

NOTES ON SOME EARTHWORMS FROM THE INDIAN MUSEUM.

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INTRODUCTORY NOTE.

As the title indicates this paper is mainly concerned with the results of a study of some of the earthworms belonging to the Indian Museum. A few notes have been included on sundry specimens from other museums.

My heartiest thanks are due to Dr. B. Prashad, Director of the Zoological Survey of India, for the opportunity to examine these collections and for the assistance graciously extended in numerous ways during the course of the investigation.

The figures are from camera lucida sketches by Maung Kyaw Zan to whom the author's thanks are again extended. Except in special cases references to the original specific descriptions are given only for species erected subsequent to the publication of Stephenson's *Oligochaeta* in the "Fauna of British India" Series.

Family MONILIGASTRIDAE.

Genus *Desmogaster* Rosa.*Desmogaster doriae* Rosa.

Material examined.—Karen Hills, east of Toungoo-Burma, October, 1 fully clitellate specimen in excellent state of preservation.

The blood vessels of the reproductive segments of this worm are distended with blood while the vasa deferentia are unusually firm. It has therefore been possible from this worm to clear up the confusion in previous accounts with regard to the vasa deferentia.

The vas emerges from the testis sac and passes ventrally in a straight line on the posterior face of the septum. Before reaching the ventral parietes the vas turns and passes dorsally (either on the posterior face of the septum and covered over by connective tissue or actually within the septum) nearly to the testis sac. Just before reaching the testis sac the vas turns again and passes ventrally in such a way as to form an elongated hairpin loop, the limbs of the loop either in contact or much closer together than either of the limbs is to the entalmost portion of the duct. Before reaching the parietes the vas is twisted several times into short loops, some of the loops are covered over by strong connective tissue. The vas then passes into the parietes and underneath a fairly thick layer of longitudinal muscles and in a straight line to *c* or nearly to *c*. At this point the vas emerges from the body wall and proceeds dorsally along the prostate to the ental end of the latter. No nephridia were found in xi and xii of this worm. A hairpin loop of the vas deferens attached to the posterior face of the septum was probably mistaken previously for a modified nephridium.

Genus *Drawida* Michaelsen.*Drawida affinis* Stephenson, *sp. inq.*

Material examined.—One specimen, holotype, in tube labelled, "W 131/1. *Drawida affinis* sp. nov. Rangamati, Chittagong Hill Tracts. 11-vii-15 R. Hodgart."

The type is acitellate. Definite reproductive apertures are not recognizable. There is a minute vestige of a pore about in line with

b on each side on the posteriormost margin of *x*; possibly the rudiment of a male pore. There is a pore-like marking about in line with *c* in 7/8 on each side; possibly the rudiment of a spermathecal pore.

The small testis sacs extend from 9/10 only slightly into *x*. The vas deferens is short with very few loops. The prostate is rather long and spirally coiled; a rather short ectal portion is slightly widened. The vas passes into the ectal part of the swollen region.

The spermathecal ampullae are vestigial. The atrium is finger-shaped, erect, on the anterior face of 7/8. The atrium of one side was removed and cleared. The lumen is represented by a narrow slit at the centre, the wall of the atrium being unusually thick.



FIG. 1.—*Drawida affinis*. Spermathecal atrium from holotype. $\times ca. 46$.

There are two or more whitish bodies (enterosegmental organs) on the dorsal surface of the intestine at each side of the dorsal blood vessel, in each of four segments just behind the gizzard region.

In the genus *Drawida* the reproductive apertures and in particular the male pores can be recognized as patent apertures in very small specimens long before the worms have attained their full size. Conversely, the absence of definitely recognizable reproductive apertures on the single specimen of *D. affinis* is evidence that the worm is far from fully grown (or else abnormal). In the absence of any evidence that the specific characteristics of the worm have been developed the species must be regarded as dubious. So far as can be determined the relationships seem to be with *D. hodgarti*. Possibly the holotype of *D. affinis* is a very small and juvenile specimen of *D. hodgarti*.

***Drawida decourcyi* Stephenson.**

Material examined.—One dissected specimen, holotype, labelled "ZEV. 5160/7. *Drawida decourcyi* sp. nov. Upper Rotung, alt. ca. 2,000 ft. Capt. M. de Courcy" and two dissected, paratypes, labelled "ZEV. 5381/7. *Drawida decourcyi*. Abor Exped. Renging. 24-xi-11. F. H. Stewart".

One of the paratypes, an anterior fragment, is more nearly mature than the type and from this specimen the subsequent description is mainly derived.

External characteristics.—The prostomium is prolobous.

In intersegmental furrow 7/8 on each side there is a deep invagination with a transversely slit-like aperture. On the anterior wall of this invagination there is a circular area on which the small, primary, spermathecal pore is located.

The secondary male pores (apertures of copulatory chambers?) are crescentic slits on 10/11, so placed that the concavity of the crescent faces anterolaterally, the median end of the slit about at *b*.

Internal Anatomy.—The gizzards are in xx-xxvii with a rudimentary gizzard in xix.

The testis sacs are (apparently) within posterior outpocketings of septum 9/10 into x, the anterior portion of the pocket is narrowed and contains only the entalmost portion of the vas deferens. The vas is long, twisted into a closely compacted mass of coils that is much larger than the testis sac. Some of the loops of the vas appear to project into ix but are covered over by a delicate transparent membrane that may represent a portion of septum 9/10; coils projecting into x are not (apparently) so covered over. The vas deferens of one side, straightened out but without stretching is 640 mm. long. The prostates are smooth surfaced, firm, rather cone-like bodies. The prostates are not erect but are bent backwards towards the ventral body wall, pushing septa 10/11-12/13 into posteriorly directed pockets within which the prostates are contained. The ental end of the prostate is not pointed but bluntly rounded and at its centre the vas deferens passes into the prostate. To the anterior face of the prostate near the parietes numerous, strong, flattened, muscular bands are firmly attached. The length of the prostate is about 5 mm.; an ental portion about 3 mm. long smooth, an ectal portion about 2 mm. in length roughened by the attachment of the muscular bands. The parietal invagination is continued through the body wall into the ectal portion of the prostate, the lumen within the ectal part of the prostate fairly wide though the wall is by no means thin. On the roof of the copulatory chamber there is a smooth, round, genital papilla, at the centre of which there is a depression. Within this depression and attached at one side is a wrinkled, thin-walled, translucent, penial body. The latter is club-shaped and bears at the centre of the bulbous ventral end a male pore. The stalk portion of the penial body narrows gradually as it passes dorsally into the depression on the genital marking.

The lumen of the prostate is reduced by the projection into it of numerous, long, thick ridges.

The prostates in the holotype are similar to those just described but are smaller.

The ovarian chambers and the ovisacs are not sexual though the ovisacs penetrate into xiv-xvi.

The spermathecal atria are about 8 mm. long and of a rather flattened columnar appearance. An ental, coelomic portion about 5 mm. in length passes into the longitudinal musculature in the anteriormost portion of vii and after a right angled bend passes straight posteriorly within the body wall, opening to the exterior, after passing through the rather thin wall of the parietal invagination, by the pore on the circular area on the anterior wall of the invagination. The lumen of atrium is narrowly slit-like, the wall of the atrium of three distinct layers. The spermathecal duct is about 20 mm. long, glistening throughout and slightly widened ectally. The duct passes through 7/8 and into vii and then into the body wall in vii where it joins the atrium.

Remarks.—The second paratype is quite juvenile. The male pores or apertures of the copulatory chambers are not visible; the *anlage* of the spermathecal pores are possibly represented by the minute, blackish depressions on the posterior margin of vii. The spermathecal ampullae are very rudimentary, the testis sacs are small, the prostates are repre-

sented by a small hemispherical body in the parietes just projecting into the coelom, and the ovarian chamber is shut off only mesially. Even at this stage the coiled mass of the vas deferens is much larger than the testis sacs. The gizzards are in xiv-xx.

Although all of the types are acitellate and the ovarian chambers and ovisacs are juvenile the prostates and spermathecae and associated structures are sufficiently developed to enable adequate characterization of the species, at least to the extent of distinction from all known forms of the genus *Drawida*.

***Drawida hodgarti* Stephenson, sp. inq.**

1917. *Drawida hodgarti* Stephenson, *Rec. Ind. Mus.* XIII, p. 366.

Material examined.—One tube labelled, "W 70/1. *Drawida hodgarti* Stephenson. Rangamati, Chittagong Hill Tracts, Bengal. R. Hodgart (Mus. Collr.) Types," containing 3 acitellate specimens, two of which, paratypes, are unopened.

External characteristics.—On the type-specimen there is on the posteriormost margin of x on each side a whitish, narrow, slightly protuberant, transverse ridge, extending from *a* into *bc*. On the median portion of each ridge is a minute, open, round, male pore, about in line with *b*. The transverse male pore ridge is not quite as well developed on the larger of the two paratypes but is recognizable. The male pores are minute but rather slit-like, diagonally placed but about in line with *b*. The reproductive apertures are not visible on the smaller of the paratypes.

The spermathecal apertures are minute, round pores in 7/8, slightly median to *c* (type). The female pores are minute, transverse slits on the anteriormost margin of xii, about in line with *b* (type).

Immediately anterior to each spermathecal pore, on the type, there is a half-moon-shaped, whitened area, the base or straight margin of the marking on 7/8. There is also a slight, whitish tumescence immediately anterior to the male pore ridge on x on each side.

The definitive genital markings are tiny, transversely oyal, greyish areas, just behind *c* on viii and just behind *b* or *ab* on vii.

There are no genital markings on the smaller paratype. On the larger paratype there are four, transverse, greyish-translucent areas on vii, immediately in front of the spermathecal pores and just posterior and slightly lateral to *d*.

Internal anatomy.—(The larger paratype was opened.)

The testis sacs are kidney-shaped and are not constricted by 9/10. The prostates are elongate and coiled, the entalmost portion slightly thicker than the remainder. The vas is rather short, twisted into a small mass of loops on the posterior face of 9/10 under the testis sac; passing into the prostate quite definitely ventral to the ental end.

The ovarian chamber was opened in opening the worm; 10/11 and 11/12 appear to pass independently to the parietes laterally; segment xi is closed off mesially from the oesophagus as in worms with the horseshoe-type of ovarian chamber.

The spermathecal atria are erect, finger-shaped structures in vii. One of these (text-fig. 2) was removed and treated with lactophenol and glacial acetic acid but was not successfully cleared.



FIG. 2.—*Drawida hodgarti*. Spermathecal atrium. $\times ca.$ 46.

The gizzards are four in xv-xviii (in the type, according to Stephenson) or three in xv-xvii. There are masses of whitish material (entero-segmental organs) on the dorsal surface of the gut, on either side of the dorsal blood vessel for a few segments posterior to the gizzard region.

Remarks.—*D. hodgarti* is very similar to *D. papillifer* and is distinguished from the latter species only by the small, finger-shaped spermathecal atria in vii. This distinction can be regarded as valid evidence for separation of the species only if the spermathecal atria of *D. hodgarti* have attained their definitive form. The condition of the ovarian chambers, the ovisacs and the spermathecal ampullae shows quite clearly that the types of *D. hodgarti* are juvenile. Quite possibly then the spermathecal atria are also incompletely developed and hence not characterized by definitive form. The difficulty of demonstrating a lumen in the atrium may be regarded as an additional evidence for the immaturity of the atrium.

The types of *D. hodgarti* and *D. papillifer* were all secured along with the holotype of *D. affinis* from one locality, by the same collector and apparently at the same time.

Drawida kempii Stephenson.

