXVIII).

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INTRODUCTION.

The present paper deals with Oligochaeta received from the three following sources:—

(1) The majority of the specimens were received from the Indian Museum, and a large number of these were brought from Manipur by the Manipur Survey Party; others are from the Nilgiris in S. India, and a few from other parts.

(2) I received a small collection from Mr. R H. Whitehouse, Marine Biologist to the Madras Fisheries Department, obtained from the Laccadive Islands during a recent visit by one of his assistants.

(3) A tube of specimens, collected in May, 1920 in the forests of Shimoga and Kadur Districts, Mysore, which contained three interesting species, two of which are new, was forwarded to me, at the suggestion of Prof. J. P. Hill, by Mr. A. Subba Rau, a student of University College, London.

To the Director of the Zoological Survey, and to the other gentlemen named, I am much indebted for the opportunity of examining these collections. I propose to offer a few general remarks on them before passing to the systematic description.

Distribution of the species investigated.

The species are distributed as follows:—

Manipur	<i>Branchiura sowerbyi</i> , Bedd. <i>Pheretima hawayana</i> (Rosa). <i>Pheretima heterochaeta</i> (Mich.). <i>Perionyx excavatus</i> , E. Perrier. <i>Eutyphœus manipurensis</i> , sp. nov.
Madras Pres. :—	
Madras City	<i>Branchiodrilus menoni</i> , Steph. <i>Branchiura sowerbyi</i> , Bedd.
Nilgiris	<i>Tubifex (Tubifex) tubifex</i> (O. F. M.). <i>Plutellus aquatilis</i> , sp. nov. <i>Pheretima heterochaeta</i> (Mich.). <i>Perionyx saltans</i> , Bourne. <i>Perionyx sansibaricus</i> , Mich..
Barkuda I	<i>Nais paraguayensis</i> , Mich. var. <i>barkudensis</i> , nov. <i>Octochaetus barkudensis</i> , Steph.. <i>Eudichogaster barkudensis</i> , sp. nov.
Godaveri Dist.	<i>Megascolides annandalei</i> , sp. nov. <i>Megascolex mauritii</i> (Kinb.).
Mysore	<i>Drawida ravi</i> , sp. nov. <i>Perionyx mysorensis</i> , sp. nov. <i>Glyphidrilus annandalei</i> , Mich..
Central Provinces	<i>Nais paraguayensis</i> , Mich.. <i>Branchiodrilus</i> sp. <i>Aulodrilus remex</i> , sp. nov.
Laccadive Islands.	<i>Megascolex mauritii</i> (Kinb.). <i>Megascolex konkanensis</i> , Fedarb.

The Oligochaeta of the Laccadive Islands.

The Laccadives are a group of coral islands, the nearest of which is about 150 miles from the Malabar Coast. The only previous account of the Oligochaeta of these islands is by Beddard,

on the basis of Gardiner's collections from the Maldives and Laccadives, made in 1899 and 1900 (1). Beddard received two species only from the Laccadives, both from Minikoi,—*Pontodrilus laccadivensis* (united by Michaelsen with *Pontodrilus bermudensis*, Bedd.), and *Megascolex mauritii* (Kinb.). In the present more extensive collection also only two species are found, *Megascolex mauritii* (Kinb.) and *Megascolex konkanensis*, Fedarb.

Pontodrilus bermudensis, littoral in habit, as are all the species of the genus, has spread widely on the shores of tropical and subtropical seas all round the world. *Megascolex mauritii* is also in a special degree peregrine; it is very common in India, and inhabits also the lands bordering the Indian Ocean, and S. and S.E. Asia generally. *Megascolex konkanensis* is common on the Malabar coast,—i.e. that part of India which is nearest to the islands, and with which communication is most frequent.

It appears therefore that the earthworm fauna of the Laccadives, as was to be expected, is entirely introduced, and is very limited in the number of species.

The Indian Tubificidae.

Tubificids appear to be rare in India, and hitherto only four species have been recorded, belonging to as many genera:—*Branchiura sowerbyi*, Bedd., *Limnodrilus socialis*, Stph., *Bothriocnecurum iris*, Bedd., and *Monopylephorus parvus*, Ditlevsen. The present communication brings a fresh record for *Branchiura sowerbyi* (from Manipur), and adds two more species to the Indian list,—*Tubifex (T.) tubifex* and a new *Aulodrilus*.

Branchiura sowerbyi, remarkable for its gills, was discovered first by Beddard in the mud of the Victoria regia tank in the Royal Botanical Society's Gardens in London in 1892; it was not seen again for sixteen years, when Michaelsen found it in a warm water tank of the Botanical Gardens at Hamburg; Southern then found specimens in the Victoria regia tank at Dublin, and Perrier in the Rhone; and in recent years a number of finds have been recorded by Keyl and Stephenson from warm houses in Europe, and from the open in India, Burma, China and Japan. Indeed it appears to be quite common in the East.

Tubifex (Tubifex) tubifex (O. F. M.), a widely spread European species, is now found in the Nilgiris, where it differs but slightly from the common form.

The genus *Aulodrilus* was established by Bretscher in 1899 (2) for *A. limnobius*, found in Switzerland. Though he places it as an appendix to the Tubificidae, he recognizes that it fits in neither with that family nor with the Lumbriculidae, and suspects that it may be necessary to found a new family for it. The reproductive organs are still, as they were to Bretscher, unknown; but the genus is distinguished from most other Tubificidae by the fact that the needle setae (crotchets) have the upper tooth (the one on the outer side of the curve of the shaft) much smaller than

the other,—the reverse is the case in most other genera of the family.

A second species was described in 1906 by Piguet (10), who placed it among the Naididae as *Naidium plurisetia*, but later (11) transferred it to *Aulodrilus*.

The justification for the inclusion of these species in the Tubificidae is to be found in the absence of asexual reproduction by fission, which is a constant characteristic of the Naididae; as well as, perhaps, if *A. plurisetia* resembles *A. limnobius* and *A. remex*, in the presence of large parietal vascular loops at the hinder end of the body. It must however be owned that if, as Piguet states, an *Aulodrilus* from the S. of France, the study of which was not completed when he wrote, has retractile penes in front of the ventral setae of segment vii, the genus is probably nearer to the Naididae than to the Tubificidae, though capable of inclusion in neither; and Michaelsen's caution in placing *Aulodrilus* as a doubtful genus (of Tubificidae) (6) is justified.

A. limnobius and *A. plurisetia* form tubes, as does perhaps, to judge from the foreign matter which adhered to the present specimens the Indian species also. The hinder end of both *A. plurisetia* and the present species (and, it may be conjectured, *A. limnobius* also) is remarkable; the most posterior region shows no proliferation, nor even any segmentation; but there is a zone of proliferation and formation of numerous new segments some little distance *in front of* the anus. These zones are known in other worms in two situations;—terminal, in probably all Oligochaetes and other segmented worms which continue to produce new segments during their life; and in the middle of the body, in *Acolosoma* and the Naididae, where such a production of new segments (a "budding zone") indicates the site of approaching fission. Such a budding zone as that of the present genus is, so far as I know, unique.

The terminal unsegmented region Piguet looks on as physiologically a gill; it possesses a rich cutaneous vascularization; and during life the anus can dilate, giving rise to a "branchial fossa."

Some interesting species in the collections.

