DESCRIPTIONS OF INDIAN OLIGOCHAETA.

I.

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With Plate XIII

INTRODUCTION.

The following paper contains an account of a consignment of worms received some time ago from the Director of the Zoological Survey of India ; I have included also a record of a few specimens sent me for identification by the authorities of the British Museum, as well as of a few which were kindly sent me by Prof. Gates of Rangoon and Mr. Senior-White of Ceylon.

Of the structural peculiarities presented by these worms, by far the most interesting is the presence of the curious tuft-like intestinal glands of *Drawida cacharensis ;* such glands, in the form here described, are I believe so far unique among the Oligochaeta.

Pheretima planata has recently been described by Gates (3). When I wrote the account which appears below, I had not received Gates' paper, and though, as will be seen from a comparison of the two accounts, there can be no doubt of the identity of Gates' worm and mine, I allow my description to stand verbatim as I wrote it, believing that a second and quite independent account of specimens from a different locality, will supplement Gates' description, and taken along with that will perhaps give a completer knowledge of the species. I may add that Gates is probably right in describing as a gland what I call the second spermathecal diverticulum.

Michaelsen (4) has recently received from S. India material which allows the characters and position of the long doubtful genus *Hoplochaetella* to be definitely established. It appears that my genus *Erythraeodrilus* must now be merged in it ; and I have altered the names of the worms I originally described as *Erythraeodrilus khandalaensis* and *E. mullani* accordingly.

Fam. NAIDIDAE

Genus **Aulophorus** Schmarda

Aulophorus furcatus (Oken)

Rangoon. Prof. G. E. Gates. A number of specimens.

Fam. TUBIFICIDAE

Genus **Limnodrilus** Clap.

Limnodrilus socialis Steph.

Rangoon. Prof. G. E. Gates. Numerous specimens along with the above.

Fam. MONILIGASTRIDAE

Genus **Moniligaster** E. Perr.

Moniligaster deshayesi E. Perr.

On the way to Shenbagadevi Falls, Courtallam, Tinnevelly Dist., S. India. 24.xi.24. H. S. Rao. A single specimen, in two pieces.

The worm appears to have undergone autotomy. I add a few notes on certain features presented by the specimen.

Length 160 mm. ; diameter 6 mm. Colour a dark olive dorsally, somewhat lighter ventrally. Segments 267 ; no secondary annulation.

Prostomium apparently absent.

I cannot see any indication of setae on the first three segments ; indeed the lateral setae appear to be absent from the first four.

The male pores, in furrow 10/11, are here equidistant between the lines *b* and *c*.

The gizzards are five in number, in segms. xvi-xx ; that in xvi is weaker than the others.

The testis sacs are of moderate size, and are very irregular in shape ; they occupy segms. ix and x, and the sac on one side extends underneath the dorsal portion of the ovarian chamber into segm. xii. The anterior portion of the testis sacs is much cut up, while the posterior portion constitutes a rounded bag.

The atrial glands are contained altogether in segm. vii ; each is divided into two distinct p rtions, each portion having its own narrow duct ; the ducts of the two p rtions join in a Y-like manner.

Genus **Drawida** Mich.

Drawida cacharensis sp. nov.

Katlicherra, S. Cachar, Assam. March 1925. S. L. Hora. Several specimens.

External Characters.

Length of one of the longest specimens 112 mm., others somewhat shorter. Diameter 3·5 mm. Colour pale, no difference between dorsal and ventral surfaces. Segms. 185 ; a slight biannulation in a number of segments in the anterior part of the body behind the male apertures.

Prostomium prolobous.

There appear to be no pervious dorsal pores ; but from furrow 15/16 (or in another specimen from 20/21) backwards, there are indications of pores in the usual situations, more distinct in some specimens than in others. A careful examination was made from the inside of the body-wall in one of the specimens in which the appearance of pores was best marked ; their position was easily seen, but I could not make out that there was an actual perforation.

The setae, small and closely paired, begin in segm. ii ; the interval *aa* is slightly less than, or in some parts equal to, *bc* ; *dd* is equal to half the circumference.

The clitellum, indistinct in a number of specimens otherwise apparently mature, extends over segms. x-xiii (=4) ; setae are present on the clitellar segments.

The male pores are in furrow 10/11 on transversely elongated papillae which project in varying degrees, and may almost present the appearance of small penes ; the middle of the papillae is midway between the lines of setae *b* and *c*.

The female apertures are in furrow 11/12, in the line *b*.

The spermathecal pores are in 7/8, in or immediately below the line *c*.

The majority of the specimens have no genital markings; some however have a few whitish papillae, elongated—sometimes very considerably—in a transverse direction, some larger than others, and in various situations. Thus in one specimen the papillae were very indefinite, paired, on segm. vii near the posterior border internal to the line of the spermathecal apertures; in another there were rather indefinite single but not quite median papillae on segms. xii and xiii; in a third, they were paired as in the first example, and in addition there were paired papillae on segm. viii behind the spermathecal apertures; in a fourth, there was a pair of papillae on the posterior part of segm. ix between the lines of the ventral and lateral setal bundles, and near the middle of the same segment a single papilla, almost median in position.

Internal Anatomy.

Septa 5/6 and 6/7 are much thickened; 7/8 is moderately strengthened, and 8/9 is also somewhat thickened.