1914. *Drawida kempii*, Stephenson, *Rec. Ind. Mus.* VIII, p. 376.
 1923. *Drawida kempii*, Stephenson, *Oligochaeta, F. B. I. Series*, p. 144.
 1914. ?*Drawida rotungana*, Stephenson, *Rec. Ind. Mus.* VIII, p. 372.
 1923. ?*Drawida rotungana*, Stephenson, *Oligochaeta, F. B. I. Series*, p. 155.
 1914. ?*Drawida pellucida*, Stephenson, *Rec. Ind. Mus.* VIII, p. 368.
 1923. ?*Drawida pellucida* f. *typica* (part), Stephenson, *Oligochaeta, F. B. I. Series*, p. 150.

Material examined.—One specimen labelled “ZEV. 5382/7. *Drawida kempii* sp. nov. Egar Stream between Renging and Rotung. 9-i-12. Under stones in water”; two specimens labelled “ZEV. 5154/7. *Drawida rotungana* sp. nov. Abor Exped. Rotung. Alt. 1,300 ft. Under stone. 8-iii-12. S. W. Kemp”; and one specimen labelled “*Drawida pellucida* Bourne (?) (not fully mature). Upper Rotung. 5-i-12. ZEV. 5411/7.”

A

The holotype of *D. kempii*.

The male pores are minute apertures, each located on a slight, soft, wrinkled and translucent protuberance which is on 10/11, in *bc*, slightly nearer to *c* than to *b*. The margins of *x* and *xi* immediately in front of and just behind these tumescences are slightly swollen but firm. The spermathecal pores are very small, transverse slits in 7/8, about

in *c*. The female pores are very small transverse apertures in 11/12, just lateral to *b*.

The genital markings (?) are a pair of longitudinal, slightly depressed, translucent areas of epidermal thinness. Each of these areas extends anteroposteriorly from just behind 9/10 to just in front of 11/12 and lateromesially from slightly lateral to *c* (as indicated on segments other than *x* and *xi*) to *b*. The translucence and depression are most noticeable on the posterior, anterior and lateral margins of each of these areas. Setae *c* and *d* (of *x* and *xi*) are displaced laterally, apparently by the development of these markings. In addition to these markings there is a small area, rather faintly indicated, on the right side of *ix* just lateral and slightly posterior to *b*. that may represent a vestige of a genital marking.

The vas deferens is slender, short, with a few loops, passing into the dorsal surface of the prostate towards the anterior margin. The testis sacs are constricted dorsally by 9/10, the portion of the sac in *ix* of about the same size as the part in *x*. "The prostate is a large cuboid milky white mass" (Stephenson, 1914, p. 377) sessile on the parietes. The whitish material is unusually soft, softer than the granular layer so often present on the coelomic face of a prostate in *Drawida*. The whitish material falls apart readily, when probed, into club-shaped bodies. Removal of the whitish material discloses a firm, spheroidal body with the ventral face imbedded in the parietes. This central body is very similar to the prostate of *D. rotungana*.

The spermathecal ampullae are filled with whitish material and are probably fully developed. The ovarian chamber is sexual, distended by ova. The ovisacs appear also to be fully sexual.

Remarks.—The holotype of *D. kempi* is probably fully sexual though acitellate. The clitellum appears to be a rather evanescent structure in *Drawida* and does not appear until after the internal reproductive organs are fully sexual. The type-specimen may be somewhat abnormal; the thinness and translucence of portions of the ventral epidermis and the vestigial condition of the asymmetrical genital marking (?) do not appear to be quite normal.

The club-shaped bodies into which the whitish material on the prostate fragments are larger, softer and less firmly bound together than the granulations of the coelomic layer on the ordinary *Drawida* prostate.

B.

The types of *D. rotungana*.

The posterior margins of *x* and the anterior margins of *xi* are swollen and slightly protuberant in a sort of conical fashion in the region of *bc* on each side. Intersegmental furrow 10/11 is uninterrupted in the region of swelling. The rudiments of the male pores are minute apertures on 10/11, in mid *bc*, each pore about at the centre of the marginal swellings.

The spermathecal pores are minute, in 7/8 just median to *c*, each pore on a slight, transversely ridge-like swelling on the intersegmental furrow. The female pores are transverse slits in 11/12 in *b* or very slightly lateral to *b*.

The genital markings are a single pair of inconspicuous, transversely oval, postsetal areas on ix, the width of the marking about equal to interval *ab*, the depressed centres of the markings in line with *b* or *ab*, the markings about equidistant from the setae of ix and 9/10.

The testis sacs extend into both ix and x, the dorsal margin markedly constricted by 9/10, the portion in ix smaller than the part in x. The vas deferens is short with very few loops. It drops to the ventral body wall in x and after a short loop passes into the anterior face of the prostate close to the parietes. The prostate is a smooth-surfaced, firm, spheroidal body, sessile on the parietes. The coelomic wall of the prostate is a very thin, and transparent but tough membrane. Within this membrane there is very soft, whitish material. At the centre of the whitish material there is a small lumen, crescentic in section. The whitish material is, apparently, continued through the parietes in the form of a small column or plug. If this plug is carefully pulled out from the parietes there is visible at the ventral end of the plug a small bit of epidermis on which the male pore is located.

The spermathecal ampullae of the type are fairly well developed but the ovarian chamber and the ovisacs are not sexual. The spermathecal ampullae are not so well developed in the paratype.

Remarks.—The paratype is smaller, less developed sexually and in a poorer state of preservation than the type. The marginal swellings in the vicinity of the male pores are better developed on the paratype than on the type. On the former the anterior and posterior margins of the swellings (*i.e.*, margins away from the intersegmental furrow) are demarcated by transverse furrows which do not pass, either laterally or mesially, into 10/11.

As the types of *D. rotungana* are not sexual the species cannot be adequately characterized. So far as can be determined the species appears to be close to if not actually conspecific with *D. kempi*. About all that is needed to convert the types of *rotungana* into *kempi* is for the whitish material within the prostate to grow through the tough membranous wall into the coelom as club-shaped bodies. Some such process as this probably takes place in the maturing of *kempi* and a similar development has been previously suggested by Benham in *D. indica*.

Another resemblance possibly of minor importance is that the vestige of a genital marking on the type of *D. kempi* is located approximately in the same position as the genital markings of *D. rotungana*.

C.

The specimen of *D. pellucida*.

The spermathecal apertures are small slits in 7/8, just median to *c*. The male pores are not definitely recognizable. There are no genital markings.

The only indications of the presence of the prostates is the bulging of the floor of x in two places, the longitudinal musculature uninterrupted above the bulges. Presumably rudiments of the prostates within the parietes are responsible for the bulging.

Remarks.—The specimen mentioned above is a very immature juvenile. Organs of taxonomic importance have scarcely begun to develop. Identification, at least at present, is impossible. The worm comes from the same region as *D. kempi* and *D. rotungana* and *D. decourcyi*. The absence of colouration suggests a greater possibility of relationship to *kempi* or *rotungana* than to *decourcyi*.

***Drawida limella*, sp. nov. ?**

Material examined.—“From the edge of a tank at Kinchana,” near Amingaon, Kamrup District, Assam. S. L. Hora, 1 clitellate specimen.

Description : External characteristics.—Length, 58 mm. Maximum diameter, 2 mm. There are traces of bluish pigmentation on the dorsum, the pigmentation especially marked in the region of the intersegmental furrows. In the anterior region on each side there is a longitudinal row of tiny but quite evident, blackish spots, each spot in or close to an intersegmental furrow and in line with *c*. The spots are rather pore-like in appearance and doubtless indicate points of especial thinness in the body wall. Similar but less evident spots also in the intersegmental furrows can be recognized in the same region in line *b* on each side.

Setae *ab* and *cd* are closely paired ; $aa < bc$.

The clitellum is annular and indicated by a definite whitening of segments ix-xiv.

The spermathecal pores are tiny, transverse slits in 7/8 in mid *bc*.

The male pores were not recognised.

The female pores are in 11/12 about in line *b*.

The male porophores are roughly conical, whitened, conspicuous protuberances belonging apparently to both x and xi as 10/11 ends abruptly against the base (dorsal portion) of the porophore mesially and laterally. The base of the porophore extends from just median to *a* to slightly lateral to *b*. At the ventral end of the porophore is a tiny, nipple-like projection on which the male pore is presumably located.

The genital markings are a pair of transversely oval, whitish areas, each marking in *bc* on the posterior margin of vii. At the centre of each marking is a tiny, round pore which is very slightly lateral to the spermathecal pore.

Internal anatomy.—Gizzards, 3. Last hearts, ix.

The testis sacs are ovoidal, in 9/10 projecting into both ix and x. The vas deferens was traced on one side where it passes ventrally on the anterior face of 9/10 nearly to the ventral parietes and then posteriorly into x where it passes into the centre of the mid-dorsal face of the prostate. The vas is short and almost straight, *i.e.*, without loops. The prostates are represented by circular, sessile patches of granular bodies in the parietes. Removal of the granulations reveals a central body that is thin-walled, transparent, longer than thick with a constant diameter except that in the outermost layers of the parietes and within the male porophore (nipple-portion) the thickness gradually decreases.

Segment xi was opened by the mid-dorsal incision. If an ovarian chamber is present its anterior and posterior walls are considerably

distended by the accumulated masses of ova. The ovisacs are rather thick for 2-3 segments but are continued posteriorly through several additional segments as much narrower, cord-like bodies.

The spermathecal ampullae are ovoidal. The spermathecal duct is rather thick considering the size of the worm, whitish not glistening, looped on the posterior face of 7/8 and passes into the parietes without noticeable trace of an atrial enlargement.

Erect in segment vii and passing into the parietes dorsal to each genital marking is a columnar body with a finely granular, coelomic surface. From a central point on the dorsal end of the column a fine thread rises and then drops over onto the ventral parietes from whence it could be traced no further. This thread is, on one side of the worm, of a faint reddish colour. The granulations can be easily scraped off revealing an elongate, tubular, central body.

Remarks.—The account above is not as complete as is desirable. The anteriormost segments are softened; no setae were visible on these segments.

The ectal end of the male deferent apparatus is probably in an everted condition; it is scarcely probable that the conspicuously protuberant porophores represent the normal condition of the ectal end of the male apparatus in the living worm. The central body of the prostate of one side has been traced through the parietes to the nipple at the end of the male porophore, so that the location of the male pores on the nipple can be regarded as established with a fair degree of certainty. The spermathecal duct has not however been traced through the parietes to the spermathecal pore as is usually done. The location of the spermathecal pore and the absence of an atrial widening of the duct require, in these circumstances, confirmation.

The septa just behind the ovarian segment and the ovisacs are very fragile so that the membranes were ruptured in exploring the post-genital segments. The exact location of the gizzards is not known, possibly they are in xiii-xv.

The glands in vii are of interest; their appearance and gross morphology is almost exactly like that of the prostates of certain species of *Drawida*. The thread which hangs over onto the parietes may possibly be a blood vessel.

D. limella is close to *D. periodiosa* but is distinguished from the latter species by the absence of spermathecal atria and the more lateral (but only slightly) location of the spermathecal pores. Just how significant or real these apparent distinctions may be can only be determined when further material from Amingaon becomes available for study.

Drawida nepalensis Michaelsen.