Drawida rauli, sp. nov., described below is interesting from the fact that it possesses a well-developed pair of prostates in segment ix, equal in size to those in segment x. The anterior pair have no direct communication with the male reproductive apparatus, while the posterior are, as usual, joined by the vasa deferentia. Michaelsen has previously (7) found a rudimentary second pair in segment ix in *D. willsi*, and has argued that the genus originally possessed two fully-developed pairs, of which the anterior has disappeared. This anterior pair, in turn, is the index of a formerly existing second pair of testes, the ancestors of the genus *Drawida* having been holandric while their present-day representatives are metandric (retaining only the posterior of the two original pairs of testes). The genus *Desmogaster* (Burma, Sumatra, Borneo) is

actually holandric, and is to be looked on as the most primitive member of the family.

Drawina ravi may thus be regarded as the most primitive existing member of the genus, at any rate in respect of its male reproductive apparatus. There are other primitive features also:—(1) In a considerable number of species of the genus segment xi, which lodges the ovaries and female funnels, forms an "ovarian chamber," being shut out from the body-wall by the meeting and coalescence of the septa which bound it; in the present species however, as in some others, the septa have the usual arrangement, and there is no ovarian chamber. (2) In many species of the genus the setae are remarkably small, and in some may even be absent or unrecognizable in the most anterior segments; here however the setae are remarkably large for so small a worm. (3) The fact that the spermathecal atrium is large and sac-like may not improbably be another primitive feature; in this case the numerous species in which it is small, almost or entirely hidden in the body-wall, or even absent, would represent a secondary condition.

A specimen of *Branchiodrilus* (interesting, like *Branchiura*, from the possession of gills), the species unfortunately indeterminate, comes from Burhanpur in the Central Provinces. The genus, so far found only in India, and for long represented only by Bourne's *Chaetobranchnus semperi* (Madras, 1890), has been in recent years rediscovered in Madras, and occurs also at Lahore and Lucknow.

The new species *Plutellus aquatilis*, *Eutyphocus manipurensis*, and *Eudichogaster barkudensis* bring about no change in the areas of distribution of these genera as already known. *Megascolides annandalci* (Godaveri District, on the E. coast) extends the range of this genus to a region where it had not previously been found; the genus appears to be widely spread, but nowhere abundant.

The rediscovery of Bourne's *Perionyx saltans* after thirty-five years, in the Nilgiris, not far from where it was originally found, is interesting.

Systematic changes adopted in the present paper.

I have, following Michaelsen, restored the worm which for a long time has been known as *Lampito mauritii* to the genus *Megascolex*. Michaelsen, who in the 'Tierreich' volume (6) had united Kinberg's genus *Lampito* with *Megascolex*, separated it again in 1909 (7), in consequence of finding two other worms which agreed with *L. mauritii* in the possession of a peculiar form of nephridial system,—micronephridia throughout the body, and meganephridia in addition in the postclitellar segments; to these three species Stephenson later added two others (13, 14). Michaelsen again fused the two genera in 1916 (8), since he had come to believe that the coexistence of micro- and meganephridia had no special impor-

tance; the peculiarity has arisen at various times, and is found in a number of genera of Megascolecinae,—*Megascolides*, *Notoscolex*, *Megascolex*, and *Plionogaster*. With this I agree; there are many varieties of nephridial distribution in the genus *Megascolex*, and I see no reason for separating the worms possessing this particular form of nephridial distribution as a separate genus; indeed, *M. escherichi* var. *papillifer* has this special arrangement while the type form of the species has not. Nor is there anything in the geographical distribution of the worms with this special arrangement to suggest a common origin.

The genus *Eudichogaster* I have placed under the subfamily Octochaetinae, instead of, as has been done by Michaelsen, under the Trigastrinae. I have discussed the question of the descent and systematic position of the genus at some length in a recent paper (16), and need not refer to it further here.

Michaelsen has recently (9) united the Glossoscolecidae and Lumbricidae as one family, the latter group becoming a subfamily, the Lumbricinae, and the several subfamilies of the former becoming subfamilies of the Lumbricidae, *s.l.* I can have no hesitation in adopting the view of one whose experience of these groups entitles him to speak with the authority of Dr. Michaelsen.

Fam. NAIDIDAE.

Gen. *Nais*, O. F. M. *em.* Vejd.

Nais paraguayensis, Mich.

Pachmarhi, Satpura Hills, Central Provinces; 300 ft. no date. F. H. Gravely. Numerous specimens.

Indian specimens have been found to be larger than those originally described by Michaelsen (5), and the number of their segments greater; this is the case also with the present specimens, the longest of which measured 13–14 mm. In one example 106 segments were counted, plus a posterior region of some little length in which new segments were about to be differentiated. None showed any sign of fission.

The coelomic corpuscles are large, a fairly large one being 16 μ in diameter, and one of average size 12 μ ; they are circular in shape, with a central nucleus.

No budding zone, nor any sign of approaching fission has apparently as yet been observed in this worm, nor have sexual organs been seen. It is therefore a question how the animal ordinarily reproduces itself. I think it possible that it does so by simple fragmentation,—*i.e.* without the formation of an internal budding zone,—and subsequent regeneration. Thus, in the present batch of material, besides the longer worms are some much shorter, with a large number of new segments, evidently rapidly produced, at the hinder end; this appearance of a considerable length of rapidly produced posterior segments seems to be a frequent characteristic (compare, for example, the description

and figure in 12). Others are shorter still,—about 30 segments,—with a short stumpy conical “tail,” evidently about to regenerate a hinder end. One or two fragments have not yet begun to regenerate, but these may possibly be simply the result of injury at the time of capture.

var. *barkudensis*, nov.

(Pl. XXVIII, fig. 1.)

Pond, Barkuda Island, Chilka Lake, Ganjam Dist., Madras Pres. Aug. 19 (no year). F. H. Gravely. Three specimens, all disintegrating.

The condition of the worms was quite useless for any study of the anatomy. The discrimination of the species of the Naididae however is based largely on setal characters; and since these were still discernible in the specimens,—and indeed more easily than in better preserved material,—it seems justifiable to offer the following description.

One specimen is a fragment 2 mm. long, incomplete at both ends; the other two are incomplete behind, and about 4 mm. long. The original length of the worm may thus be about 5 mm.

The anterior end, comprising the first six segments, is rather bulbous. There seem to have been no eyes; the pigment of the eyes is usually fairly resistant, and would have been visible if eyes had existed. As far as can be seen, there is no stomachal dilatation on the alimentary tube.

In one specimen there are 33 fully developed segments, followed by 21 very short and recently produced segments, after which the hinder end is broken off. In the other there are 31 segments, after which two short ones follow; these are apparently the beginning of a posterior series of rapidly produced segments, the rest of which are wanting.

The ventral setae of segments ii-v differ from those of the remainder of the body. In this anterior group of segments they are four per bundle, 100μ in length and 3μ in thickness; the nodulus is proximal to the middle of the shaft (proximal portion: distal portion: : 4:5); of the two terminal prongs, the distal is nearly twice as long as the proximal, and about equal to it in thickness at the base, or perhaps slightly thinner. In the rest of the body the ventral setae are 4-5 per bundle, their length 90μ and thickness 3μ ; the nodulus is distal to the middle of the shaft (proximal portion: distal portion: : 5:3 or almost 2:1); the prongs are equal in length, and the proximal is one and a half times as thick as the distal.