The gizzards appear to be usually two in number. In the specimen first dissected, they occupied segms. xiv and xv, but the septa in this region were much pushed back, so that the hinder of the two gizzards lay in the situation of segms. xviii and xix as delimited externally. In a second specimen the gizzards were in segms. xvi and xvii, and there was some thickening of the alimentary wall in xv also; while in a third specimen there were three gizzards, in xv-xvii.

The intestine begins behind the gizzards. A curious appearance, which I have not seen before, is presented by the dorsal surface of the intestine in certain segments shortly behind its beginning. In segments xx-xxiii, and also, in two out of the three specimens dissected, in a less marked degree in xxiv, small tufts of fingerlike processes arise from the dorsal surface of the intestine. The individual fingerlike processes are whitish in colour, cylindrical, somewhat curved or coiled, and lie parallel, side by side with the others in the tuft. The tufts are in pairs, one tuft of each pair on either side of the dorsal vessel, and in a transverse sense occupy most of the dorsal surface of the gut. Each tuft arises from and is limited to its own segment, except those of segm. xx; these latter consist of only a small number of processes, perhaps only of two, on each side, which run backwards and appear to join the intestine in xxi. In xxiv there are only three or four small processes on each side; but in the other segments a tuft consists of about eight processes on each side. Under the binocular dissecting microscope the processes seem sometimes to be attached to the gut wall at both ends, thus forming an arch; or sometimes they seem to be attached to each other at their free ends.

Under the dissecting microscope the processes have the appearance of tubules; and accordingly I at first regarded the tufts as masses of blood-vessels, until I made sections of the intestine in this region. In sections, the apparent "tubules" are seen to be aggregates of gland-tubes bound together by a delicate investment of connective tissue; traced to their connection with the intestine, the aggregate of gland-tubes enters the dorsal intestinal wall, joining there in a common mass with the other similar aggregates which together form the tuft. A

number of the gland-tubes open into the lumen of the gut in the dorsal region; but a number are continued downwards in the lateral wall of the intestine, lying side by side, parallel and closely apposed, and opening ultimately into the gut not far from the mid-ventral line.

The intestinal blood-sinus extends between the individual gland-tubes in the gut wall, and the deeply staining (with eosin) blood may also be seen filling up the spaces between the gland-tubes in the free fingerlike processes.

The last hearts are in segm. ix.

The excretory system is meganephridial.

The testis sacs may be very asymmetrical. In the specimen first dissected, they were not markedly so, having each of them a quarter to a third of their bulk in segm. ix, and the rest in segm. x; their form was irregular, being moulded by the surrounding organs. In two other specimens one of the sacs extended far backwards, passing underneath the ovarian chamber and encroaching on segm. xii, or even reaching the level of segm. xiii.

The vas deferens is relatively very bulky, and forms a close coil on the hinder face of septum 9/10.

The prostates are relatively small, cylindrical, barely wider at the ental end, slightly narrowed where they join the body-wall; they are variously bent, into a semicircle or a U shaped loop, or into an S-shaped double curve. The surface is smooth but neither papillose (" glandular ") nor shining (" muscular "). The vas deferens enters its ental end.

Segment xi constitutes a completely closed ovarian chamber—a horseshoe-shaped tubular cavity over the dorsal surface of the intestine.

The ovisacs have an ovoid form, but their longer axis is, somewhat unusually, transverse and not longitudinal; they are moderately bulky, and may be confined to segm. xii or may extend backwards to the level of segm. xv (by pushing back septum 12/13). The connection with the ovarian chamber is by a narrow neck on each side close to the middle line.

The spermathecal ampulla is small, and the duct, which lies on the posterior face of septum 7/8, is narrow and sinuous. The atrium (fig. 1) is a long irregular cylinder, or in another specimen (fig. 2) an elongated sac, narrowing and somewhat twisted near its ectal end, and bending over the alimentary canal dorsally, where it overlaps its fellow across the middle line; it is situated entirely in segm. vii, and is a much larger organ than the ampulla with its duct. The spermathecal duct and the atrium are separate up to their junction with the parietes, and probably therefore unite within the body-wall.

Remarks.

The present species comes near *D. papillifer*, which has also been found in Assam (Amingaon), as well as at Rangamati, Chittagong Hill Tracts, Bengal.

Tubular intestinal glands, such as occur here in segms. xx-xxiv, are of very rare occurrence in the Oligochaeta. Somewhat similar structures have been described by Beddard in *Megascolex caeruleus* (1), and in species

of *Eutyphoeus* (2); but in these genera there are no projecting cylindrical processes, the whole of the glandular tubules being contained within the gut wall. In the present species the histological appearance suggests the possibility of their being nephridial; nephridia of the usual type are however present in the same segments.

Drawida willsi Mich.

Puri, Orissa coast. 14-27.x.23. S. L. Hora and B. N. Chopra. A single specimen, in two pieces, probably not fully mature.

I subjoin a few notes on the present specimen of this interesting species.

External Characters.

Length ca. 30 mm. (the posterior fragment is much curled); diameter 1½ mm. Colour pale brownish, a little darker on the dorsal surface. Segms. 165.

Prostomium perhaps prolobous (distorted, the buccal cavity being protruded).

Setae closely paired, beginning in segm. ii; *aa* is a little less than *bc*, and *dd* is equal to half the circumference.

The clitellum is not developed.

The male pores, two pairs, in furrows 9/10 and 10/11, are in or immediately outside the line of setae *b*. The female and spermathecal apertures are not visible, but from internal examination the latter lie in the line of setae *ab*.