1907. *Drawida nepalensis*, Michaelsen, *Mitt. Mus. Hamburg*, XXIV, p. 146.
 1909. *Drawida nepalensis*, Michaelsen, *Mem. Ind. Mus.* I, p. 147.
 1917. *Drawida nepalensis*, Stephenson, *Rec. Ind. Mus.* XIII, p. 372.
 1922. *Drawida nepalensis*, Stephenson, *Rec. Ind. Mus.* XXIV, p. 430.
 1923. *Drawida nepalensis*, Stephenson, *Oligochaeta, F. B. I. Series*, p. 146.
 1909. *Drawida burchardi*, Michaelsen, *Mem. Ind. Mus.* I, p. 149.
 1923. *Drawida burchardi*, Stephenson, *Oligochaeta, F. B. I. Series*, p. 134.
 1925. *Drawida burchardi*, Stephenson, *Rec. Ind. Mus.* XXVII, p. 50.
 1933. *Drawida burchardi*, Gates, *Rec. Ind. Mus.* XXXV, p. 426.

1925. *Drawida papillifer* (part), Stephenson, *Rec. Ind. Mus.* XXVII, p. 51.
 1925. *Drawida hodgarti*, Stephenson, *Rec. Ind. Mus.* XXVII, p. 50.

Material examined.—Three juvenile specimens without male porophores and 1 acitellate specimen with male porophores labelled "ZEV. 2936/7. *Drawida burchardi* Michl. Mt. Harriet, S. Andaman. B. B. Osmaton;" one acitellate specimen labelled "W 1224/1. *Drawida burchardi* Mich. Mt. Harriet, Andamans. Dr. N. Annandale;" 9 juvenile specimens without male porophores and 6 acitellate specimens with more or less rudimentary male porophores labelled "W 1223/1. *Drawida burchardi* Michl. Amingaon. Dr. S. L. Hora;" fragments of two acitellate specimens labelled "ZEV. 2940/7. *Drawida nepalensis*, Gowchar, Nepal. Hodgart. Type;" one juvenile specimen without male porophores and one acitellate specimen with male porophores labelled "W 72/1. *Drawida nepalensis* Michl. Rangamati, Chittagong Hill Tracts, Bengal. R. Hodgart;" 7 acitellate specimens labelled "W 80/1. *Drawida nepalensis* Michl. Kierpur, Purneah District, Bihar. C. Paiva;" two softened, acitellate specimens with male porophores labelled "W 680/1. *Drawida nepalensis* Michl. Compound of Forest Research Inst., Dehra Dun;" two acitellate specimens with male porophores labelled "W 1226/1. *Drawida papillifer* Steph., Amingaon, Assam;" 4 specimens labelled "W 1225/1. *Drawida hodgarti* Amingaon. Dr. S. L. Hora." From the Hamburg Museum: 5 acitellate specimens labelled "V 7140. *Drawida nepalensis* Michl. Hodgart. Nepal;" 3 acitellate specimens labelled "V 7170. *Drawida burchardi* Michl. B. B. Osmaton. S. Andaman;" and 1 specimen labelled "V 5781. *Drawida burchardi* Mich. W. Burchard. Sumatra."

The holotype of *D. burchardi* is represented at present only by a posterior portion, the anterior end containing all the reproductive structures has been removed and lost. The holotype was acitellate but the reproductive apertures and spermathecal atria were developed, presumably the worm was fairly near to sexual maturity though the size was small, only 50×1.4 mm. Michaelsen referred worms from the Andamans to his Sumatran species "notwithstanding certain differences" One of these differences that at first appears to rather unimportant is that of size. The worms from the Andamans and India do not have definite male porophores until they are much larger than the Sumatran specimen. Other differences between the Sumatran and Andaman forms will probably, as in the case of body size, be accentuated by completion of sexual maturity. Further, there is no definite evidence in the original description of *D. burchardi* to indicate that the Sumatran worm is conspecific with the forms from other areas that have been referred to *D. burchardi* or *D. nepalensis*.

All specimens of *D. nepalensis* and *D. burchardi* from India, Burma and the Andaman Islands, so far as can be determined in view of the immaturity and preservation, belong to one and the same species. This species, in the absence of definite evidence of identity with the Sumatran form must bear the name *nepalensis*.

The two specimens of *D. papillifer* are quite obviously referable to *D. nepalensis* as at present defined (*vide* Gates, 1933).

One of the specimens of *D. hodgarti*, an anterior fragment, lacks reproductive apertures and is probably not specifically identifiable. The other three specimens are also juvenile but further developed than the fragment.

Greatest length, 128 mm. Diameter, 5 mm. The setae begin on ii and are closely paired, *aa* and *bc* about equal.

The spermathecal pores are minute but open, transversely slit-like apertures, apparently on the posterior margin of vii slightly median

to *c*. The male apertures are minute, open slits in *bc* but much nearer to *b* than to *c*. On one specimen the male pores are quite definitely in 10/11. On the other two specimens each male pore is on a slight, rather indefinite protuberance that involves the anterior margin of *xi* and the posterior margin of *x*, intersegmental furrow 10/11 only faintly indicated on the protuberance or lacking, in the latter case the male pore in line with 10/11. The female pores are minute, on the anterior-most margin of *xii*, in *b*. The nephridiopores of *vii* and *viii* are slightly more dorsal to *d* than on the neighbouring segments.

Septa 5/6-8/9 are thickly muscular. The last pair of hearts is in *ix*. There are two pairs of commissures in *viii*. There are paired, whitish, enterosegmental organs in each of several segments just behind the gizzard region.

Determination of the segmental locations of the gizzards has been difficult. In a previously opened specimen there are three gizzards in *xv*, *xvi*, and *xvii* and then a break in the gut behind which there is a fourth gizzard much longer than any of the others and apparently in *xx*. In another specimen the gut just behind *xi* is rotten and some of the septa are in bad condition but the septa of the gizzard segments appear to be well preserved with the gizzards apparently in *xx*, *xxi*, *xxii* and *xxiii*. In a third specimen there was, when the worm was first opened, no septum visible at the parietes in the region of intersegmental furrow 18/19. After the specimen had dried slightly it was possible to separate what had appeared at first to be septum 19/20 into two distinct sheets, one of which could be peeled off from the parietes anteriorly to 18/19. In peeling off this septum from the gut the posterior-most gizzard is left in *xix* with no gizzard in *xviii*; other gizzards are in *xv*, *xvi*, and *xvii*.

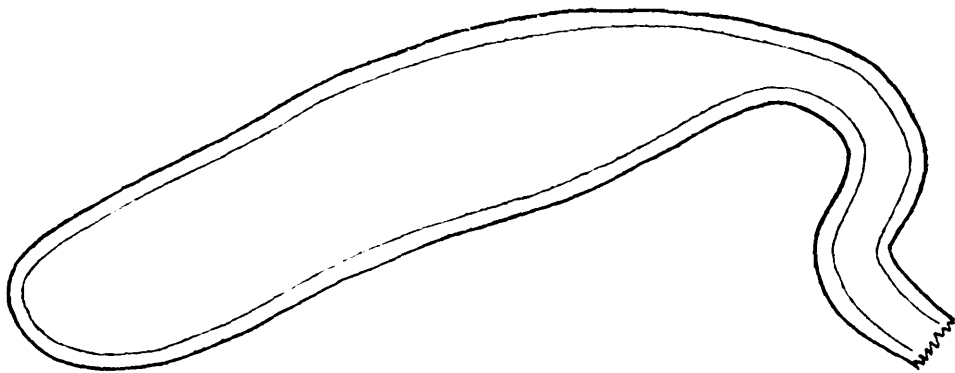


FIG. 3.—*Drawida nepalensis*? Spermathecal atrium of a specimen of *D. hodgarti* Stephenson 1925, non 1917. $\times ca.$ 26.

The testis sacs are small. The vas deferens is very long, coiled into a mass of loops that is larger than the testis sac. The prostate is elongate, slender, variously twisted; surface, smooth. The vas passes into the extreme ental end of the prostate.

The ovarian chamber was opened by the mid-dorsal incision in each specimen but is probably closed off from the parietes, at least dorsally; mesially the chamber is closed off from the gut. The ovarian chambers are not distended as in sexual animals and the ovisacs are rudimentary. The spermathecal ampullae are also rudimentary.

The atria are long, in fact so long that an atrium is either folded back on itself or else passes dorsally over the gut and dorsal blood vessel into the other side of the body.

These specimens of *D. hodgarti* are quite obviously specifically distinct from the types of *D. hodgarti*. In view of the juvenile condition of the specimens it is possible at present to indicate nothing more than their resemblances to *D. nepalensis*, as remarked above.

Drawida papillifer Stephenson.

1917. *Drawida papillifer*, Stephenson, *Rec. Ind. Mus.* XIII, p. 370.

1923. *Drawida papillifer*, Stephenson, *Oligochaeta, F. B. I. Series*, p. 148.

1922. *Drawida rosea*, Stephenson, *Rec. Ind. Mus.* XXIV, p. 430.

1923. *Drawida rosea*, Stephenson, *Oligochaeta, F. B. I. Series*, p. 155.

1933. *Drawida ancisa*, Gates, *Rec. Ind. Mus.* XXXV, p. 421.

Material examined.—One specimen labelled, "W 83/1. *Drawida papillifer* sp. nov. Rangamati, Chittagong Hill Tracts, Bengal. 11-vii-15. R. Hodgart" and one specimen labelled, "W 681/1. *Drawida rosea* sp. n. Khasi Hills. Sta. 5. S. L. Hora. Under stones and in muddy pools around Dak Bungalow, Cherrapunji, Assam. 28-x-21" and cotypes of *D. ancisa* from Burma.

A.

The holotype of *D. papillifer*. The male apertures are minute, open, diagonally placed, slit-like pores on the posterior margin of x, each pore just lateral to *b*. (The statement as to the position of the male pores in the original account is inaccurate.) The female apertures are transverse slits, on the anteriormost margin of xii, in *b*. The spermathecal pores are minute, open slits in 7/8 slightly median to *c* and are of about the same size as the male pores. The nephridiopores are about in *d* except on viii where they are displaced slightly dorsal to *d*.

Genital markings. (*a*) Two pairs of greyish, translucent, half-moon shaped areas, one pair on vii, one pair on viii, the markings so placed that the straight base of the half-moon is at intersegmental furrow 7/8 with the spermathecal pore near to the median margin of the marking. (*b*) Transversely oval to almost circular, greyish, translucent, small areas located as follows: one presetal marking on xi in *bc* on the right side, near to 10/11; one pair of presetal markings on x in *bc*, the centre of the right marking slightly lateral to the centre of the marking on xi; one pair of postsetal markings on vii, each marking lateral or dorsal to *d*.

The prostate is club-shaped, gradually narrowing towards the parietes, with the surface granular. The vas deferens is short but is twisted into a small mass of loops and passes into the prostate slightly below the ental end. The spermathecal ampulla is fairly large and filled with whitish material. The atria are fairly large, each atrium with a thin-walled, saccular, ental portion and a much narrower, duct portion. The spermathecal duct is slightly widened as it passes into the atrium. The ovisacs are well developed.

B.

The holotype of *D. rosea*. Each male pore is a minute, open aperture on a short, transversely placed ridge that extends on the posterior

margin of *x* from *a* into *bc*, the male pore very close to *b*. The ridge is especially protuberant about the male pore as a sort of annular lip. The female pores are minute, on the anteriormost margin of *xii*, in *b*. The spermathecal pores are minute (not conspicuous as previously stated) in $7/8$ just median to *c*.

Genital markings. (*a*) Four half-moon shaped areas on *vii* and *viii* as on the holotype of *D. papillifer*, the presetal areas on *viii* smaller than the postsetal areas on *vii*. (*b*) One pair of presetal, transversely oval, very small areas on *xi*; the markings nearer to $10/11$ than to the setae, extending from slightly median to *b* to slightly lateral to the male pore lines.

The nephridiopores of *iii-vii* are very slightly dorsal to *d*, while those of *viii* and *ix* are still further dorsal to *d*.