The dorsal setae begin in segment vi, and each bundle consists of two or three hairs and two or three needles,—perhaps most often of two of each. The hairs are about .25 mm. long, rather less than the diameter of the body. The needles, about 94μ in length, have a slight sabre-like curve; the nodulus is one-third the length of the shaft from the distal end; the tip is bifid, the prongs being visible to the ordinary high power, set at an acute

angle, that on the outer side of the curve of the shaft being rather longer and perhaps slightly stouter than the other (fig. 1).

Remarks.—In the absence of the posterior end of any of the specimens, there is no strict proof that they may not belong to the genus *Dero* or *Aulophorus*, which have gills around the anus, though their setal characters are similar to those of *Nais*. The existence of a long region of newly budded segments posteriorly, however, is very suggestive of *Nais paraguayensis*; and it is difficult to imagine developed gills at the hinder end of a series of rudimentary or still undifferentiated segments.

The three varieties of *Nais paraguayensis* form a series distinguished by the relative sizes of the inner and outer prongs of the dorsal needles:—

- N. paraguayensis typica* . . . outer prong considerably smaller.
 „ „ var. *aequalis* . . . prongs equal.
 „ „ var. *barkudensis* . . . inner prong smaller.

The difference between the typical form of the species and the present variety is such that, but for the existence of the intermediate variety *aequalis*, it would have been necessary to separate them as distinct species.

Gen. *Branchiodrilus*, Mich.

Branchiodrilus sp.

Burhanpur, Central Provinces. 4-6.iii.1919. F. H. Gravely. A small fragment, in a tube with *Aulodrilus remex*.

The fragment was incomplete at both ends, and the species therefore indeterminable.

Branchiodrilus menoni, Steph.

Madras, Prof. K. Ramunni Menon's collection 5-iii-1912. Seven specimens or fragments, in a tube with two specimens of *Branchiura sowerbyi*.

One specimen was undergoing fission, but showed no budding zone; the gills of the posterior animal began immediately behind the point of impending separation. The heads of the other specimens showed a prebranchial region of varying extent, sometimes small, sometimes comprising four seta-bearing segments.

Fam. TUBIFICIDAE.

Gen. *Branchiura*, Bedd.

Branchiura sowerbyi, Bedd.

Northern portion of Loktak Lake, Manipur, Assam: 2600 ft. 16-17.ii.1920. Three specimens.

Loktak Lake, Manipur; on *Tivipara lecythis*. 17.ii.1920. A single specimen.

Off Thanga Island, Manipur. 24.iii.1920. Three specimens, all fragments, two probably comprising together one individual.

Madras, Prof. K. Ramunni Menon's collection. 5.iii.1912. Two specimens.

The following measurements were made from two specimens of the first batch:—(a) Length of animal 62 mm.; whole gill-bearing region one-sixth of length of animal; length of gills half diameter of body; hints of gills on seven segments, gills quite small in the next seven, of moderate size on 51 segments, and small on the three last (total 68 segments with gills); (b) length of animal 60 mm.; whole gill-bearing region nearly one-third of the length of the animal; length of gills half diameter of body; hints of gills on 16 segments, gills quite small on the next 19, of moderate size on 64, and small on the terminal one or two (total 100).

Gen. **Tubifex**, Lm.

Tubifex (Tubifex) tubifex (O. F. M.).

Law's Falls below Coonoor, Nilgiris; ca. 6500 ft., 9'iv.1919. N. Annandale and R. B. S. Sewell. A number of specimens.

The only difference from the current diagnosis discoverable in the present specimens is in the ventral setae. The diagnosis gives the upper prong as longer than the lower. I find them usually equal, but slightly variable; either one or the other may be slightly the longer.

Gen. **Aulodrilus**, Bretscher.

Aulodrilus remex, sp. nov.

(Pl. XXVIII, figs. 2-6.)

Burhanpur, Central Provinces. 4-6'iii.1919. F. H. Gravely. Three specimens.

Some yellowish foreign matter had to be pencilled off two of the specimens, to which it adhered round a short length of the middle of the body in the manner of an incomplete tube.

Length 12 mm. Diameter .43 mm. anteriorly; the hinder portion of the worms was however much thinner, the diameter being .25 mm. one-third of the length of the animal from the hinder end. Segments 49 plus a considerable region of greater opacity where new segments are differentiating, and this again followed by a terminal transparent region, not divided into segments nor the site of formation of new segments (fig. 2). The number of new segments forming in the region of proliferation is very large; in one specimen about 30 can be distinguished, while in the type-specimen there are about 40, and even behind these there is a cellular mass where no differentiation of segments whatever can be made out, before we arrive at the transparent terminal region. The worm has thus a characteristic appearance.

There is no budding zone or sign of fission anywhere in the middle of the animal's length.

The prostomium has the shape of a blunt equilateral triangle. There are no eyes.

The dorsal setae begin in the second segment. The bundle consist of needles and hairs, the latter short, with a bayonet curve

(fig. 3); the hairs are only about half as long again as the needles, and thus are very much shorter than the diameter of the body. In the anterior segments some needles are singly pointed and rather blunt, and others, perhaps the majority, double-pointed with the outer prong much shorter and less conspicuous than the inner. In this anterior region the bundles consist of about seven needles with one, two, or up to four hairs.

Further back the needle setae of the dorsal bundles are peculiar and characteristic. The distal end becomes flattened and blade-like or oar-like, the tip being usually rounded in outline (fig. 4a); occasionally the flattened part retains a trace of the bifid character (fig. 4b). These oar-like setae begin in segment xiii in one specimen, in vii in another; they continue to the hinder end of the body. The number of setae in a bundle in the hinder part of the body is usually 5 needles with two or three hairs. The length of the needles in the anterior segments is from 74μ to a maximum of 98μ ; and posteriorly about 60μ .

Some of the needles in the posterior dorsal bundles seem to be of the single-pointed type, but I think this is only the appearance of the flat blade seen edgewise. Indeed I am not absolutely confident that any are truly singly pointed even in the anterior dorsal bundles; in one specimen, mounted in glycerin and therefore showing details of setae more easily than the balsam preparations, I was unable to convince myself with the oil immersion lens that any of the dorsal setae which were in a favourable position for examination were certainly singly pointed.

The ventral setae are singly or doubly pointed needles, the bundles consisting of as many as nine in the anterior, and six or seven in the posterior region. In length they are about 86μ in the anterior, and 51μ in the posterior segments. Some setae in segments ii, iii and iv are singly pointed; with this exception all have a slight second outer prong (fig. 5); one, in an anterior segment, appeared to have two small outer prongs (fig. 6).

The pharynx extends back to the hinder end of segment iii; the oesophagus is narrow, and occupies segments iv to vii; then a sudden dilatation occurs, and thenceforward the tube is wide and occupies most of the available space in the segments. A pair of hearts are present in segment vi. The dorsal vessel is ventral in position, lying to the left side of the ventral vessel throughout most of the body; at the anterior limit of segment vii it mounts dorsalward, and becomes dorsal in vi. There are large parietal vessels, in complicated loops on the inner surface of the body-wall, in the posterior segments.

There was no trace of sexual organs.