Internal Anatomy.

Septum 5/6 is somewhat strengthened, 6/7 is moderately, 7/8 and 8/9 considerably thickened for so small a worm.

There are two gizzards, in xiii and xiv, the first rather smaller than the other; the alimentary tube is slightly strengthened in xii also.

The testis sacs, of relatively considerable size, occupy and fill out segms. ix and x, the larger part of each sac being in x; they are scarcely constricted by the septum. Each prostate, of which there are two pairs, in segms. ix and x, is a shortly rectangular mass with a soft surface, attached to the body-wall by one of its small ends; the vas deferens joins it half way up its anterior face; the prostates in segm. ix are smaller than those in x.

An ovarian chamber is present; the anterior and posterior walls apparently meet just about where they join the parietes, and in the dissection can be separated by introducing a fine needle between them. The ovisacs are small, narrow, and cylindrical; they are confined to segm. xii, but probably they are not fully developed in the present specimen.

The spermathecal ampullae are very small; probably they also are not fully developed. The atrium is a simple short cylinder, extending (in the position of dissection) obliquely upwards and outwards in the segment; it is contained in segm. vii, and is joined by the spermathecal duct near its base.

Drawida pellucida (A. G. Bourne) var. **raoi** var. nov.

Terkumalai, Courtal'am, Tinnevelly Dist. 27.X.24. H. S. Rao. A single specimen, much damaged near the anterior end.

External Characters.

Length 70 mm.; diameter 4 mm. Colour a dirty mottled light olive green, much the same on both dorsal and ventral surfaces. Segms. 240, mostly very short; ix, x, and xi are triannular, xii and xiii biannular.

The prostomium is prolobous.

Dorsal pores are absent.

The setae are closely paired, and are small, especially on the anterior segments; none are visible on segm. ii, and on some of the following segments they are only to be distinguished with difficulty. The interval $aa = \frac{1}{2} bc$, or is even less than this near the hinder end; *dd* is equal to half the circumference.

The clitellum is scarcely distinguishable; it may perhaps include segms. x-xiv (=5), though this would be one segment more than is usual in the genus.

The male apertures are in furrow 10/11, between the lines of setae *b* and *c*, though nearer to *c*; on the left side of the single specimen the pore is bounded by anterior and posterior swollen lips, but not on the right.

The female pores are not visible.

The spermathecal pores are in furrow 7/8, in or perhaps just below the line of setae *cd*.

Internal Anatomy.

Septum 5/6 is moderately, and 6/7, 7/8 and 8/9 considerably thickened.

The gizzards are four in number, but it is impossible to be certain which segments they occupy, on account of the damage which this part of the worm has suffered. Since the ovisacs lie alongside the two anterior gizzards, the gizzards segments are perhaps xii-xv, or it may be xiii-xvi.

The last hearts are in segm. ix.

The excretory system is meganephridial.

The testis sacs have unfortunately disappeared in the damage done to the specimen. The vas deferens forms a small or moderate sized coil in segm. x, and enters the prostate on its antero-lateral aspect.

The prostate is almost accurately hemispherical, sessile on the body-wall, soft and smooth, not shining ("muscular") nor yet papillose ("glandular").

I think there is not an annular ovarian chamber, but I cannot be certain, owing to the condition of the parts. The ovisacs are slender, and rather long, extending through two segments at least.

The spermathecal ampulla is an ovoid sac which almost touches its fellow in the middle line. The duct is coiled on the hinder face of septum 7/8; the last portion is almost straight, and enters the middle of the upper surface of the atrium. The atrium is situated in segm. viii, in the line of setae *cd*; it is hemispherical in shape, and sessile; it appears as a bulging of the end of the spermathecal duct, and, considered as

such, is of some size ; it is not by any means embedded in the body-wall (as in one or more of the other varieties of the species), but forms a conspicuous organ in segm. viii, fully half the diameter of the prostate.

Remarks.

The special characters of the present variety are the small extent of the setal interval *aa*, and the relatively large size of the spermathecal atrium ; *aa* being smaller (relatively to *bc*), and the spermathecal atrium larger, than in any of the other forms included in the species.

Fam. MEGASCOLECIDAE

Subfam. Megascolecinae

Genus **Megascolex** Templeton

Megascolex mauritii (Kinb.)

Bombay. Sept. 1924. J. P. Mullan. Five specimens.

Genus **Pheretima** Kinb.

Pheretima elongata (E. Perr.)

Bombay. Dr. A. Powell. Two specimens. (Br. Mus.).

Pheretima hawayana (Rosa)

Lahore. April 1923, J. P. Mullan. A number of specimens, in a bad state of preservation
Bombay. Sept. 1924. J. P. Mullan. Two specimens.

Pheretima planata Gates

Katlicherra, S. Cachar, Assam. March 1925. S. L. Hora. Two specimens.

External Characters.

Length of the larger specimen, which is the one on which the description is based, 235 mm. ; diameter 5 mm. Colour slaty dorsally and anteriorly, lighter posteriorly, pale ventrally. Segms. 141 ; secondary annulation from segm. vi to the clitellum, brought about by the marking off of the setal zone as a continuous circular ridge ; some segments may be further subdivided. The second specimen was much smaller,—length 113 mm., average diameter 4 mm., segms. 102.