The epidermis of a midventral region between the male pores and between the markings of *xi* is thinned and on this thin region $10/11$ is not visible.

There are two pairs of vascular commissures in *viii*. The enterosegmental organs in *xviii-xxi* are yellowish and translucent.

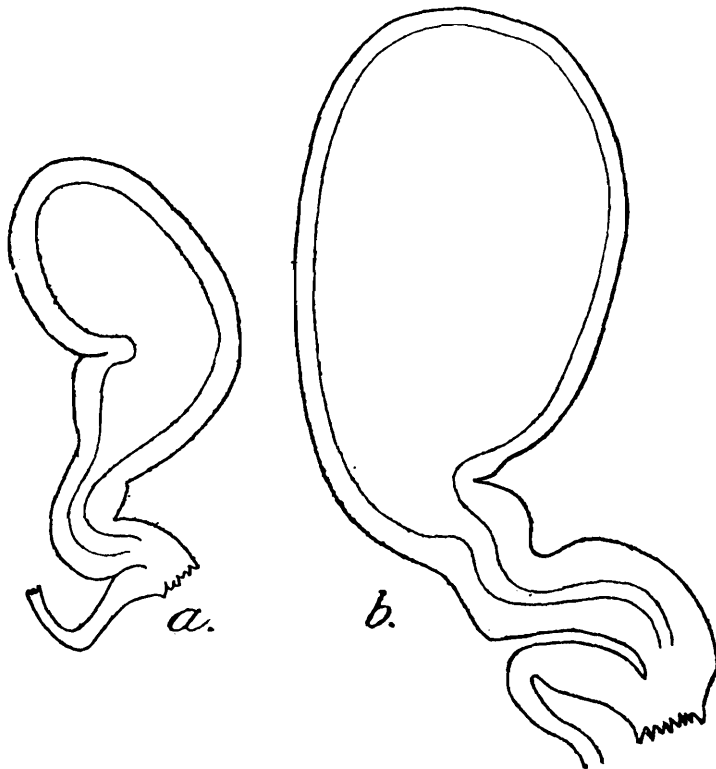


FIG. 4.—*Drawida papillifer*. *a*. Spermathecal atrium from holotype of *D. papillifer*. $\times ca. 26$. *b*. Spermathecal atrium from holotype of *D. rosea*. $\times ca. 46$.

The testis sacs are larger than in the holotype of *D. papillifer*. The vas deferens is short and is twisted into a few, loose coils. The prostates are club-shaped, gradually narrowing towards the parietes, the surface granular, but each prostate is slightly flattened and bent into a u-shape. The vas deferens passes into the prostate slightly below the ental end.

The spermathecal ampullae are large and filled with a whitish material. The atria are large, each with a thin-walled, saccular, ental portion and a much narrower, stalk-like, ectal portion. The spermathecal

duct is slightly thickened as it passes into the atrium. An ovarian chamber, which is closed off mesially from the gut, is present. In the ventral portion of the body 10/11 and 11/12 pass to the parietes independently of each other but dorsally there is only one septal attachment to the parietes, 10/11 doubtless in contact with or fused to 11/12 dorsally. The ovisacs are fairly well developed, each being provided with a posterior appendage or tail which is turned dorsally or ventrally.

Remarks.—The holotypes of *D. papillifer* and *D. rosea* are sexually mature. The differences between the two specimens are unimportant taxonomically, similar variations occur in an extensive series of cotypes of *D. ancisa*. The latter are quite obviously conspecific with the types of *D. papillifer* and *D. rosea*. The erection of *D. ancisa* was necessitated by errors in, and the incompleteness of, the accounts of the earlier species. The types of *D. affinis* and *D. hodgarti* are probably juvenile individuals of *D. papillifer*; the types of all three species are from the same locality; but the spermathecal atria of *D. affinis* and *D. hodgarti* are not sufficiently developed to justify a more definite statement.

***Drawida periodiosa*, sp. nov.**

Material examined.—Agarru, West Godavery District, Madras Presidency, April, K. John, 6 a clitellate and 4 clitellate specimens.

Description: External characteristics.—Greatest length, 57 mm. Maximum diameter, 2 mm. Colour dorsally, deep bluish; of clitellum, reddish.

The setae are closely paired, $ab=cd$; behind the clitellar region $aa < bc$. All setae of ii or ii and iii may be lacking or cd only of ii or ii-iii may be lacking.

The clitellum is annular, the clitellar colouration extending across x-xiii and onto the posterior portion of ix and the anterior portion of xiv.

The slit-shaped spermathecal pores are either in line b or very slightly lateral to b , in 7/8 or on vii or viii on one of the genital markings in the region of 7/8.

The male pores are probably about in line b or very slightly lateral to b , the approximate position of the male pore indicated by the lumen of the prostatic duct which is visible in the parietal tissues; the actual male pore and the epidermal tissue immediately around it was not observed.

The female pores are in 11/12, about in line b .

The male porophores are whitish, more or less conical protuberances. On some specimens these protuberances appear to belong to both x and xi while on others they appear to belong solely to segment xi. The porophores are in ab with the median margins slightly median to a and the lateral margins slightly lateral to b .

The genital markings of ix and x are presetal, transversely oval areas about in line with but slightly wider than the male porophores and located as follows: one pair on x, 5 specimens; 1 pair on ix, 3; 1 marking on the left side of x, 1; no markings on ix and x, 1 specimen.

On two specimens there are no further genital markings but on each of the other specimens there is an additional pair of smaller markings located as follows : one postsetal marking on vii on each side, 1 specimen ; one presetal marking on viii on each side, 2 ; one marking on each side, extending across 7/8, 1 ; one marking across 7/8 on the right side, one postsetal marking on vii on the left side, 2 ; one postsetal marking on vii, on the right side and one presetal marking on viii, on the left side, 2. The markings are about in *ab* (the lateral margin may reach slightly beyond *b*) but are not visible until the margins of the deep groove between segments vii and viii are separated. Each marking is demarcated by a slight but definite circumferential furrow and has at its centre, like each of the posterior markings, a circular pore. The shape of the marking varies from spherical to transversely oval or longitudinally oval.

The nephridiopores are about in line with *d* and are not displaced dorsal to *d* on vii, viii or ix.

Internal anatomy.—Septa 5/6-8/9 are thickened and muscular ; succeeding septa thin ; 9/10-10/11 dislocated posteriorly, 10/11 attached to the parietes only ventrally.

The gizzards are two, in xiv-xv (2) or xv-xvi (2) ; or three, in xiii-xv (2) or xiv-xvi (2).

The last pair of hearts is in ix.

The testis sacs are ovoidal or rather flattened bodies, extending apparently into ix and x though not constricted by 9/10. The anterior end of the testis sac is not however in ix but in a space between two lamellae of septum 9/10. These lamellae cannot be separated from each other lateral to the testis sac, but can be traced mesially to the oesophagus and ventrally to the parietes. The ental portion of the vas deferens is between these two lamellae, emerging ventrally into x where it passes posteriorly and into the anterior face of the prostate. The vas deferens is short, looped back and forth in a rather zigzag fashion, especially in x just anterior to the prostate, but not twisted into a mass of coils as in many of the Burmese species. The prostate is a short, cone-like body, erect in x just anterior to the ovarian chamber, with a softish surface of granular appearance. Removal of the granular layer discloses a firm, tubular, relatively quite small, central body just barely protruding through the parietes into the coelom. The vas deferens was broken off while removing the granular layer of the prostate, but as far as can be determined the vas passes into the ental end of the central body.

Segment xi is reduced to a horseshoe-shaped chamber. The ovi-sacs are fairly large, extending posteriorly into xvi, xvii or xviii. The spermathecal ampulla is spheroidal to ovoidal ; the duct which is rather thickish is bent to and fro in a sort of zigzag fashion on the posterior face of 7/8. The spermathecal atrium is a short, stumpy tube, about twice the thickness of the spermathecal duct. Usually the atrium is concealed within the parietes and the tissues of septum 7/8 but in one specimen it protrudes, on each side into vii. The spermathecal duct passes into the posterior face of the atrium.

Dorsal to each genital marking is an erect, thickly tubular gland with a bluntly rounded ental end ; the gland projecting conspicuously into the coelom. Each gland is provided with a finely granular investment. The granulations (glands ?) can easily be scraped off revealing an erect, firm, reddish, central body with a narrow lumen which opens to the exterior by the pore at the centre of the genital marking. In three specimens there is visible at the dorsal terminus of each gland in ix a fine thread which rises slightly in the coelom and then falls over onto the parietes in a series of very short rather zigzagged loops. Attempts to trace this thread further, either on or within the parietes failed completely. The glands in vii and (or) viii are usually of the same size, shape and appearance as those in ix but may be a trifle shorter. In one specimen the anteriormost glands are bent, not erect, but project through the parietes into the coelom.

Remarks.—On the whole the worms are in good condition and appear to have been well preserved. However all the specimens have been eroded, possibly due to friction during transportation. The erosion is especially marked on the anteriormost and posteriormost segments and on the projecting male porophores.

The location of the spermathecal pore has been confirmed by tracing the atrium through the parietes. The pore at the ectal end of the atrium is always slit-shaped. This characteristic shape will serve to distinguish the spermathecal pore from a gland pore even when the two pores are on the same genital marking. On one specimen each spermathecal pore is at the centre of a tiny round genital marking that is clearly demarcated by a slight but definite circumferential furrow. This spermathecal pore marking is in contact with a genital marking. On other worms the spermathecal pore is either on the margin of a genital marking or on the intersegmental furrow a slight distance from the genital marking and with no indication of the delimitation of a special area about the pore.

The structures dorsal to the genital markings that project through the parietes into the coelom of segments vii to ix, which have been referred to in the preceding description merely as glands, are of peculiar interest as they are very similar in appearance and structure to prostates and in particular to those of a generalized *Desmogaster* type, as in *D. doriae*. In another Indian species, *D. scandens*, glands in ix, apparently similar to those of *D. periodiosa*, are "of the same size, shape and appearance" (Stephenson, 1921, p. 756) as the prostates in x. In fact, the glands of ix in *D. scandens* have been regarded as prostates and the external apertures as male pores. The interpretation of glands in segment ix as prostates leads to an assumption that the presence of the prostates is evidence for the former presence of an extra pair of testes. Referring to these extra prostates, Stephenson (1921, p. 748) writes, "Michaelson has previously 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.

The genus *Desmogaster* is actually holandric and is to be looked on as the most primitive existing member of the family." *D. scandens* with two pairs of equisized prostates is accordingly regarded "as the most primitive existing member of the genus at any rate in respect of its male reproductive apparatus" (p. 749).

D. periodiosa does not however fit into the phylogenetic scheme quite so nicely as does *D. scandens*. Thus, for instance, is the presence of "prostates" in segments vii, viii and ix to be accepted as evidence for the former existence of four or five pairs of testes in the ancestors of *Drawida*? If not, then why are exactly similar "prostates" in vii and viii not as good an evidence for the former presence of testes as "prostates" in ix? Again, the prostates in the coelom of segment ix may belong morphologically to ix (when associated with the genital markings of ix) or to x (when associated with the genital markings of x). In the latter case the glands are actually within the coelom of ix but only because septum 9/10 has been dislocated posteriorly behind its normal level. In such specimens there are two pairs of "prostates" belonging to x. Is the presence of two pairs of prostates belonging to segment x to be accepted as an index of the former presence of two pairs of testes?

While the supposed vestigial prostates are smaller than the true prostates in *D. willsi* and of about the same size in *D. scandens*, they are actually larger and better developed than the true, functional prostates in *D. periodiosa* and *D. limella*. Yet it is these large "prostates" of *D. periodiosa* which are most like a generalized, supposedly primitive and ancestral type of *Desmogaster* prostate.