Remarks.—The present form is at once distinguished from the two other species of the genus by the possession of the remarkable oar-like setae in the dorsal bundles.

Fam. MONILIGASTRIDAE.

Gen. *Drawida*, Mich.*Drawida raii*, sp. nov.

(Pl. XXVIII, fig. 7).

Forests of Shemoga and Kadur Districts, Mysore, S. India May, 1920.
A. Subba Rau. Several specimens.

External Characters.—Length 45 mm. Diameter 1.75 mm. Colour dark bluish grey to olive, somewhat lighter ventrally. Segments ca. 159. Anterior end of the body rather bulbous.

Prostomium prolobous.

No dorsal pores.

Setae closely paired, beginning in ii; remarkably large and prominent for so small a worm, especially in the ventral bundles of segments iii-xii. In the pregenital segments *aa* is rather greater than *bc*, or may be about equal to it; in the middle of the body $aa=bc$; *dd* is equal to half the circumference.

The clitellum was not present.

Over the ventral surface of segment xi, extending to its posterior limit, and encroaching anteriorly on the hinder end of x, is a thickened patch, with a definite and slightly swollen margin, rather rectangular in shape with rounded ends. It extends laterally on each side to not far from the line of seta *c*, and is thus broad from side to side and narrow antero-posteriorly. The male apertures are situated on small papillae in the antero-lateral corners of the patch, and are thus over the situation of furrow 10/11 and midway between *b* and *c*, rather nearer *b* (fig. 7).

Over furrow 9/10, and taking up the posterior third of segment ix and the anterior third of x, are a pair of transversely oval papillae, narrower at their internal ends and slightly sunk in their centres, while the periphery of each is swollen and definitely marked. Each extends from a point between *b* and *c* but rather nearer *b*, to not far from the middle line (fig. 7).

Neither the female nor the spermathecal apertures were visible externally; from internal dissection the latter open in the line of setae *ab* in groove 7/8.

Internal Anatomy.—Septum 5/6 is thin; 6/7, 7/8 and 8/9 are considerably thickened; 9/10 is somewhat strengthened; 10/11 11/12 and perhaps 12/13 slightly so.

There are two gizzards, in segments xiii and xiv.

Some of the nephridiopores are in *cd*, but I think not all.

The testis sacs are large, extending into both segments ix and x,—equally into both, or with the larger part in ix; they are not constricted by the septum. The vas deferens, narrow and coiled, lies on both sides of septum 9/10. The prostates are elongated, somewhat cylindrical or pear shaped, rather narrowed towards their insertion in the body-wall. There is no distinct duct; the vas deferens, joining the gland below, can be seen running up its surface towards the free upper end. The surface of the glands is soft, and minutely papillated.

A second pair of prostates occurs in segment ix, of the same size, shape and appearance as the former in x. They are inserted into the body-wall near or in the situation of furrow 9/10, between the lines of setae *b* and *c*, though nearer, almost in *b*.

The ovaries are in segment xi; the septa here are quite normal, and there is no ovarian chamber, as occurs in so many species. The ovisacs extend back to segment xv; they are tubular as they pass through segments xii, xiii and xiv, and swollen in xv; or they may be moniliform, constricted by the septa.

The spermathecal ampullae are small and spherical, in segment viii; the duct is narrow and coiled, lying on the posterior face of septum 7/8. The atrium is a relatively large ovoid structure in vii, the duct entering near its base; it pierces the body-wall in the line *ab*.

Remarks.—The well-developed second pair of prostates, and the genital markings, are characteristic, and serve at once to distinguish the present species.

Fam. MEGASCOLECIDAE.

Subfam. MEGASCOLECINAE.

Gen. *Plutellus*, E. Perrier.

Plutellus aquatilis, sp. nov.

(Pl. XXVIII, fig. 8).

Small stream below Kotagiri, Nilgiris; ca. 5700 ft. N. Annandale and R. B. S. Sewell. A single specimen, broken into two.

External Characters.—Length of both pieces together 115 mm. Diameter 1.75 mm., near anterior end 2 mm.; a long thin worm. Unpigmented, colour grey, due to the intestinal contents; at anterior end quite pale. Segments 162; segment iv biannular, v–viii triannular, the rest simple.

Prostomium small, proepilobous.

Dorsal pores are present from furrow 8/9.

The setae are paired; in the middle of the body $ab = 2/5$ $aa = 1/2$ $bc = 2/3$ cd ; behind the genital region $ab = 1/3$ $aa = 2/5$ $bc = 1/2$ cd ; in front of the genital region $ab = 2/5$ $aa = 1/2$ $bc = 1/2$ cd (*i.e.* the lateral setae are not paired in front of the genital region); dd is less than half, and in the middle of the body is only one-third of the circumference, the setae *d* being above the lateral line of the body.

No clitellum was visible.

The male pores are on segment xviii, on small papillae which take up the interval between the lines of setae *a* and *b*; these papillae are connected across the middle line by a transverse ridge.

The female and spermathecal pores were not visible externally; from internal dissection the latter are found to open at the middle of the length of segments viii and ix, in the setal zone, and rather outside the line *b*.

There were no genital papillae or other markings.

Internal Anatomy.—Septum 5/6 is very thin; 6/7—13/14 are all present and all slightly thickened, the first few perhaps a little more than the rest.

The gizzard in segment v is large, firm, elongated, and barrell-shaped. There is a slight swelling of the oesophagus in segment xii, with close-set transverse vascular striations. The intestine begins in xv.

The last heart is in xii.

The excretory system consists of rather small meganephridia.

The testes and male funnels are free in segments x and xi. Seminal vesicles occupy segments xi and xii; they are small, those in xi smaller than the posterior pair, are much divided up into small lobules and thus have a racemose appearance; in both segments they are arranged in the form of a transverse band, continuous across the middle line, on the posterior surface of the septum (10/11 and 11/12).

The prostates are relatively large; the twisted tubular glandular portion occupies segments xviii—xxi or xviii—xxii. The duct is very thin, and much shorter than the gland; it is confined to segment xviii, and pursues a twisted course to pierce the body-wall in line with setae *b*. There are no penial setae.

The female organs have the usual situation.

The spermathecae are two pairs, in segments viii and ix (fig. 8). The ampulla is of an oval or inverted pear-shape. The duct is about as long as the ampulla, moderately stout, of an equal diameter throughout, and either straight or rather twisted in its course. The single diverticulum is tubular, as long as the main pouch (ampulla plus duct), and arises from the ectal end of the duct; in one of the four spermathecae its ental half is rather twisted, and showed three small rounded seminal chambers as irregularly arranged swellings; this is the organ illustrated in the figure, which I take to be the fully developed form. Of the other three spermathecae, one appeared to have no diverticulum, and in the remaining two the diverticulum was simply tubular and transparent.

Remarks.—This species bears a considerable resemblance to *P. indicus*, Mich.; the latter differs however in having the setae *cd* paired in the preclitellar region, the posterior spermathecal apertures in groove 8/9, the seminal vesicles in ix and xii, a straight prostatic duct, and a shorter spermathecal diverticulum with a single seminal chamber.

Gen. *Megascolides*, McCoy.

Megascolides annandalei, sp. nov.

(Pl. XXVIII, fig. 9).

Dowlaishweram, Godaveri Dist. 29.viii.1918. N. Annandale. Five specimens, all sexual.