Prostomium in the larger specimen epilobous $\frac{1}{4}$, broad from side to side, short antero-posteriorly. In the smaller specimen there are in addition grooves, very like other numerous small longitudinal wrinkles on segm. i, which prolong back the prostomium as a tongue, so that it might here be described as epilobous $\frac{2}{3}$; in addition, there is a median groove on the dorsum of the prostomium and its tongue.

Dorsal pores begin in furrow 11/12.

Setae in rings ; the dorsal and ventral breaks are absent as a rule, though occasionally there is an interval of about $1\frac{1}{4}ab$ or $1\frac{1}{4}yz$. The setae are not markedly closer set dorsally or ventrally. The following numbers were counted :—ca. 67/v, ca. 76/ix, 73/xii, 64/xix, and 51 in the middle of the body.

The clitellum occupies segms. xiv-xvi (=3); there are no setae or dorsal pores, but a number of small pale tubercles are visible on it, perhaps accidental.

The male apertures, on segm. xviii, are of large size, with puckered lips, in the setal zone, and about one-third of the circumference apart; there are 8 setae ventrally between the apertures, but the setae do not extend over the whole of the interval. In the second specimen the copulatory sacs are everted to form short cylindrical projections, about as high as broad; the exposed surface of each sac is marked with closely set small papillae, 10 on one side and 12 on the other, on each of which is a minute pore; the appearance of the whole is somewhat cauliflower-like.

The female pore is single, minute, on segm. xiv apparently about the middle of its length.

The spermathecal apertures are two pairs, in furrows 6/7 and 7/8, about in the lateral line.

There are no genital markings.

Internal Anatomy.

Septum 4/5 is slightly strengthened, 5/6, 6/7 and 7/8 considerably so; the next is 10/11, which is somewhat thickened, as is also 11/12; 12/13 is slightly strengthened.

The subspherical gizzard is situated between septa 7/8 and 10/11. The beginning of the intestine is indefinite. The caeca originate in segm. xxvii, and are smooth and short, extending forwards only into xxv.

There are small segmentally distributed lymph glands, in pairs, at the sides of the dorsal vessel on the intestine, from segm. xxii backwards.

The last hearts are in segm. xiii. No blood glands, such as occur, for example, in *P. posthuma*, *hawayana*, and *heterochaeta* (6), are to be seen in segms. iv-vi.

The micronephridia are numerous, small and scattered. There are nephridial tufts, as usual, in segms. iv, v, and vi.

The testis sacs, in segms. x and xi, do not, according to a dissection from the ventral surface, communicate with each other, neither with the one in front or behind, nor with their fellows across the middle line. The seminal vesicles, in segms. xi and xii, are of moderate size, and only slightly lobed.

The prostates are large, occupying segms. xvi-xx or xvii-xxi, and much cut up into lobes. The duct is curved like the letter C or S, shining, a little wider in the middle of its length, and rather narrower at the two ends. There is a well marked copulatory sac.

"Accessory prostates" are present, as a group of four or five closely set mushroom-shaped glands in front of, and a similar group behind, each copulatory sac; they are thus situated in segms. xvii and xix,—sometimes partly in xviii. The stem of each mushroom-shaped gland is distinctly made up of a number of separate strands; the glands open into the copulatory sac, the stems running respectively forwards and backwards; from internal inspection it might appear that some of the

glands perhaps open not into the sac but in its immediate neighbourhood, though in the specimen in which the sacs are everted, all the pores appear to be on the free end of the evaginated organ.

In the situation of the ovaries are two organs which look much more like accessory seminal vesicles than ovaries; they are not fanlike, and no ova are distinguishable; on the contrary they are round, compact, and somewhat flattened against the septum, on which they are sessile, attached by a broad base. But on teasing a portion of one of these organs and examining it microscopically, ova were found in the mass.

The spermathecal ampulla (fig. 3) is pearshaped, the narrow end being continued into a duct, which is narrow, cylindrical, about as long as the sac, and very slightly shiny in its ectal portion. There are two diverticula; one of these is long —as long as the duct and ampulla together, cylindrical on the whole, the ental portion rather irregular in contour, the ectal third or two-fifths smoothly rounded and shining, rather narrower than the portion above it, and discharging into the spermathecal duct close to where the latter joins the body-wall. The second diverticulum is half as long as the other, or about equal in length to the duct of the main spermathecal sac; it is similar in form to the main pouch with its duct, and is attached to the body-wall close to the extremity of the latter.

Pheretima insolita Gates

$\frac{W1179}{1}$ Rangoon. 1924. G. E. Gates. A single specimen (Labelled *Pheretima ?* cotype.)

Pheretima posthuma (L. Vaill.)

Bombay. Dr. A. Powell. Three specimens. (Br. Mus.)

Genus **Perionyx** E. Perr.

Perionyx excavatus E. Perr.

Almora Dist.. U. P. Sta. 2. J. N. and D. N. Bagchi. Seven specimens.
Katlicherra, S. Cachar, Assam. Mar. 1925. S. L. Hora. Numerous specimens.

Perionyx sp.

Lonavla, Bombay Pres. Aug. 1924. S. L. Hora. Numerous specimens.

These small worms were all immature; they may very possibly also have been *P. excavatus*.

Perionyx sansibaricus Mich.

In the roots of grass at the shore of a rocky stream at Kapurwala (Poona, Wai Road). Sept. 1924. S. L. Hora. A single specimen.

The tongue of the prostomium is V-shaped, the point of the V reaching back halfway through segment i; there is a slight longitudinal groove on the tongue.