In these circumstances it appears preferable to regard the structures in vii-ix merely as glands of a rather peculiar type, variable as to number and segmental location in *D. periodiosa*, but possibly more definitely restricted in certain segmental locations in *D. limella*, *D. scandens* and *D. willsi*.

D. periodiosa is close to *D. limella* and *D. scandens*. From the latter *D. periodiosa* is distinguished by the segmental location of the gland pores and by the presence of genital markings on vii and viii as well as by differences in the male porophores.

Drawida pomella, sp. nov.

1925. *Drawida papillifer* (part), Stephenson, *Rec. Ind. Mus.* XXVII, p. 51.

Material examined.—Twenty-one specimens from a tube labelled "W 1226/1. *Drawida papillifer* Steph. Amingaon, Assam".

The male pores are not in mid *bc* but are minute, open, diagonally placed slits on the anterior margin of xi slightly lateral to *b* toward the median margins of the male porophores. The spermathecal apertures are minute (not conspicuous), open slits in 7/8, slightly median to *c* (not in *b*). The female pores are minute, transverse slits on the anterior-most margin of xii, in *b*.

On segment xi there is visible on each side a protuberant area which may be short and transversely ridge-like or more extensive antero-posteriorly and nearly half-moon shaped. The protuberance extends from *b* nearly to *c* and anteroposteriorly from 10/11 nearly to the setae

of xi or only about half way to the setae of xi and is demarcated anteriorly by 10/11 but is otherwise without definite boundaries. On each of these areas there are usually small genital markings, as a rule lateral and posterior to the male pore but rarely just median to the male pore; the number of the markings is variable. Similar genital markings may be present on the posterior margin of x just in front of the male porophore and on the posterior margin of vii in a limited region anterior to each spermathecal pore. These markings are very small, transversely oval to circular, usually quite sharply delineated. Slightly larger markings, closely paired in *aa* may also be present on the posterior margin of x or the anterior margin of xi. Rarely there may be an odd marking or two on viii.

The vas deferens is short, twisted into a few loose loops. The prostate is elongately club-shaped with a short but thick, rounded ental knob and a fairly long narrow stalk. The prostates are variously bent; the surface smooth or very finely granular. The vas passes into the prostate towards the ectal end of the round terminal portion.

The ovarian chamber is closed off mesially from the gut and probably also from the parietes dorsally, as 10/11 and 11/12 pass independently to the parietes only in the ventral portion of the body. The ovisacs are small and vestigial. The spermathecal ampullae are small but within each ampulla is a little whitish material. The atria are elongate and flattened, narrowing gradually towards the parietes. Attempts to clear the atria were not very successful, at least no lumen was seen. The spermathecal duct passes through 7/8 and into the atrium dorsal to the body wall.

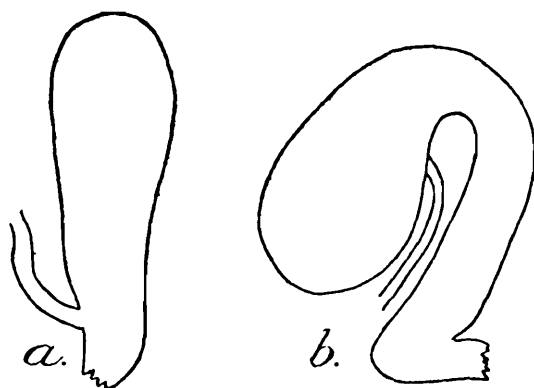


FIG. 5.—*Drawida pomella*. a. Spermathecal atrium. $\times ca.$ 20. b. Prostate. $\times ca.$ 20.

The gizzards are 3-4 in xiii-xviii : xiii-xv (1), xiii-xvi (1), xiv-xvi (2), xv-xvii (1), xvi-xviii (1).

There are paired enterosegmental organs on the dorsal face of the intestine in at least 2-4 segments just behind the gizzard region.

Very small, rounded glands protrude through the parietes into the coelom dorsal to the genital markings in one specimen.

Remarks.—The small size of the spermathecal ampullae, the indistinctness and fineness of the granular layer on the prostates, the empty or nearly empty ovarian chambers and the small ovisacs show that the worms are not fully sexual. Nevertheless *D. pomella* can be distinguished from *D. rangamatiana*—the only other Indian species with

male pores on xi—by the genital markings and the associated parietal glands. In these circumstances the erection of a new species seems to be justified even though the specimens are not sexual.

The two specimens of *D. nepalensis* in the tube with *D. pomella* are very readily distinguished from the latter by the larger setae of the anterior segments and the characteristic male porophores.

Drawida rangamatiana Stephenson.

Material examined.—One specimen labelled “W 82/1. *Drawida rangamatiana* sp. nov. Rangamati, Chittagong Hill Tracts, Bengal. 17th July 1915. R. Hodgart.”

The spermathecal apertures are minute, just median to *c*; each pore on the posteriormost margin and towards the median border of a genital marking on vii. The female pores are minute, transverse slits in 11/12, just lateral to *b*.

The male pores are minute, diagonally placed slits on slight, transverse protuberances of the anterior margin of xi. Each porophore is delimited posteriorly by a slight furrow that passes mesially and laterally into 10/11. The anterior boundary of the male porophore is a deep groove (much deeper than the furrow at the posterior margin of the porophore), which is regarded as intersegmental furrow 10/11 but slightly dislocated anteriorly by the marginal swelling of xi. The median margin of the porophore does not quite reach to *b* nor does the lateral margin reach to *c*, the male pore quite definitely nearer to *b* than to *c*. A portion of xi just behind each male porophore is also slightly swollen.

Genital markings.—On vii: a pair of postsetal, half-moon shaped areas, the straight bases of the markings about at 7/8 or possibly transgressing that furrow very slightly, the centres of the markings about in *c*. On ix: two patches of special glandularity, each patch extending anteroposteriorly the whole length of the segment in the lateral half of *bc*, the margins of the patches are not clearly demarcated. On x: one pair of postsetal markings, each marking just lateral to the male pore. On xii: a single, transversely oval, presetal area on the right side, the median margin about at *b*.

The last hearts are in ix (not viii as previously stated).

The prostates are elongate and spirally coiled as in *D. longatria* the surface finely granular. The vas deferens is fairly short, looped, back and forth into a fairly regular series which forms a dorso-ventral band on the posterior face of 9/10. The ectal portions of the vasa deferentia were broken across, presumably in the previous dissection. Attached to the ental end of one prostate is a filament that may be a portion of the vas.

The ovarian chamber and the ovisacs are not sexual. The spermathecal ampullae are small and do not appear to be fully developed. The atria are large, conspicuous structures, about 3 mm. in length, reaching to the dorsal blood vessel.

Remarks.—The holotype is not sexual. If the interpretation of the furrows and grooves associated with the male porophores that was

given above be correct, the segmental location of the male pores on xi will distinguish *D. rangamatiana* from other Indian species of *Drawida* (except *D. pomella*) even though the prostates, spermathecal atria and genital markings have not attained their definitive, specific characteristics.

***Drawida troglodytes* Stephenson.**

1924. *Drawida troglodytes*, Stephenson, *Rec. Ind. Mus.* XXVI, p. 129.

Material examined.—One specimen labelled "W 1150/1. *Drawida troglodytes*, sp. nov. Siju Cave, 2,000 feet from entrance. Feb. 1922."

The prostomium is probably prolobous and of the usual type but was damaged in the previous dissection.

The spermathecal pores are very small, transverse slits in 7/8, just median to *c*. The female pores are minute, transverse slits in 11/12, in or slightly lateral to *b*.

The male porophores are transversely oval, extending across 10/11, equally onto x and xi and lateromesially from *b* nearly to *c*. Intersegmental furrow 10/11 ends against the lateral and median margins of the porophores. The anterior and the posterior margins of the porophores are sharply marked off. The male pore is a minute, diagonally placed slit towards the median margin of the porophore and accordingly nearer to *b* than to *c*.

The vas deferens is coiled into a number of loose loops, the mass of loops nearly equal in size to that of the testis sac. One prostate is erect though this may not have been its original condition. The other prostate is bent over posteriorly to pass through the perioesophageal annulus between the ovarian chamber and the oesophagus into xii. The prostates are not spirally coiled.

The ovarian chamber and the ovisacs are sexual but the spermathecal ampullae are rather small, translucent and possibly not fully sexual. There is a pair of unusually large atria in vii. Each atrium is erect but is so long that it passes over to the opposite side of the body above the dorsal blood vessel. The atria are flattened, thin-walled sacs without definite demarcation of a duct but narrowing gradually towards the parietes. An atrium figured here (text fig. 6) had been severed by the



FIG. 6.—*Drawida troglodytes*. Spermathecal atrium. $\times ca. 11$.

previous dissection so that a small ectal portion is still visible in the coelom. The figure does not accordingly show the whole length of the organ. The ental end of this atrium is bent over on itself as a sort of flap; the ental end of the other atrium is invaginated.

Remarks.—According to the original description "there is no trace of an atrium" Possibly the large size is responsible for the atria being overlooked.

The holotype is probably nearly sexual, but if the small size and translucent appearance of the spermathecal ampullae are characteristic of the species the type may be fully sexual.

According to Stephenson the relationships of *D. troglodytes* are with *D. pellucida* but the large spermathecal atria quite definitely negative this suggestion.

Family MEGASCOLECIDAE.

Subfamily MEGASCOLECINAE.

Genus **Plutellus** E. Perr.

Plutellus sp. ?

Material examined.—Curjung village, Nepaul, K. N. Sharma, 3 acitellate specimens.

Length, to 50 mm. Diameter, to 4 mm. Male pores in *ab* on xviii. Spermathecal pores paired, in or nearly in line with *c*, in 7/8-8/9. Nephridiopores lateral to *b* (probably).

The intestine begins in xv. The male funnels and the female funnels are readily recognizable. The seminal vesicles are paired in ix and xii; the testes and ovaries large, free in x-xi and xiii. The prostates are tubular, the ducts nearly straight. The ectal tips of the penial setae are bent slightly towards one side and ornamented with rows of teeth. The spermathecae are rudimentary, just barely projecting into the coelom of segments viii-ix.

There is a rudimentary gizzard in v.

Remarks.—In the coelom there are numerous nematodes with strong, paired hooks.

Genus **Tonoscolex** Gates.

Tonoscolex oneilli (Stephenson).

1914. *Megascolides oneilli*, Stephenson, *Rec. Ind. Mus.* VIII, p. 377.

1916. *Megascolides oneilli*, Stephenson, *Rec. Ind. Mus.* XII, p. 314.

1923. *Notoscolex oneilli*, Stephenson, *Oligochaeta, F. B. I. Series*, p. 212.

Material examined.—One specimen labelled "ZEV. 5159/7. *Megascolides oneilli*; Steph. Janakmukh (Abor Exped.) Capt. J. S. O'Neill. Type."

None of the olive green colouration is now visible.

All of the grooves on the male genital shield are not of equal importance. Some represent merely creases in the epidermis. The seminal grooves are L-shaped; the longitudinally placed posterior limb of the L parallel to the midventral line; the transverse limb of the L passing midventrally but ending abruptly before reaching the midventral line. Immediately in front of the median end of each anterior limb of the groove there is a deep depression or invagination with a transverse slit-like aperture. The margin of the aperture of the invagination is tumescent and lobulated, one of the lobulations larger than the others and at the median end of the anterior limb of the seminal groove.

The prostate is folded.

Remarks.—The male pores were not identified. The pores were not visible externally and determination of their position would have involved tracing the prostatic duct through the parietes. The holotype is rather badly preserved and the male genital shield should be preserved in as good condition as possible.