External Characters—Length 95 mm. Diameter 5 mm. Colour pale, unpigmented, no difference between dorsal and ventral surfaces. Segments 130; segment v is triannular, vi triannular and partially (ventrally) 4-annulate; segments vii and onwards to the clitellum are triannular, or triannular with one or two secondary rings; while behind the clitellum the segments show three annuli with some secondary annuli in addition.

The prostomium, withdrawn under segment i, appears to be prolobous. There is a short median groove dorsally on segment i, which extends backwards from the prostomium over two-thirds of its length or more, or even to the hinder end of the segment.

Dorsal pores begin in groove 12/13.

The setae are paired; in the middle of the body $ab = 1/3$ to $2/7$ $aa = 1/2$ bc or slightly less $= cd$; behind the clitellum $ab = 2/7$ $aa = 2/5$ $bc = cd$; in front of the clitellum $ab = 1/4$ $aa = 1/3$ bc and is slightly less than cd ; in the anterior segments $ab = 2/5$ $aa = 1/2$ $bc = cd$. The median dorsal distance $dd = 2/3$ of the circumference.

The clitellum is swollen, smooth, without annulation, and comprises segments xiii–xvii (= 5).

The male genital field is a transverse depression on segment xviii which extends from a point outside the line b on one side to a corresponding point on the other, and includes the whole length of the segment. The male pores appear as pits in line with setae b ; in front and behind the pores are curved grooves, with the concavities facing each other, so that the region of the pore has an eye-like appearance.

The female area is a transverse oval depression on segment xiv just in front of the setal zone; the actual apertures were not distinguishable.

The spermathecal apertures are one pair, in groove 7/8, in line with b , or between a and b .

Internal Anatomy.—Septum 4/5 is slightly thickened, 5/6–8/9 considerably, 9/10 and 10/11 moderately and 11/12 and 12/13 slightly so.

The gizzard, in segment v, is of moderate size, firm and rounded. There are calciferous glands in xi and xii, stalked, and lamelated internally. The intestine begins in xv.

The last heart is in xii. In segment xiii is a large vessel, not bulged after the manner of a heart, which runs on each side from the middle line in front in a backward, outward and downward direction.

The excretory system is micronephridial. Behind the clitellum the micronephridia are arranged on each side in a transverse row of about six, the inner two or three on each side being smaller than the rest; in the clitellar region they are considerably more numerous, about ten on each side in each segment, and in less regular rows than behind the clitellum. Towards the hinder end of the body there are about seven or eight on each side, and of these the inner three or four are smaller than the rest, except the

innermost of all; this increases in size, and forms a more compact coil than the dorsally situated nephridia of the row, though it is not so elongated in a transverse direction as these.

The testes and male funnels are free in segments x and xi. Seminal vesicles occupy segments ix and xii, those in the latter segment being large, contiguous in the middle line dorsally, and slightly bulging back septum 12/13; the pair in ix are slightly, those in xii considerably lobed.

The prostates are tubular, of moderate size, closely coiled, and cause the septa bounding segment xviii to bulge apart somewhat. The duct is much narrower than the glandular part, is bent on itself, short, slightly shining, the ectal part wider than the rest.

Ovaries and female funnels are present in segment xiii.

The spermathecae (fig. 9) are one pair only, in segment viii. The ampulla is moderately large, of an inverted pear-shape, and marked by a number of slight annulations. The duct is short, one-third to a quarter of the length of the ampulla, bulged in its upper portion, narrowed at its ectal end, with a row of four or five small seminal chambers on its inner side which take up the greater part of its length.

The penial setae are apparently two in each bundle. In length they are .66 mm.; in form tapering, slightly bowed, the curve more marked towards the distal end, the tip slightly hooked and rounded; there is no ornamentation except a few very fine transverse markings or slight notches on the distal portion a little distance from the tip,—so slight that they might be accidental.

Remarks.—The nearest ally of the present form appears to be *M. duodecimalis*, from Parambikulam; but the presence of only one pair of spermathecae distinguishes the present species. The penial setae, and the curious row of seminal chambers sessile on the spermathecal duct, are also characteristic.

Gen. *Megascolex*, Templeton.

Megascolex mauritii (Kinb.).

Dowlaishweram, Godaveri Dist. 29.viii.1918. N. Annandale. Two specimens.

Amini, Laccadive Islands. 21.x.1920. Madras Fisheries Dept. Three specimens.

Kalpeni, Laccadive Islands, 18.xii.1920. Madras Fisheries Dept. Four specimens.

Agatti, Laccadive Islands. 3.xii.1920. Madras Fisheries Dept. Five specimens.

Kavarti, Laccadive Islands. 11.xii.1920. Madras Fisheries Dept. Three specimens.

Androth, Laccadive Islands. 23.xii.1920. Madras Fisheries Dept. Four specimens.

In addition, three specimens of which the label was lost, probably from Androth.

Megascolex konkanensis, Fedarb.

Agatti, Laccadive Islands. 3.xii.1920. Madras Fisheries Dept. A single specimen.

A single specimen, probably from Androth, Laccadive Islands (label lost.)

Gen. *Pheretima*, Kinb. em. Mich.*Pheretima hawayana* (Rosa).

The Residency, Imphal, Manipur. 2'iii'1920. Four specimens.
Same place. No date. Two specimens.

Pheretima heterochaeta (Mich.).

The Residency, Imphal, Manipur. 2'iii'1920. Three specimens.
Small stream running from swamp below Kotagiri, Nilgiris; ca. 5700 ft.
3'iv'1919. N. Annandale and R. B. S. Sewell. A single specimen.

Gen. *Perionyx*, E. Perrier.*Perionyx* sp.

Khandala, Bombay, under stones and masses of weed at bottom of wet rocks near waterfall. July, 1919. R. B. S. Sewell. Several specimens, immature.

Perionyx excavatus, E. Perrier.

Langol Hills near Lamphal Pat (Lake), close to Bishenpur, Manipur, Assam; 2600 ft. 1'iii'1920. Two specimens.

The Residency, Imphal, Manipur. 2'iii'1920. Numerous specimens.

Same place. No date. Numerous specimens.

Paddy fields, Potsengbham, N. of Loktak, Manipur. No date. Manipur Survey Party. Numerous specimens.

Swamps round about Thanga Island in Loktak Lake, Manipur. 21'ii'1920. Very numerous specimens.

Perionyx saltans, A. G. Bourne.

Small rocky stream below Kotagiri, Nilgiris; ca. 5700 ft. 4'iv'1919. N. Annandale and R. B. S. Sewell. Two specimens, immature.

In 1886 Bourne (2) gave a description of a small *Perionyx* from Ootacamund and Naduvatam in the Nilgiris, in which, as in *P. sansibanicus* subsequently described by Michaelsen (4), the nephridiopores alternated in position in successive segments. Though the resemblance between the two is considerable, Michaelsen refrained from uniting his specimens with Bourne's species, since *P. saltans* has two spermathecal diverticula while *P. sansibanicus* has only one.

Though the present specimens are immature, in one there are signs of the male pores. This was accordingly opened, and three of the spermathecae, still very small, examined microscopically; of these two showed two diverticula each, the third a single one, which was however bilobed. It appears therefore that the specimens belong to *P. saltans*; the species had not previously been found since Bourne's original discovery.