The dorsal pores begin very far forward,—in furrow 1/2.

The identification was made after examining internally the characteristic nephridia, along with the spermathecae.

Subfam. OCTOCHAETINAE

Genus **Octochaetus** Bedd.

Octochaetus (Octochaetoides) fermori Mich.

Bombay Sept. 1924. J. P. Mullan. A single specimen, sexually mature.

Octochaetus (Octochaetoides) roseus sp. nov.

Secunderabad, Deccan. October 1923. J. P. Mullan. Numerous specimens, mostly mature.

External Characters.

The length varies much, the longer specimens being 200-210 mm., the shorter 125-130 mm.; one fully mature, measured only 52 mm. In this last specimen there were no signs of damage or regeneration at the hinder end, though it would be difficult to be certain that no damage had ever been sustained. Diameter $4\frac{1}{2}$ mm. Colour (in the preserved state) a p nkish brown; no difference between dorsal and ventral surfaces; clitellum purplish. Segms. of one of the longer worms 246; secondary annulation present in the anterior part of the body, segm. iv being biannular, v triannular, vi-xii with four annuli, or sometimes a fifth is ndicated.

Prostomium epilobous $\frac{5}{6}$, almost tanylobous; tongue narrower in front, where it is crossed by a transverse groove.

The first dorsal pore is in furrow 12/13, at the anterior border of the clitellum; pores are either absent or only faintly indicated on the clitellum.

The setae are paired; in front of segm. viii they are very small. There appear to be considerable variations in the intersetal ratios; in the anterior and middle parts of the body $ab=\frac{1}{3}aa=\frac{1}{2}bc$ or a little more $=\frac{2}{3}$ — cd; in the posterior region $ab=\frac{1}{3}aa=\frac{1}{3}$—$\frac{2}{5}bc=\frac{1}{2}cd$; $dd=\frac{4}{7}$ or sometimes $\frac{2}{3}$ of the circumference; but in general the intervals are irregular.

The clitellum includes segms. xiii-xvii (=5). It is sharply limited at each end, swollen, purple in colour, and the setae are distinguishable.

The male field is rectangular with rounded corners, and includes the posterior third of segm. xvi, the anterior third of xx, and the intermediate segments; in breadth it extends between the lines of setae *c*. It is limited by a rounded lip. On this area are two deep transverse depressions or transversely elongated pits, expanded in their lateral portions, and separated from each other by a transverse ridge; the pits occupy approximately the situation of segms. xvii and xix, the ridge that of xviii. The ridge separating the trenches may also be —indeed usually is—sunk below the general level of the surface, the trenches of course being sunk deeper still.

The prostatic pores are in line with setae *b* (or between *a* and *b* ?); the sem nal grooves are approximately straight.

The female pores are paired, in a transversely oval whitish patch which takes up the anterior half of segm. xiv in the midventral region; the apertures are seated a little anterior and internal to setae *a*.

The spermathecal pores are two pairs, on small papillae which are situated on segms. viii and ix near their anterior borders; to be precise, the papillae are on the first of the interannular grooves of these segments, and each takes up approximately the space between the lines *a* and *b*. The pores have the form of transverse slits extending across the surface of the papillae.

Behind the pores on each of these segments is a lighter area, much and rather irregularly swollen; each area extends backwards to the hinder border of the segment, and outwards on each side to the line of seta *c*. These swollen areas are always lighter in colour, and very definitely limited,—definite large papillae, in fact. They are however variable:—(*a*) in one specimen, the posterior of the two is very slightly marked; (*b*) sometimes there are indications of each area being composed of two halves, united in the middle line; (*c*) in one specimen there is also a swollen patch on the right side of segm. xi (not x), which occupies the whole length of the segment; (*d*) in one, there is a large pad on x which occupies the whole length of the segment; (*e*) in one, there is a pad on one side only of segm. x.

In addition, the area in front of the pores, as far as the anterior border of the segment, may be slightly swollen. Setae *a* and *b* of segms. viii and ix are not distinguishable.

Internal Anatomy.

Septum 5/6 is much thickened; the next is 7/8, which is moderately strengthened; septa 8/9—11/12 are all much thickened, 12/13 somewhat so, and the rest are thin.

The ovoid and elongated gizzard is in the space between septa 5/6 and 7/8,—perhaps morphologically in segm. vi, since there are two pairs of vascular commissures between it and septum 7/8 (*i.e.*, these would be the commissures belonging to segms. vi and vii). The calciferous glands are large and rounded; they are situated dorso-laterally, meeting in the mid-dorsal line; they are symmetrically placed, apparently in segm. xvi; septum 15/16 is however vestigial, and exists only as a small low transverse lamina on the parietes. The intestine swells out behind the prostates.

The last hearts are in segm. xiii.

The excretory system is micronephric; in the anterior part of the body there are a very large number of very small nephridia on the body-wall; towards the hinder end the nephridia are difficult to distinguish, but none seem to be enlarged. Nephridial tufts lie over the hinder end of the pharynx in segm. v.

Testes and funnels are free in segms. x and xi. Large seminal vesicles are present in ix and xii, those in ix being cut up into large lobes, those in xii into small lobules.

The tubular prostates are two pairs, their coils closely adpressed; together they occupy segms. xvii—xx. The duct of each begins suddenly, is narrow and of the same diameter throughout, irregularly coiled or looped, and shining.

The female organs occupy the usual situation.