T. oneilli is distinguished from the Burmese and other Indian species of the genus by the invaginations near the anterior ends of the seminal grooves.

Tonoscolex striatus (Stephenson).

1914. *Notoscolex striatus*, Stephenson, *Rec. Ind. Mus.* VIII, p. 380.

1923. *Notoscolex striatus*, Stephenson, *Oligochaeta, F. B. I. Series*, p. 218.

1914. *Notoscolex stewarti*, Stephenson, *Rec. Ind. Mus.* VIII, p. 382.

1923. *Notoscolex stewarti*, Stephenson, *Oligochaeta F. B. I. Series*, p. 216.

Material examined.—Two specimens labelled “ZEV. 5394-5/7. *Notoscolex stewarti* Steph. Rotung, alt. 1,300 feet (Abor Expedt.) Capt. F. H. Stewart. Types”; three immature specimens labelled “ZEV. 5385-6/7. *Notoscolex striatus*, sp. nov. Abor Exped. Rotung, alt. 1,300 feet. 21st December 1912. Under stones. S. W. Kemp;” one dissected, acitellate specimen labelled “ZEV. 5384/7. *Notoscolex striatus*, sp. nov. Abor Exped. Upper Rotung, alt. ca. 2,000 feet. 4th January 1912. Found in earth when road making”; and 1 dissected specimen labelled “ZEV. 5410/7 *Notoscolex striatus*, sp. nov. Upper Rotung. 5th January 1912.”

None of the specimens of *N. striatus* are fully clitellate; one of the specimens in the first tube of *striatus* as well as the specimen in the third tube have slight indications of the development of the clitellar glandularity.

The seminal grooves are usually as figured by Stephenson but on one specimen the grooves are straight, without the laterally directed terminations. The absence of these short terminations may be an individual variation, an abnormality or may represent a juvenile condition. The “tags” may be entirely lacking, rudimentary or well developed. The “tags” when present are developments of the anterior-most margins of xvii and xviii just lateral to the seminal grooves (the intersegmental furrows 16/17-17/18 visible ventrally clear to the seminal grooves). The “tags” are slightly more lateral to the seminal grooves on the types of *stewarti* than on *striatus*.

The types of *stewarti* have markedly protuberant clitella on which the intersegmental furrows are lacking.

The prostates are in xvii-xviii, the portion of the gland in xviii folded so that the lobulation is more apparent than real.

Remarks.—The differences between *stewarti* and *striatus* in size, presence or absence of calciferous glands in ix, size of prostates, the presence or absence of seminal vesicles in xii are of little significance especially in view of the immaturity of the specimens of *striatus*. Intra-specific variation in body size may be considerable within the genus *Tonoscolex*. The very striking similarity, almost identity, of structures on the male genital shield, the seminal grooves and tag-like processes, does furnish very definite evidence for the specific identity of the two forms.

Tonoscolex horai (Stephenson), *sp. inq.*1922. *Megascolex horai*, Stephenson, *Rec. Ind. Mus.* XXIV, p. 432.1923. *Megascolex horai*, Stephenson, *Oligochaeta, F. B. I. Series*, p. 247.*Material examined.*—One specimen labelled "W 703/1. *Megascolex horai* Steph. Cherrapunji, Assam. Dr. S. L. Hora."

The male pores are minute, on small papillae on xvii. There are no seminal grooves.

The prostates are small, each with two flattened lobes, the length of the prostatic duct which is bent into a single loop slightly greater than the length of each of the lobes. Prostates and ducts are confined to xvii.

The calciferous glands are three pairs in x-xii. The male funnels are paired in ix and x, but there is only a single pair of seminal vesicles in xi.

The spermathecae are in vi and vii. The duct is slightly coelomic but is shorter and stouter than the diverticulum. The latter is longer than the ampulla, slenderly tubular and passes into the median side of the duct.

Remarks.—The holotype of *T. horai* is acitellate. The species cannot be adequately characterized until mature specimens are available for examination, but even so the type is much more like specimens of *Tonoscolex* than *Megascolex*. Differences from Indian and Burmese species—slightly wider separation midventrally of the spermathecal pores, the absence of the seminal grooves—appear, on the whole to be relatively unimportant, especially in view of the immaturity of the type. Perichaetine setae are present in *T. ferinus* from Burma.

Genus **Pheretima** Kinberg.**Pheretima annandalei** Stephenson.1917. *Pheretima annandalei*, Stephenson, *Rec. Ind. Mus.* XIII, p. 386.*Material examined.*—The holotype in a tube labelled "W 8/1. *Pheretima annandalei* Stephenson, Casuarina woods at Singgora, Talé Sap, Siam. Dr. N. Annandale."

The setal numbers are: vi/28, vii/30, viii/40, xvii/15, xviii/12, xix/17.

The spermathecal pores (secondary) are fairly large, transverse slits in 5/6-8/9.

The apertures of the copulatory chambers are transversely slit-like with tumescent and finely lobulated margins.

The genital markings are very small, rounded tubercles located in the midventral region. On viii, a presetal row of three markings near the anterior margin and a postsetal row of three markings. In addition a single presetal marking between the anterior row and the setae. On xviii, one presetal marking and a postsetal row of 3 markings. On xix, two presetal rows of three markings each and two postsetal tubercles, one near the setae and one just in front of 19/20. Single markings on viii, xviii and xix are in line with one of the markings in the rows.

The intestinal caeca are simple.

The prostatic ducts are bound by connective tissue to the dorsal faces of the very conspicuous copulatory chambers. Within the copulatory chamber is an elongately tubular penis, slightly more than 2 mm. in length. The penis is slightly widened in the dorsalmost portion of the chamber.

The seminal vesicles are very large.

The spermathecae (text fig. 7) are similar to those of *P. gemella*.



FIG. 7.—*Pheretima annandalei*. Spermatheca. $\times ca. 11$.

Remarks.—The holotype is probably incomplete posteriorly.

P. annandalei can be distinguished, for the present, from *P. floweri* by the presence of the genital markings and from *P. gemella* by the absence of the pseudocopulatory chambers in xix or xix and xx.

***Pheretima bipora* (Beddard).**

1900. *Amyntas biporus*, Beddard, *Proc. Zool. Soc. London*, p. 908.

1932. *Pheretima bipora*, Stephenson, *Ann. Mag. Nat. Hist.* (Ser. 10) IX, p. 213.

Material examined.—From the British Museum; three specimens in a tube labelled "*Amyntas biporus*. 1904. 10th May 1915-16. Malay Peninsula. Coll. Beddard."

The genital markings are paired and postsetal on vii. The two markings nearer the midventral line are transversely oval and close to the setae. The smaller markings are circular or nearly circular, close to 7/8, one marking just median to each spermathecal pore in 7/8. The larger markings are probably about 7-8 intersetal intervals median to the spermathecal pores.

Remarks.—Stephenson looked at these specimens, noting that the jar contained "three hard, black and shrunken specimens, in which even the external characters are not distinguishable." The worms were soaked for 24 hours in water and after this treatment the external genital markings could be recognized. None of the specimens had been previously dissected. The soaking in water did not appear to be sufficient to enable much of the internal anatomy to be worked out, but four brief notes were jotted down which are transcribed herewith. The protuberant body in the pseudocopulatory chamber in xix is more like the penis in the copulatory chamber of xviii than in *P. gemella*. The spermathecal diverticulum appears to pass into the duct nearer to the parietes than in *P. gemella*. The last pair of hearts is probably in xiii. The testis sacs of x and xi are probably U-shaped, the seminal vesicles of xi within the sac of that segment (?).

Remarks.—*P. bipora* can be distinguished from *P. gemella*, for the present, by the paired, transversely oval genital markings and the limitation of the genital markings to a postsetal location on vii.

***Pheretima dunckeri* Michaelsen.**

1902. *Pheretima dunckeri*, Michaelsen, *Mitt. Mus. Hamburg*, XIX, p. 9.

Material examined.—From the Hamburg Museum, four clitellate and undissected specimens and some fragments in a tube labelled, "V 5876. *Pheretima Dunckeri* Michl. Duncker. Malayische Halbinsel."

External characteristics.—The first dorsal pore is 11/12 (3).

The spermathecal apertures (secondary) are transversely slit-like openings in 6/7-7/8 into deep invaginations. On the anterior wall of the invagination and sometimes visible from the exterior if the aperture gapes open or is held open there is a genital marking on which there is a minute pore. This pore may possibly be the minute, primary spermathecal pore.

The "grosse männliche Poren" (Michaelsen, 1902, p. 10) are the apertures of the copulatory chambers. The smaller male pores are located on penial bodies in the copulatory chambers. These bodies may be visible from the exterior when the aperture of the chamber is relaxed. The penial bodies are softened and wrinkled and probably somewhat macerated.

On vii there are about 19 spermathecal setae. Presumably the midventral setae on xviii have dropped out.

Internal Anatomy.—The intestinal caeca are simple. The single heart of ix is on the left side. The last pair of hearts is in xiii.

The testis sacs of x and xi are unpaired and U-shaped. The hearts of x are within the limbs of the sac which are in contact dorsally above the gut but apparently not fused mid-dorsally. The seminal vesicles and hearts of xi are included within the limbs of the sac of xi; the limbs of the sac not in contact above the gut and but loosely attached by connective tissue to the gut. The prostatic duct is rather slender, slightly sinuous and passes into the lateral face of the copulatory chamber close to the parietes. The copulatory chambers are large. The prostates extend through xix-xxiv.

The dorsal portion of a spermathecal invagination projects in a rounded fashion quite noticeably into the coelom. The diverticulum which passes into the posterior face of the duct is twisted into a closely compacted mass of loops from which projects slightly the ovoidal ental terminus.

Remarks.—Only one other quadrithecal species of *Pheretima* with spermathecal pores in 6/7-7/8 is known at present from the Asiatic mainland, *P. immerita* from Burma. The latter is distinguished from *P. dunckeri* by the presence of septa 8/9-9/10.

***Pheretima floweri* (Benham).**

1897. *Perichaeta floweri*, Benham, *Journ. Linn. Soc. London*, XXVI, p. 217.

1900. *Pheretima floweri*, Michaelsen, *Das Tierreich*, X, p. 267.

Material examined.—Three softened specimens in a tube labelled "*Perichaeta floweri*. 96. 9. 30. 9-11. Bukit Timah, Singapore. S. S. Flower."

The setal numbers are : vi/11, vii/14, viii/13, xviii/8. Setae are present ventrally on xvi.

The clitellar colouration does not extend either to 13/14 or to 16/17

The female pore is single.

The apertures of the copulatory chambers are transversely slit-like with the margins in apposition.

The spermathecal apertures are tiny, transverse slits ; four pairs, in 5/6-8/9.

There are no genital markings. The "flat, rounded papillae" mentioned by Benham are doubtless the copulatory chambers which are visible through the transparent epidermis as white, circular patches.

According to Benham, "one of the 'penial ducts' is partially protruded" from the aperture of the copulatory chamber. The penes are not actually visible externally but a flattened tag-like process protrudes slightly from one of the copulatory chamber apertures. Doubtless it is this tag-like process which was referred to as a "penial duct."

Septum 8/9 is possibly present (?).

The intestinal caeca are simple, probably extending from xxvii into xxi. The last pair of hearts is in xiii (2).

Each seminal vesicle is provided with a finger-like to conical, primary ampulla (2). There are paired pseudovesicles in xiii and xiv (2). The prostates extend through xvii-xviii or xvi-xviii. The prostatic ducts are short but stoutish and nearly straight. The copulatory chambers are fairly large. Within the copulatory chamber is an elongately tubular penis, the dorsalmost portion slightly thicker than the ventral terminus.