The specimens being immature scarcely allow of an extension of Bourne's description. The more advanced of the two was 31 mm. long, and comprised 66 segments, but the hinder end was regenerating; it was 2 mm. in diameter. The other had a length

of 40 mm., a diameter of 1.75 mm., and 108 segments. Bourne's data are rather unusual,—length 60 mm., segments 61; it is uncommon, in a small worm such as this, to find the segments on an average 1 mm. long; his specimens must have been unusually relaxed. The prostomium is epilobous $2/3$. The dorsal pores begin in one specimen in groove $3/4$, in the other in $4/5$.

The numbers of the setae correspond to Bourne's figures. I found 50 in an anterior segment, and 46 and 47 in the middle of the body; the ring is closed ventrally, and almost so dorsally ($2z=2y2$).

It is not always the case, as Bourne says, that a segment which has the outer (dorsal) position of the nephridiopore on one side has the inner (ventral) on the other; the alternation of the position in successive segments is not strict, and hence the above statement of Bourne's sometimes holds and sometimes does not; the rule however is as given by Bourne. The nephridia end in considerable end-sacs, as in *P. sansibaricus*.

The male pores, as noted by Bourne, are situated in a median depression; this has sloping sides, and takes up the whole length of segment xviii.

Perionyx sansibaricus, Mich.

Small jungle streamlet, Bandy Shola, near Coonoor, Nilgiris; ca. 5500 ft. 8'iv'1919. N. Annandale and R. B. S. Sewell. Eight specimens.

Small jungle stream, Longwood Shola, near Kotagiri, Nilgiris. 4'iv'1919. N. Annandale and R. B. S. Sewell. Three specimens.

I append a few notes which serve to amplify previous descriptions.

The dorsal pores in a number of specimens examined begin as far forwards as groove $2/3$; in one the pores appeared rudimentary in $2/3$ and $3/4$, and were well marked behind this.

The small male field varies in appearance; it is always depressed, but the depression may be rectangular, oval, or nearly circular, the bottom flat or marked by a transverse groove at the ends of which the pores probably lie; the sides may be steep or gradually sloping. I did not in these specimens observe, as I did in a previous batch (15), that the setal ring was continued across the ventral surface immediately behind the male pores.

The clitellum, not well marked, extended over segments xiv—xvi (=3).

No septa are noticeably thickened. The gizzard, in vi, is extremely rudimentary. I found no calciferous gland-like swelling of the oesophagus in segment xii. The last heart is in segment xii. The position of the alternating nephridiopores is about $2/5$ of the half-circumference from the midventral and $1/5$ of the half-circumference from the mid-dorsal line.

The spermathecal diverticulum consists of three or four closely aggregated seminal chambers.

There are no penial setae.

Perionyx mysorensis, sp. nov.

(Pl. XXVIII, fig. 10).

Forests of Shemoga and Kadur Dists., Mysore, S. India. May, 1920.
A. Subba Rau. A single specimen, incomplete behind, not fully mature, in poor condition.

I at first decided against describing the present species; but the various parts of the sexual apparatus are present (except the clitellum) though small, and the penial setae, in conjunction with the other characters, will allow of the species being recognized when it is met with again.

External Characters.—Length 38 mm. (incomplete posteriorly). Diameter 2 mm. Segments present 90. Colour light brownish purple dorsally, pale ventrally.

Prostomium rather broad, probobous or slightly epilobous.

Dorsal pores present.

Setae in rings, closed dorsally and ventrally. In segment xix they were about 54 in number, in the middle of the body about 62.

The clitellum was not distinguishable.

The male pores, in segment xviii, are situated close to the middle line, each in a small depression, the depressions themselves lying on a transverse ridge across the middle of the segment. This ridge is not elevated above the general surface, and comes into existence through the presence of two depressions, which have the form of short transverse trenches and occupy the anterior and posterior fourths of segment xviii, in front of and behind the pores; the trenches are continuous with the intersegmental fissures (17/18 and 18/19), and in transverse extent are about equal to the antero-posterior length of the segment.

The female apertures were not seen.

The spermathecal pores are small, in grooves $7/8$ and $8/9$, near the middle line.

Internal Anatomy.—Septa $6/7-9/10$ are somewhat thickened, and also $12/13-15/16$.

The gizzard,—hardly to be called a gizzard,—is quite vestigial, in segment vi. There are lateral swellings of the oesophagus in xiii, and to some degree in xiv, but they cannot be called calciferous glands.

The last heart is in segment xii.

Testes and funnels are free in segments x and xi. Seminal vesicles occupy segments xi and xii; they are moderately large, but do not meet dorsally in the middle line.

The prostates are small, and confined to segment xviii; each is a squarish mass, cut into deep lobes. The duct is short, straight, moderately stout relatively to the size of the gland, of the same diameter throughout, and passes transversely inwards.

Ovaries and funnels are present in segment xiii.

The spermathecae are two pairs, small and perhaps not fully developed; they are spherical, sessile on the body-wall, to which

they are attached by a rather broad base; there is no hint of a diverticulum.

The penial setae (fig. 10) are .44 mm. long and 8μ thick at the middle, slightly bowed, the curvature being more marked at the proximal end; the tip is tapering and fairly sharply pointed. The ornamentation consists of a few transverse markings irregularly distributed and each composed of a row of extremely fine teeth.

Subfam. *OCTOCHAETINAE*.

Genus *Octochaetus*, Bedd.

Octochaetus barkudensis, Steph.

Barkuda Island Chilka Lake, Ganjam Dist. Madras Pres. Aug., 1919. F. H. Gravely. A single specimen.

On old brick-field in the same locality, 10^v1920. N. Annandale. Three specimens.

The variations in the arrangement of the micronephridia in this and allied genera are of some interest. In the present species the nephridia in the anterior part of the body are small and scattered, not arranged in a single row per segment. Towards the hinder end they are arranged in two fairly definite rows in each segment, one behind the anterior and one in front of the posterior septum; there is no constant difference in size between the nephridia of different parts of the row.

The gizzard in these specimens is an obliquely placed muscular ring, which leaves the posterior part of the ovoid oesophageal swelling quite soft above, and similarly the anterior part of the dilatation is quite soft below.

Gen. *Eutyphoeus*, Mich.

Eutyphoeus manipurensis, sp. nov.

(Pl. XXVIII, fig. 11).

Swamps round about Thanga Island in Loktak Lake, Manipur. 21^v iii 1920. Three specimens.

External Characters.—Length 120 mm. Diameter 5 mm. Segments 162; segment iv is biannular dorsally, v and vi biannular, vii triannular but with four annuli dorsally; subsequent segments as far as the clitellum are multiannular, the number of annuli varying, but as a rule three chief annuli can be distinguished; behind the clitellum the segments are triannular. Colour dark grey throughout, rather lighter ventrally.

Prostomium tanylobous, with a slightly marked transverse furrow behind the prostomial lobe, and another similar one half way along segment i. Segment i. is fissured radially round its anterior border.

The dorsal pores begin in groove 10/11.

The setae are paired. In the middle of the body $ab=2/5 aa=1/2 bc=2/3 cd$ (or sometimes $=1/2 cd$, i.e. the lateral setae are

then not paired); behind the clitellum $ab=2/5$ $aa=2/5$ $bc=4/7$ cd ; in front of the clitellum $ab=1/2$ $aa=1/2$ $bc=3/5$ cd ; $dd=4/7$ of the circumference.