The spermathecae (fig. 4) are two pairs; the ampulla is saclike, irregular in outline, and narrows ectally to form a short duct only a fraction of the length of the sac. The single diverticulum is fully as large as the ampulla; its sperm-holding portion is approximately oval in form, with slightly lobed surface and margin; its duct is as long as the lobed portion and about two-thirds or three-quarters as wide.

The penial setae (fig. 5) are 1·5 to 2 mm. long, usually with a gentle simple curve; a few seem to be slightly recurved near the tip. They taper very gently throughout their length, their diameter being 28μ at the middle, 20μ near the tip. They are smooth and without ornamentation; the tip is slightly expanded and flattened, 28μ wide, bluntly pointed and perhaps faintly hollowed (spoonshaped).

The copulatory setae of the spermathecal region (fig. 6) are 1 to 1·1 mm. in length and 22μ in thickness, slightly bowed in the distal portion, and a little bent also at the proximal end. The tip is somewhat bluntly pointed, but not clawed; the distal third of the seta except the extreme tip is ornamented with several series of toothed ridges, each ridge somewhat semicircular in shape with the concavity towards the tip; two longitudinal series of such ridges are visible as the seta lies on its side, or perhaps three near the tip.

Remarks.

The external markings are strongly reminiscent of *O. paliensis*, but the size, spermathecae, and penial and copulatory setae differ considerably.

The copulatory setae resemble those of *O. prashadi*; and here, too, the male field has some resemblance; the size, spermathecae, and penial setae however establish a clear distinction.

Genus **Eudichogaster** Mich.

Eudichogaster matheranensis Steph.

Lonavla, Bombay Pres. August 1924. S. L. Hora. Numerous specimens.

As this is only the second time that examples of this species have been submitted to examination, I add a few notes by way of supplementing my original description (5).

Length of three specimens 76, 80 and 93 mm.; maximum diameter 3 mm. Colour pale the same on both dorsal and ventral surfaces. Segms. of the longest specimen 240; a faint secondary annulation on segm. vi, well marked on vii; three or four annuli on viii, five on ix, three or four on x, three on xi.

Prostomium tanylobous or very nearly so, with or without a transverse groove near the middle of the length of the tongue.

The setal intervals were estimated as follows:—Behind the male genital area and further back $ab = \frac{1}{3}$—$\frac{1}{4}aa = \frac{1}{2}bc = \frac{2}{3}cd$; towards the anterior end $ab = \frac{2}{5}aa = \frac{2}{3}bc = \frac{2}{3}cd$ (*i.e.*, the lateral setae are here not paired); *dd* is equal to about $\frac{4}{7}$ of the circumference.

The clitellum is not well marked; it seems to begin on segm. xii, but its hinder end is very indefinite,—it might perhaps (as I thought

in my former specimens) be at xviii, or it might equally well be at xxvi, or even behind xxx.

The genital markings were found in five specimens, in the setal zones of segms. ix-xi, ix-xii, or ix-xiii.

The condition of the septa in the anterior part of the body seems to be as follows (the description differs from my previous one) :—4/5 is moderately strengthened, 5/6 extremely tenuous, 6/7 absent; 7/8 is thin, and displaced backwards half a segment, 8/9 is moderately thickened, and at its attachment to the dorsal parietes is displaced a whole segment backwards; 9/10 is considerably thickened, and is displaced backwards almost a whole segment; 10/11 is moderately thickened and displaced backwards half a segment; 11/12 is slightly thickened and has its normal position. The rest are thin.

The gizzards are, as before, in segms. vi and vii; there is a constriction between them, but no softer portion of the oesophagus, and no septum.

The last heart was in segm. xii on one side, and in xiii on the other.

Seminal vesicles were not present in the specimen dissected, which also in other ways (absence of recognizable testes and ovaries) appeared not to have reached, or probably to have passed, sexual maturity. There was however a small ovisac containing an opaque white mass, presumably ova, on the right side in segm. xiv.

The penial setae were distinctive of the species.

Genus **Eutyphoeus** Mich.

Eutyphoeus assamensis sp. nov.

Katlicherra, S. Cachar, Assam. March 1925. S. L. Hora. A number of specimens.

External Character

Length of three examples 185, 200, 245 mm.; diameter 4 mm. Colour a nondescript greyish, rather darker in the anterior part of the animal. Segms. (of the longest of the above three specimens) 255; segm. vi is biannular, vii triannular, viii has four, ix-xi five, and xii-xiii three or four annuli.

The prostomium is of a combined prolobous and tanylobous form, but is somewhat variable; there are numerous longitudinal grooves or wrinklings on segm. i.

The dorsal pores begin in furrow 11/12.

The setae are paired; in the middle of the body $ab = \frac{2}{7}aa = \frac{2}{5}bc = \frac{2}{3}cd$; behind the genital region $ab = \frac{1}{5}aa = \frac{1}{4} - \frac{1}{3}bc = \frac{2}{5} - \frac{1}{2}cd$; dd is a little more than half the circumference. Setae are indistinguishable on the first four segments, and not all seem to be present on v or vi,—on v also they may be altogether indistinguishable.

The clitellum extends over $\frac{1}{2}$xiii—xvii ($=4\frac{1}{2}$), but it is not well marked in any of the specimens. Setae and dorsal pores are present; there is no great thickening of the body-wall, and its limits are rather indefinite, especially posteriorly.