The spermathecal diverticulum comprises a slenderly tubular stalk and an ovoidal, definitely demarcated, seminal chamber.

Remarks.—One of the specimens is very badly softened and was completely disregarded. The account above is based mainly, and so far as the external characteristics are concerned entirely, on an undissected specimen. Some of the internal structures in both specimens are now rather shapeless.

***Pheretima hawayana* (Rosa) 1891.**

"Banks of stream north of Mowkhar," Shillong, Dec. 4, 1930. H. S. Rao, 2 clitellate specimens.

Material examined.—Kali Jhora, Kafibari and Singla Tea Gardens, Kurseong, 4,000 feet, Sta. 20, March 6, 1926, M. Sharif, 6 clitellate specimens.

***Pheretimā houletti* (E. Perr.) 1872.**

1916. *Pheretima trivandranā*, Stephenson, *Rec. Ind. Mus.* XII, p. 335.

1923. *Pheretima trivandranā*, Stephenson, *Oligogochaeta, F. B. I. Series*, p. 314.

1898. † *Perichaeta travancorensis*, Fedarb, *Journ. Bombay Nat. Hist. Soc.* XI, p. 435.

Material examined.—One specimen labelled "ZEV. 7233/1. *Pheretima trivandranā* Stephenson. Trivandrum Museum, Trivandrum, Travancore. Type." From the British Museum: two dissected specimens labelled "*Pheretima crescentica* ? 1904. 10. S. 18-26. Dehra Dun. Coll. Beddard" and one specimen labelled "*Megascolex (Pheretima) houletti* E. Perr. 1924. 6. 21. 6. Salem and Bangalore."

The holotype of *P. trivandranā* is acitellate but is quite obviously referable to *P. houletti*; the spermathecae, copulatory chambers and

penial bodies are quite characteristic. One spermatheca has an extra diverticulum.

The specimens from the British Museum are quite clearly referable to *P. houletti*.

Fedarb's *P. travancorensis* is something of a puzzle. The type is, apparently, no longer in existence. The original account which has never been emended is inadequate. Except for the spermathecae the worm could quite easily be placed in *P. houletti*. Possibly Fedarb mistook the stalked glands associated with the spermathecae for the spermathecal diverticula.

***Pheretima mekongiana* (Cogn.).**

1922. *Megascolex (Promegascolex) mekongianus*, Cognetti di Martiis, *Boll. Mus. Zool. Torino*, XXXVII, No. 744, p. 3.

Material examined.—From the British Museum: the holotype in a tube with the following label "*Megascolex (Promegascolex) mekongianus*. 1921. 7. 30. 4. (Type). R. Mekong (Ban Leum) Annam. Pres. Dr. Malcolm Smith."

The single, female pore is on xiii.

The male pores are short, transverse slits, on xvii; each male pore towards the lateral margin of a fairly large disc that is apparently retractile into the parietes. Just lateral to each male-pore disc there is a rather crescentic but deeply bowed groove, the concave side of the groove facing midventrally.

The spermathecal pores are transverse slits; four pairs, in 4/5-7/8. The intestinal caeca are simple.

In the pharyngeal region there are acinous masses of "blood glands."

Remarks.—The holotype is immature, the clitellar glandularity only slightly indicated. The internal organs of the anterior end are rather messed about as a result of the previous dissection.

The worm is obviously a *Pheretima* as indicated by the testis sacs, the intestinal caeca and the blood glands, but whether the holotype is to be regarded as an abnormal specimen or the species as characterized by an anterior homeosis is not obvious. The male and female pores, the origin of the intestine and the intestinal caeca, and the gizzard are all one segment anterior to the usual locations in the genus. It might almost be expected, in these circumstances that the testis sacs and the seminal vesicles would also be one segment anterior to their usual location. According to Cognetti di Martiis, however, the seminal vesicles are in xi and xii while the testis sacs are in x and xi, *i.e.*, in the segments in which they would normally be found. If these locations are correct the last pair of testes are just one segment anterior to the ovaries while the last pair of seminal vesicles are actually in the ovarian segment. These are characteristics so very unusual that they might almost be regarded as evidences of abnormality.

***Pheretima mirabilis* (Bourne).**

1887. *Perichaeta mirabilis*, Bourne, *Proc. Zool. Soc. London*, 1886, p. 668.

1900. *Pheretima mirabilis*, Michaelsen, *Das Tierreich*, X, p. 284.

1891. *Perichaeta heterochaeta*, Michaelsen, *Abh. Ver. Hamburg*, XI, part 2, p. 6.

1923. *Pheretima heterochaeta* (part), Stephenson, *Oligochaeta in F. B. I. Ser.*, p. 302.

With reference to *P. heterochaeta* Stephenson 1923, "The extra-Indian distribution of *P. heterochaeta* on p. 304 of my F. B. I. volume is all wrong, since it includes the localities of *P. indica* as given in Michaelsen's 'Tierreich' volume—I was under the impression, when I compiled the list, that *P. indica* was a synonym of *P. heterochaeta*" (from a letter of J. Stephenson, dated Aug. 12th 1930).

1926-32. *Pheretima heterochaeta* Gates, *Rec. Ind. Mus.* XXVIII, p. 156 ; XXXII, p. 310 ; XXXIII, p. 387 and p. 487 ; XXXIV, p. 524 ; XXXV p. 529.

1900. *Pheretima indica* (part) Michaelsen, *Das Tierreich*, X, p. 275.

Material examined.—"From among potato plantation fields and cowdung manure on the gorge below Dumpep Dak Bungalow," Cherrapunji, Nov. 19, 1926, S. L. Hora, 109 clitellate and 7 a clitellate specimens.

"Banks of the stream north of Mokhar," Shillong, Dec. 4, 1930, H. S. Rao, 12 clitellate specimens.

Myntaung Valley, Nartiang, Jaintia Hills, Assam, Nov. 28-29, 1930, H. S. Rao, 2 clitellate specimens.

Bababudan Hills, Mysore State, Dec. 1928, Dr. H. S. Rao, 2 clitellate specimens.

"Ravines and tea gardens between Clarendon Hotel and Forest Office," Kurseong, Darjiling District, Sta. 22, March 8, 1926, M. Sharif, 16 clitellate specimens.

Kalimpong, May 23, 1930, 53 clitellate specimens.

Tista Bridge, June 2, 1930, 7 clitellate specimens.

"Round about the forest office near Victoria School," Kurseong, Darjiling District, Sta. 21, March 7, 1926, M. Sharif, 7 a clitellate specimens.

"Under stones along sides of Evelyn Ride and the Golf Course," Shillong, Dec. 7-8, 1930, H. S. Rao, 5 clitellate specimens.

Happy Valley, near Shillong, Nov. 16, 1930, H. S. Rao, 5 clitellate specimens.

Eagles Crag near the Railway Station, Kurseong, Darjiling Dist., Sta. 24, March 10, 1926, M. Sharif, 3 clitellate specimens.

Shillong-Cherrapunji Road, near Shillong, Dec. 6, 1930, H. S. Rao, 3 clitellate specimens.

Kali Jhora, Kafibari and Singla Tea Gardens, Kurseong, 4,000 feet, Sta. 20, March 6, 1926. M. Sharif, 3 clitellate specimens.

Postclitellar genital markings are lacking except for one or two, tiny markings located either on the male pore area or in contact with the male pore area and within the concentric furrows surrounding the male pore area. Preclitellar genital markings are usually present and may be either presetal or postsetal. The presetal markings are 2-3 intersetal intervals median to the spermathecal pores, while the postsetal markings are usually located just in front of the spermathecal pores. The postsetal markings are smaller than the presetal markings. On a series of 44 individuals selected at random the markings are located as shown below.

Genital markings.	Specimens.
Presetal, on vi-ix	1
Presetal, on vii-viii	7
Presetal, on vii-ix	15
Presetal, on viii	3
Presetal, on viii-ix	2
Presetal, on vii-ix ; postsetal, on vi-viii	4
Presetal, on vii-viii ; postsetal, on vi-viii	7
Presetal, on viii ; postsetal, on vii-viii	1
Presetal, on vii-viii ; postsetal, on vii-viii	1
Lacking	3

There are fairly large, paired lymph glands in the postclitellar segments and blood glands in v and vi. There are masses of nephridia in v and vi.

The single heart of ix is on the left side in 13 specimens, on the right side in 3 specimens. Hearts of x are lacking in 15 specimens. In one worm a heart belonging to segment x is present on the side opposite to that of the commissure of ix. This aberrant vessel cannot be confused with a posteriorly dislocated heart of ix as it arises from the supraoesophageal trunk and passes into the testis sac of x ventrally.

The intestine begins with 15/16 (16). The intestinal caeca are simple and in each of the worms are without marginal constrictions of any sort.

One worm has a pair of prostates, 4 worms have each a single, rather small prostate, 11 worms have no prostates. Prostatic ducts are present though the glands are absent, the duct always c or u-shaped.

The testis sac of xi is unpaired and median in each specimen (16). In one worm no funnel is present in the sac of xi on the left side, but on the posterior face of 11/12 projecting freely into xii is a funnel, presumably the missing funnel of xi.

The testicular material of segment x may be in two distinct ovoidal masses on the anterior face of septum 10/11, the masses rather diagonal in position—the dorsal ends more median than the ventral, or the ovoidal masses may not be discrete but connected transversely by testicular material in shape varying from slenderly cord-like to thickly band-like, or the masses themselves may appear to be directly in contact by their dorsal ends, with little if any appearance of a transverse bridge or band in between (fused). The connection or fusion of the testicular masses produces an appearance which has been referred to in phrases such as “testis sacs of x paired but with transverse connection” The variation in the appearance can be interpreted however as the result of varying degrees of contraction of a single, unpaired, testis sac; the greater the contraction the more the resemblance to a paired condition. Weaker contraction on the other hand results in less indication of pairedness. In these circumstances it seems to be preferable to refer to the testis sac as unpaired rather than paired, especially when the latter term must be qualified by some statement as to transverse connection. Furthermore in each of the specimens with two, discrete, ovoidal masses of testicular material it is possible to demonstrate a connection (passage) between the two lateral portions of the sac in which the testicular material has been concentrated, even though there is no testicular material in the passage. In these particular worms it would appear that the semi-fluid contents of the single sac have been thrown into the lateral portions of the sac by strong contraction and there coagulated into ovoidal masses by the process of preservation.

The demonstration in each of these specimens of *P. heterochaeta* that the two discrete masses of testicular material are really in lateral portions of an unpaired testis sac has been possible owing to the fact that in each of the worms the membranes concerned, though thin, are strong enough to permit manipulation with the dissecting instruments. Often one must deal with worms in which the membranes are so fragile or

so poorly preserved that they rupture when manipulated before the condition of the sac can be determined.

Septum 10/11 is held posteriorly in such a way that the testis sac on its anterior face appears, in a mid-dorsal dissection, to be on the ventral parietes with a deeply incised or bilobed anterior margin. But if the tissue which holds 10/11 backwards be cut and the septum held erect, the location of the sac on the anterior face of the septum with the ventral lobes of the sac not quite reaching the ventral parietes becomes immediately obvious.

The length of the spermathecal duct absolutely and relative to the length of the ampulla varies, but is, almost always if not always, fairly slender. The length of the diverticular stalk relative to the length of the spermathecal duct varies but in each of the specimens the stalk is longer than the seminal chamber. The latter is clearly and sharply delimited from the stalk, and is not as in *P. hawayana* merely a rather indefinite and rather slight, short widening of the ental end of the stalk.