The clitellum includes $2/3$ of $xiii-2/3$ $xvii$ ($=4$ $1/3$).

The male pores are on $xvii$, on prominent round papillae which take up the interval between the lines a and b ; round each papilla is a deep trench, the outer margin of which is slightly swollen and indented. The ventral surface of segment xvi is much depressed and fissured; genital markings were present as follows:—In one specimen there were none, beyond the irregular fissuring. In a second there were a pair of eye-like markings, each an oval rather depressed area with raised margin, behind the setal zone and corresponding to the interval ab , and in addition a similar but circular marking midventrally and in front of the setal zone. In the third specimen the paired markings were present as above; and in addition a transverse row of four circular markings, touching each other, across the ventral surface in the setal zone.

The female pores were not made out.

The spermathecal pores are one pair, in groove $7/8$, slit-like, with their centre in ab , rather nearer to a than to b . The middle annulus of segment $viii$ may be raised and "glandular," and small papillae occur variously in this region; in one specimen there was a small papilla just behind the spermathecal aperture of the right side, and another in the midventral line on the glandular swelling of segment $viii$; in another specimen there was a small papilla midventrally on segment ix ; in the third there were no papillae.

Internal Anatomy.—Septum $4/5$ is slightly, $5/6$ much thickened; the next septum is $8/9$, which is somewhat strengthened; $9/10$ is considerably thickened, and $10/11$ very stout; septum $11/12$ is present, though thin (unlike most species of the genus, in which it is absent), and the rest are thin. Septum $8/9$ is attached to the parietes a little in front of groove $9/10$; septa $9/10$ and $10/11$ are confluent at their insertion into the body-wall, which is situated in the middle of segment x as determined externally,—*i.e.* midway between furrows $9/10$ and $10/11$; septum $11/12$ is normally situated.

The gizzard occupies the middle of the interval between septa $5/6$ and $8/9$; it is large, round and firm; and the oesophagus in front of the gizzard, between the gizzard and septum $5/6$, is also strengthened. There are large dark lateral swellings of the alimentary tube in segment xii , but they are not set off from the side of the canal. The intestine begins in xv .

The last heart is in segment $xiii$; that of segment xi is normally situated with reference to septum $11/12$,—on its anterior face. There are two transverse vessels in front of septum $8/9$ and behind the gizzard (belonging to segments $viii$ and vii), one at the anterior border of the gizzard (segment vi), one in front of septum $5/6$ (segment v), but none in front of septum $4/5$. The dorsal vessel is continued forwards on to the pharynx much diminished in size.

The micronephridia are somewhat sparsely scattered. Behind the clitellum they form a single transverse row in each segment, which consists on each side of a number set pretty close together ventrally, with four more dorsally placed at considerable intervals.

Testes were not identified; there are two pairs of funnels apparently free, in segments x and xi. Seminal vesicles of moderate size, lobed, are present in segment ix, and also in xii or xii—xiii, much lobed and larger than the anterior pair.

The tubular prostates form a close coil occupying segments xvii—xix or xx. The duct is also much coiled, of moderate length, narrower than the glandular part, of the same diameter throughout, and only slightly shining.

The female organs have the usual situation.

The spermathecae are one pair, in the anterior part of the interval between septa 5/6 and 8/9. Each is an ovoid sac, sessile on the parietes by a considerable portion of its under surface. There is a single diverticulum on the outer, or posterior and outer, side, of some size, also practically without stalk, slightly lobulated, one-third as broad and half as high as the ampulla.

The penial setae (fig. 11) are 1.5 mm. long and 47 μ thick at the middle, with straight shaft and slightly curved tip tapering to a blunt point. The ornamentation consists of a number of fine triangular teeth on the curved tip.

Remarks.—The present species comes near *E. mohammedi*, from which however it is distinguished by the genital marking and the character of the spermathecal diverticulum.

Gen. *Eudichogaster* Mich.

Eudichogaster barkudensis, sp. nov.

(Pl. XXVIII, figs. 12, 13).

Barkuda Island, Chilka Lake, Ganjam Dist., Madras Pres. Aug. 1919.
F. H. Gravely. Several specimens.

External Character.—Length 57 mm. Diameter max. 1.75 mm. Segments 130; first segment very short. Colour pale, unpigmented, appearing grey from intestinal contents showing through.

Prostomium proepilobous.

Dorsal pores begin from furrow 11/12.

The setae are paired. The ratios are nearly the same throughout the body; in the middle of the body $ab=1/2aa$ or nearly so $=2/3bc=3/4cd$; further back bc and cd may be almost equal; behind the clitellum $ab=2/5aa=1/2-4/7bc$; dd =half the circumference in the middle of the body and behind, and $4/7$ the circumference in the anterior part of the body.

The clitellum extends over xiii- $\frac{1}{2}$ xvii ($=4\frac{1}{2}$); it is yellowish brown in colour, and constricted.

The prostatic pores are one pair, on segment xvii, situated on round papillae which take up the interval between the lines *a* and *b*; they are slit-like, and obliquely placed, diverging from each other backwards.

The female apertures are minute pores in a circular white patch on the anterior part of segment xiv.

The spermathecal apertures are represented by a pair of very minute white points on segment viii, just in front of setae *a*.

Internal Anatomy.—Septum 4/5 is thin, 5/6 extremely tenuous. 6/7 and 7/8 also very thin; 8/9 is thin, 9/10 and 10/11 slightly strengthened; 11/12, 12/13 and 13/14 are thin, but slightly strengthened by comparison with those that follow (the specimen was in a poor state of preservation, and possibly the septa are normally somewhat thicker than the above description would lead one to suppose).

There are two gizzards, in v and vi, of comparatively large size, firm and rounded. Calciferous glands are present in segments x, xi and xii, not stalked, and diminishing in size backwards. The intestine begins in segment xv.

The last heart is in segment xii.

The excretory system is micronephridial. The organs are of relatively moderate size; in front of and in the clitellar region they are scattered; behind the clitellar region they form a transverse row of four (three to five) on each side in each segment, those towards the ventral end of the row being smaller and closer set. About 27 segments from the hinder end the innermost nephridium of each row enlarges and the arrangement comes to be as follows:—one nephridium, a long thin loop between seta *d* and the middorsal line; one small, lying in line *c*; and one, the largest and thickest extending from *a* outwards to between *b* and *c*; the series thus consists of three on each side.

There is a pair of large and conspicuous male funnels in segment x, and a smaller pair in xi. On the other hand testes were identified in xi, but not in x. No seminal vesicles were present.

The prostates are one pair, in xvii, small, tubular, and placed transversely in the segment. The duct, also transversely placed, is thin, and in length equal to the glandular portion.

The female organs have the usual situation.

The spermathecae (fig. 12) are one pair, situated in segment vii; they open externally as described above, on segment viii, septum 7.8 being rather obliquely placed. Each is a narrow elongated somewhat cylindrical tube, .66 mm. long, slightly curved, and rather wider in its ectal portion; a short terminal section which narrows to its insertion into the body-wall, may be described as the duct. A small sac-like diverticulum is given off from the junction of ampulla and duct.