The male pores are on segm. xvii, a little outside the line of setae *b*, with somewhat puckered margins; penial setae are seen projecting,

Ordinarily the region between the pores forms a slightly sunk transversely extended area which occupies the greater part of the length of the segment (xvii) ; but in the most strongly characterized examples this depression is exaggerated, and at its lateral extremities, further out than and embracing the male pores, and even rather overhanging them, are a pair of raised thick semicircular or horseshoe-shaped lips, with their concavities facing inwards ; the anterior and posterior limbs of each semicircle are continued inwards towards the middle line to within the line of setae *a*.

The female pores are inconspicuous, paired, situated just in front of setae *a* of segm. xiv.

The spermathecal apertures are one pair, fairly conspicuous, with tumid lips, in furrow 7/8, just outside the line of setae *b*.

There is a pair of genital papillae over the site of furrow 16/17, slightly raised, with flat surface, oval or round shin shape, taking up the interval between the lines *a* and *b* and extending outwards beyond the line *b* as far as *a* is internal to it,—*i.e.*, the centre of the papilla is in the line *b*. In specimens which show the horseshoe-shaped lips on segm. xvii the papillae are indistinct, being coincident with the inner end of the anterior limb of the horseshoe.

Internal Anatomy.

Septum 4/5 is considerably thickened, 5/6 is excessively thick and strong ; the next is 8/9, which is somewhat strengthened and displaced backwards into segm. x (as externally delimited) ; 9/10 is of similar thickness, and is situated at the level of furrow 10/11 ; 10/11, similarly strengthened, is somewhat in front of furrow 11/12. The rest are thin ; 11/12 is present as a distinct septum.

The gizzard is situated in the space between septa 5/6 and 8/9 ; there are two transverse vascular commissures behind it in front of septum 8/9, so that it is probably morphologically in segm. vii. The calciferous glands, in segm. xii, constitute, as usual, a pair of ovoid swellings not set off from the gut. The intestine begins in xv.

The last hearts are in segm. xiii ; those of segm. xi run freely in the segment (in many specimens they are bound down to the neighbourhood of the gut by dense connective tissue). The dorsal vessel ends behind the gizzard.

The micronephridia are few and irregularly scattered in the anterior segments, more numerous and in segmental rows in the segments of the clitellum. Behind this the nephridia are arranged in each segment as a transverse row of three or four close behind the septum, and in addition, at the inner end of the row, a small group of four to six ; this group occupies approximately the region of the body-wall which corresponds to the setal interval *bc*, while the row of three or four micronephridia is dorsal to this.

Testis sacs are present in segm. xi. There is a pair of seminal vesicles, confined to segm. xii, of moderate size, and scarcely lobed.

The tubular prostates, of moderate size, extend backwards to segm. xxii, and are constituted of a not very regular series of apposed loops. The duct has almost the same diameter as the gland ; it forms a cylindrical

shining irregularly twisted tube of some length. The vas deferens comes round the outer side of the end of the prostatic duct, and swells out into a terminal bulb posterior to and separate from the latter.

The female organs have the usual situation.

The spermathecal ampulla (fig. 7) is ovoid, with its long axis antero-posterior; the duct, situated in the middle of the under surface of the organ, is very short and stout. There are two very small diverticula, each shortly cylindrical, attached to the junction of duct and ampulla, one on the outer side of the organ, the other on its hinder aspect and slightly towards the inner side.

The penial setae (figs. 8, 9) are 2 mm. in length, and have a thickness at their middle of 40μ. They are somewhat sickle-shaped, the distal two-thirds of their length forming a wide bow-like curve; but the seta does not lie in one plane. The tip is blunt, flattened, and a little expanded; it may be as much as 50μ in width, but is usually less. The distal end, practically to the extreme tip, shows very numerous short rows of teeth or points,—or perhaps only minute dot-like sculpturings.

Remarks.

In most species of this genus there exists a peculiar modification of septum 11/12; it is replaced by a mass of dense connective tissue investing the gut, in which are embedded the hearts of segm. xi; these latter lie deeper than usual, and are not seen unless specially laid bare. In the present species however the septum, though thin, is definitely present in the normal manner, and the hearts of segm. xi also have the normal relations.

Eutyphoeus gammiei (Bedd.)

Katlicherra, S. Cachar, Assam. March 1925. S. L. Hora. Five specimens sexually mature one not fully mature.

I noted the situation of the genital markings in these specimens of this variable species. They were present in all five sexually mature specimens in the situation of furrows 13/14 and 19/20, in 20/21 in three, in 10/11 in one, in 21/22 in one. The spermathecal diverticula were 10 in number, and formed a collar round two-thirds of the periphery of the organ at the level of the junction of duct and ampulla.

Eutyphoeus masoni (A. G. Bourne)

Ballygunge, Calcutta. 18 ix. 1924. R. Hodgart. A single large specimen.

I subjoin a few notes on certain of the external characters.

The length is 265 mm., and the maximum diameter 8 mm. In colour the specimen is a light brown; there is little difference between dorsal and ventral surfaces; a dusky purple tinge however is present dorsally behind the clitellum, soon narrowing to a dark mid-dorsal stripe.

The dorsal pores begin in furrow 11/12.

The male apertures are represented by deep pits, not grooves, on segm. xvii, in line with setae *ab*, but transgressing these lines both internally and externally; the lips of the pits overhang, except at the antero-

internal portion of their circumference. Penial setae are seen within the pits.