The penial setae (fig. 13) are .53 mm. long, and very slender, 2.5 μ in thickness; they are bowed towards the distal end, where the shaft is twisted and somewhat sinuous in outline; the tip however is straight, and ends in a small rounded flat expansion which al-

most appears bifid, owing to the thinness of the expansion between its thicker margins.

No copulatory setae were discovered in the spermathecal region.

Fam. LUMBRICIDAE.

Subfam. MICROCHAETINAE.

Gen. *Glyphidrilus*, Horst.

Glyphidrilus annandalei, Mich.

Forest of Shemoga and Kadur Dists., Mysore, S. India. May, 1920.
A. Subba Rau. A number of specimens.

Most of the present specimens appear to have undergone autotomy a little distance behind the genital region, or in some cases further back, near the hinder end. Two specimens in which the characteristic ridges and papillae were only just beginning to appear had not broken; possibly the worms are more liable to fragmentation at the time of sexual maturity.

The clitellum begins in these specimens in xvii or even xvi, and ends indistinctly about xxxv or xxxvi. The "wings" begin in xxv (*i.e.* rather in front of the usual place); but they are not in any of the specimens continued further forwards as lower ridges.

The midventral series of papillae are almost constant in position, on segments xiii-xxi (once xii-xxi); they regularly diminish in size posteriorly. The anterior lateral series also begin constantly on xiii, and show in every case a peculiar arrangement, not noted in any previous account of the species; the first papillae of the series are situated between the lines *b* and *c*, succeeding ones rapidly become more dorsal, so that the fourth and fifth, on segments xvi and xvii, are between *c* and *d*; the series then returns even more rapidly to its original alignment, so that the seventh papilla, on segment xix, is again between *b* and *c*. This anterior lateral series ends on segment xxiv; there is another short series, as usual, behind the "wings."

In contrast to previous data for the species, the whole papillar arrangement is very constant, and peculiar in the respect noted above; but it does not seem worth while establishing a variety for the present specimens.

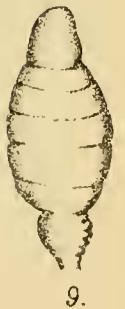
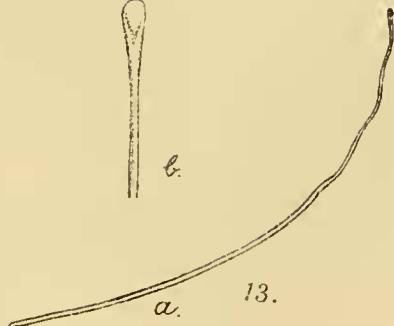
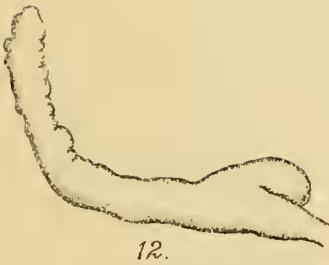
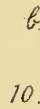
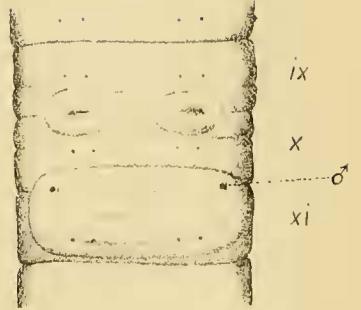
REFERENCES TO LITERATURE.

- (1) Beddard, F. E. The Earthworms of the Maldive and Laccadive Islands, in: The Fauna and Geography of the Maldive and Laccadive Archipelagoes, ed. J. S. Gardiner, I, p. 374. Cambridge, 1903.
- (2) Bourne, A. G. On Indian Earthworms. Part I. Preliminary Notice of Earthworms from the Nilgiris and Shevaroyes. *Proc. Zool. Soc. London*, 1886, p. 669.

- (3) Bretscher, K. Beitrag zur Kenntnis der Oligochaetenfauna der Schweiz. *Rev Suisse Zool.*, VI, 1899, p. 388.
- (4) Michaelsen, W. Beschreibung der von Herr Dr. Stuhlmann auf Zanzibar und dem gegenüberliegenden Festlande gesammelten Terricolen. *Mitt. Mus. Hamburg*, IX, pt. i, 1891.
- (5) „ Zur Kenntnis der Naidideen. *Zoologica*, Heft 44, 1905.
- (6) „ Oligochaeta, in: Das Tierreich, Lief. 10. Berlin, 1900.
- (7) „ The Oligochaeta of India, Nepal, Ceylon, Burma and the Andaman Islands. *Mem. Ind. Mus.*, I, 1909.
- (8) „ Oligochäten, in: Results of Dr. E. Mjöberg's Swedish Scientific Expeditions to Australia, 1910-1913, pt. xiii. Stockholm, 1916.
- (9) „ Die Lumbriciden. *Zool. Jahrb., Syst.*, XXI, 1917.
- (10) Piguet, E. Observations sur les Naididées et revision systematique de quelques espèces de cette famille. *Rev. Suisse Zool.* XIV, 1906, p. 218.
- (11) „ Notes sur les Oligochètes. *Rev. Suisse Zool.*, XXI, 1913, p. 118.
- (12) Stephenson, J. The Anatomy of some aquatic Oligochaeta from the Punjab. *Mem. Ind. Mus* I, 1909, p. 263.
- (13) „ On a Collection of Oligochaeta, mainly from Northern India. *Rec. Ind Mus.* X, 1914.
- (14) „ On a Collection of Oligochaeta belonging to the Indian Museum. *Rec. Ind. Mus.* XII, 1916.
- (15) „ On a Collection of Oligochaeta from the lesser known parts of India and from Eastern Persia. *Mem. Ind. Mus.* VII, 1920, p. 204.
- (16) „ Contributions to the Morphology, Classification, and Zoogeography of Indian Oligochaeta. I. The Affinities and Systematic Position of the genus *Eudichogaster*, Mchln., and some related questions. *Proc. Zool. Soc. London* 1921, p. 103.

EXPLANATION OF PLATE XXVIII.

- FIG. 1.—*Nais paraguayensis* var. *barkudensis*; distal end of dorsal needle seta; $\times 800$.
- „ 2.—*Aulodrilus remex*; hinder end, showing zone of proliferation some distance in front of anus; $\times ca 70$.
- „ 3.—The same; dorsal hair seta; $\times 230$.
- „ 4.—The same; *a*, usual form, and *b*, exceptional form of distal end of oar-shaped setae of dorsal bundles; $\times ca 1150$.
- „ 5.—The same; tip of ventral seta; $\times ca. 1200$.
- „ 6.—The same; tip of an exceptional form of ventral seta; $\times ca 1200$.
- „ 7.—*Drawida rati*; genital field; $\times 18$. σ , male pore.
- „ 8.—*Plutellus aquatilis*; spermatheca.
- „ 9.—*Megascolides annandalei*; spermatheca.
- „ 10.—*Perionyx mysorensis*; penial seta; *a*, general form, $\times 130$; *b*, distal end, more highly magnified; $\times ca. 400$.
- „ 11.—*Eutyphoeus manipurensis*; distal end of penial seta; $\times ca. 150$.
- „ 12.—*Eudichogaster barkudensis*; spermatheca.
- „ 13.—The same; penial seta; *a*, general form, $\times 125$; *b*, distal end more highly magnified, $\times 500$.



J. Stephenson del.

A. Chowdhary lith.

NEW INDIAN OLIGOCHAETES.