The single female pore is just in front of seta *a* on the left side of segm. xiv.

The genital markings, spermathecae, and penial setae are distinctive of the species.

Eutyphoeus nicholsoni (Bedd.)

Cawnpore. Sept. 1924. J. P. Mullan. Several specimens.

Eutyphoeus waltoni Mich.

Cawnpore. Sept. 1924. J. P. Mullan. Two specimens.

Genus **Hoplochaetella** Mich.

Hoplochaetella khandalaensis (Steph.) f. **typica.**

Lonavla, Bombay Pres. August 1924. S. L. Hora. Numerous specimens.
Bombay. Three specimens. A Powell. (Br. Mus.)

The prostomium may or may not have a transverse groove across the tongue.

There may be a faint and very indefinite swelling in the midventral line on each side of furrow 7/8, partially (but only partially) obscuring the furrow in this situation.

In the specimens from Bombay the most mesially situated setae on the ventral surface of segm. vii (setae *ab*, or in one specimen *abc*) are displaced forwards and seated on small papillae.

f. **dichordarius** Steph.

Mahableshwar, Bombay Pres. August 1924. J. P. Mullan. Three specimens.

Hoplochaetella mullani (Steph.)

Lonavla, Bombay Pres. August 1924. S. L. Hora. Numerous specimens.

From an examination of a number of these specimens it appears that the prostomium is variable; thus it may be epilobous $\frac{3}{4}$ with a faint transverse groove near the anterior end of the tongue; or it may be almost tanylobous (epilobous $\frac{5}{6}$) without transverse groove; or epilobous $\frac{1}{2}$ with well marked groove.

The papilla and pore of the accessory prostate varies in position. Thus it may be on the anterior half of segm. xviii on either the left or the right side, just outside the line of the male papillae; or there may be a pore on both sides, almost in line with the male papillae; or the pore may be on the anterior half of xvii or of xix, on the left side, immediately outside the line of the male papillae; or on the left side of xvii but in the setal zone,—outside and in the same transverse line as the male papilla. A distinction from *H. khandalaensis* however is that here the accessory pore is never median.

The position of the spermathecal pores also distinguishes the species. The two pairs are here quite constantly on segms. viii and ix respectively (not both pairs on viii).

There is a large blood-vessel on each side in segm. xiv; in my previous accounts of this and other species of the genus, I have varied in my opinion as to whether this vessel is or is not to be reckoned as a heart. Its mode of origin and course do not quite correspond to those of the hearts, and I think it is better to dissociate it from these latter.

In addition to the mega-and micronephridia previously described, there is a pair of tufted nephridia in segm. v.

In the specimen which I dissected there was in segm. x a pair of small seminal vesicles cut up into small lobules. These were not present in my original examples of the species.

One of the present specimens showed externally (*v. sup.*) a pair of additional prostatic pores (instead of a single one, as usual); these were situated on segm. xviii, almost in line with the true prostatic pores on xvii and xix. The specimen was opened; it showed on the right side three prostates of the ordinary form, all rather small, especially the middle one, and all three with soft glandular cushions (a second type of accessory prostate) lying against their ectal ends, as described in my previous paper (5). On the left side there were the two prostates of ordinary form belonging to segms. xvii and xix, and between them an accessory prostate of the sausage-shaped type. The seminal vesicles in segm. ix were here of fair size, as was also that on the left side in xii; there was a small vesicle on the right side in xii, and also a small vesicle on the same side in x; but there was none on the left side in x.

Subfam. DIPLOCARDIINAE

Genus **Dichogaster** Bedd.

Dichogaster bolaui (Mich.)

Terkumalai, Courtallam, Tinnevelly Dist. 27. x. 24. H. S. Rao: Two specimens.

Fam. LUMBRICIDAE

Subfam. GLOSSOSCOLECINAE

Genus **Pontoscolex** Schmarda

Pontoscolex corethrurus (Fr. Müll.)

Suduganga, Ceylon; in flower-pot earth. 8. xii. 24. R. Senior-White. Two specimens.

Bombay. Sept. 1924. J. P. Mullan. A single specimen.

Subfam. LUMBRICINAE

Genus **Allolobophora** Eisen

Allolobophora (Allolobophora) caliginosa (Sav.) subsp. **trapezoides** (Ant. Dug.)

Almora Dist., U. P.; Sta. 3. J. N. and D. N. Bagchi. Numerous specimens in a bad state of preservation.

Allolobophora (Bimastus) constricta Rosa

Almora Dist. U. P.: Sta. 2. J. N. and D. N. Bagchi. Two specimens.
Almora Dist. U. P.; Sta. 3. J. N. and D. N. Bagchi. A single specimen.

The specimens from Sta. 2 may perhaps represent a separate variety. The prostomium is epilobous $\frac{1}{3}$, the tongue being cut off behind. The clitellum includes segms. xxvi (part or all) to xxxi, and the walls, or ridges of puberty (not very distinct) extend through segms. xxvii—xxx, or possibly are even coextensive with the clitellum. The worms are small, one being 32 mm. long and 2·5 mm. in diameter (maximum 3 mm.), with 92 segms.; the colour is brownish, with little difference between the dorsal and ventral surfaces.

The specimen from Sta. 3 has a prolobous or proepilobous prostomium; the clitellum includes segms. xxvi—$\frac{1}{2}$xxxii (present on the dorsal side only in xxxii), and the ridges of puberty extend through xxviii-xxx.

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