The South Indian specimens collected in Mysore not far from the type locality of *P. mirabilis* are characterized by the presence of four pairs of tiny postsetal genital markings on v-viii and two pairs of larger presetal markings on vii-viii. Each postsetal marking is close to the posterior margin of the segment, just in front of or a tiny trifle median to the spermathecal pore. The number, segmental location, and intra-segmental position of these markings is exactly as in Bourne's *P. mirabilis*. There can be very little if any doubt that these Mysore worms actually belong to Bourne's species. *P. mirabilis* as it can now be defined is not distinguished from *P. heterochaeta* Mich. by any characters of specific or subspecific importance. Michaelsen's name accordingly falls into the synonymy of *P. mirabilis*.

An examination of a number of specimens from Northern India which had been identified as *P. heterochaeta* disclosed several with four pairs of postsetal markings. Not all of these markings are however easily recognizable. In most of the worms the markings on v-vi or vii are not visible at all until after the cuticle is peeled off. On other worms no postsetal markings can be found on v-vi or vii even after removal of the cuticle, yet at the approximate site of each marking there is a tiny pit or pore. On opening these worms stalked glands are visible the ducts of which pass through the parietes to the pits or pores just mentioned.

On the other hand, in a number of worms on which postsetal markings are readily visible without removal of the cuticle the stalked glands are smaller and much more difficult to find or lacking (?). The glands (also glands of presetal markings) may be entirely within the longitudinal musculature or on the parietes but covered over by connective tissue or slightly protuberant into the coelom. The glands of the postsetal markings are quite anterior to the markings, the rather long stalk or duct passing posteriorly within the parietes. In worms with four pairs of postsetal genital markings the number of presetal markings varies from 0-3 pairs.

In the table on page 261 only those markings which can be definitely identified without removal of the cuticle are noted ; no reference to pits or pores that may be recognizable is included.

***Pheretima robusta* (E. Perr.).**

1872. *Perichaeta robusta*, E. Perrier, *Nouv. Arch. Mus. Paris*, VIII, p. 112.

1900. *Pheretima robusta*, Michaelsen, *Das Tierreich*, X, p. 299.

1925. ?*Pheretima himalayana*, Stephenson, *Proc. Zool. Soc., London*, p. 893.

Material examined.—From the British Museum: one fairly well preserved, dissected but acitellate specimen in a tube labelled, "*Pheretima mandhorensis*. 1904. 10. 5. 1401. West Indies. Coll. Beddard" and the holotype of *P. himalayana* in a tube labelled, "*Pheretima himalayana* Stephenson. Type. 1924. 10. 21. 27. Darjiling, 7,000 feet. Mount Everest Expedition 1924."

The male pores, on the specimen of *P. mandhorensis*, are minute, each pore on a small, transversely oval tubercle. Just median to each male pore tubercle there is a similar, presetal tubercle. Near the midventral line, close to the setae and also on xviii there is a pair of presetal, genital markings. There are four pairs of presetal, preclitellar genital markings, on viii and ix; one marking immediately posterior to each spermathecal pore and another marking slightly median and slightly posterior to the spermathecal pore marking. Setae: viii/ca. 22, xviii/ca. 23.

The intestinal caeca are simple; the ventral margins lobulated. The last pair of hearts is in xiii. Each seminal vesicles is provided with a distinct primary ampulla. In xiii there is a pair of pseudovesicles.

The setae, on the holotype of *P. himalayana* are: viii/ca. 15, xviii/16. Each minute male pore is on a small, transversely oval tubercle. A single, presetal tubercle is visible on ix, the tubercle just median to the probable location of the spermathecal pore.

The intestinal caeca are simple.

Remarks.—The holotype of *P. himalayana* is probably not fully mature, the clitellar glandularity is only slightly indicated and the setae are visible on all three of the clitellar segments.

The specimen is very similar to some more or less abnormal specimens of *P. robusta* from Szechuan and also to *P. ornata* from the northern portion of the Shan Plateau in Burma.

Pheretima virgo* (Beddard), *sp. inq.

1900. *Amyntas virgo*, Beddard, *Proc. Zool. Soc. London*, p. 895.

1932. *Pheretima virgo*, Stephenson, *Ann. Mag. Nat. Hist.* (Ser. 10) IX, p. 236.

Material examined.—From the British Museum; two specimens in a tube labelled, "*Amyntas virgo* (types) 1924. 3. 1. 211. 13. Malay Peninsula. Cambridge (E.)" and one specimen in a tube labelled, "*Amyntas virgo*. 1904, 10. 5. 197. Malay Peninsula. Coll. Beddard."

The spermathecal setae on vii and viii are about 24 or 25. The spermathecal apertures are transversely slit-like. The apertures of the copulatory chambers are also transversely slit-like.

Each seminal vesicle is provided with a primary ampulla which is sunk into the dorsal margin of the ventral lamina. In xiii there are paired pseudovesicles. In each copulatory chamber that was opened there are three genital markings, one of which is much larger than the others. Owing to the softened condition of the structures the male pores were not definitely identified. The spermathecal diverticulum passes into the lateral side of the duct within the parietes.

In the nerve cord of one of the specimens there are cysts. On the coelomic face of the parietes of another specimen there are numerous, tiny, whitish cysts.

Remarks.—All specimens hitherto referred to this species, *P. virgo*, are doubtless abnormal, at least so far as the spermathecae are concerned. The spermathecal abnormalities are quite possibly the result of a heavy parasitic infestation. The parasites may also have influenced other characteristics of taxonomic importance in these specimens. As the "normal" characteristics of the species to which the worms belong cannot be determined, the status of the species remains dubious, though the relationships appear to be with *P. mamillana* from Burma.

Genus *Perionyx* E. Perr.

Perionyx macintoshii Beddard.

1892. *Perionyx macintoshii*, Beddard, *Proc. Zool. Soc., London*, p. 687.

1895. *Perionyx macintoshii*, Beddard, *Monog.* p. 438.

1900. *Perionyx m'intoshi*, Michaelsen, *Das Tierreich*, X, p. 208.

1917. *Perionyx m'intoshi*, Stephenson, *Rec. Ind. Mus.* XIII, p. 383.

1931. *Perionyx m'intoshi*, Stephenson, *Rec. Ind. Mus.* XXXIII, p. 184.

1883. ?*Perionyx m'intoshii*, Beddard, *Ann. Mag. Nat. Hist.* (Ser. 5) XII, p. 217.

1924. *Perionyx m'intoshi*, Stephenson, *Rec. Ind. Mus.* XXVI, p. 341.

1916. *Lampito dubius*, Stephenson, *Rec. Ind. Mus.* XII, p. 315.

1923. *Megascolex dubius*, Stephenson, *Oligochaeta, F. B. I. Series*, p. 240.

Material examined.—Two specimens of *Perionyx m'intoshii* in tubes with following labels: "W 87/1. Nepal Valley, E. Himalayas. Lt.-Col. J. Manners-Smith. Alt. 4,500-6,500 feet" and "W 1129/1. Cantonment Hill, Cherrapunji, Assam, 4,300 feet. Dr. S. L. Hora" and the holotype of *Megascolex dubius*.

"In red to light brown soil with few rocks," roadside near Leesankhu village, Chowtara District, Nepal, July-August, Prof. K. N. Sharma, 4 clitellate or partially clitellate specimens.

Description: External characteristics (Chowtara specimens).—Length to 420 mm. Greatest diameter, to 13 mm. Dark blueish grey to blueish dorsally; lighter but also pigmented ventrally; clitellum, reddish.

The setae begin on segment ii; v/106, viii/10, ix/124, xii/117, xx/101.

The first dorsal pore is in 5/6.

The clitellum probably extends over xiii-xx but the epidermis of xii and xx or xxi-xxiii may be slightly modified and reddened; intersegmental furrows 12/13 and 18/19 or 20/21-22/23 are much deeper than on the region between.

The spermathecal pores are transverse slits close to the midventral line, two pairs in 7/8-8/9, each pore surrounded by a circumferential lip.

The single female pore is presetal on xiv.

The male pores are minute, transverse slits, 2-2½ mm. apart (9-10 intersetal intervals as measured on xix), within the depressed male shield, posterior to the setae of xviii and about in line with 18/19 which (as well as 17/18) is not visible on the male shield. The pores are quite some distance behind the setae of xviii as the setal line is bent forward in a crescentic fashion with the concavity posteriorly and the anterior-most point about in line with 17/18. The whitened genital shield (male area) extends across xviii and onto xvii and xix and is transversely

oval to longitudinally oval, sharply marked off except in the immediate vicinity of the setal line of xviii where the boundaries are very indistinct or lacking. The surface is cross hatched by numerous furrows producing a warty or minutely lobulated appearance.

Internal anatomy.—(Opened 2 specimens).

The gizzard is in vi, massive and firm. The gut begins to widen gradually in xix, reaching the full width in xx.

The last pair of hearts is in xiii (2).

The male funnels in x and xi are large, several times the size of the female funnels in xiii. Testes are present in both x and xi. The seminal vesicles of xi and xii are horse-shoe-shaped, on the posterior faces of 10/11 and 11/12 to which they are firmly attached; in the anterior portions of segments xi and xii. The prostates are probably confined to xviii but bulge 17/18 and (or) 18/19 anteriorly and posteriorly. The prostatic duct is almost straight, thickish, slightly widened ectally. The posteriormost portion of the vas deferens is nearly one half the thickness of the prostatic duct.

There are no vesicular structures in xiii.

The smooth, glistening spermathecal duct is definitely marked off from the ampulla and is about two thirds to three quarters the length and thickness of the ampulla. Towards the parietes the duct begins to narrow and within the parietes is much slenderer but still muscular so that it can easily be pulled out from the body wall. No trace of a diverticulum was found on any of the eight spermathecae.

No penial setae were found in the coelom as in *P. excavatus* and other species of the genus. However, in separating the muscle fibres a number of branched objects were found, embedded in the parietes just anterior to the male pores; so placed that the long axis is perpendicular to the ventral surface. These branched structures were broken in attempting to dissect them out. Under the microscope these bodies have an appearance very similar to if not exactly like that of setae (*vide* text fig. 8).

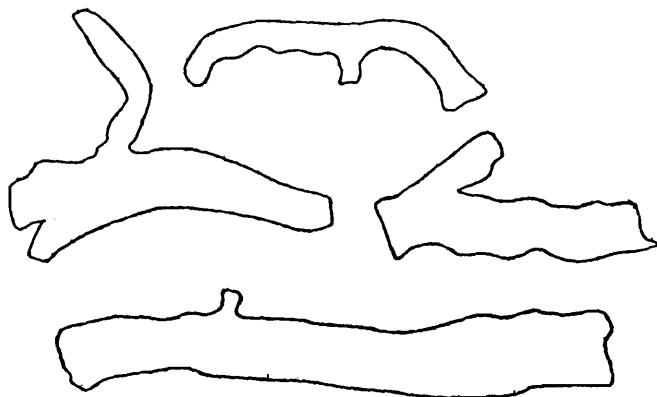


FIG. 8.—*Perionyx macintoshii*. Setal fragments from ventral body wall of xviii. $\times ca.$ 80.

For a discussion of the synonymy and status of *P. macintoshii*, see Stephenson 1931, p. 175 and p. 184.

Stephenson's 1917 specimens are probably abnormal; male pores on xix. The male shield is very similar to that on Prof. Sharma's specimens but is less extensive and appears to be incompletely developed.

With regard to the acitellate, Cherrapunji specimen Stephenson noted (1924, p. 341) that "The male area was much less marked" than on previous specimens. Presumably this is due to immaturity. The male field on the Cherrapunji specimen (of *P. macintoshii*) is almost exactly the same as that on the holotype of *M. dubius*. On both of these specimens the male field is a transverse depression on xviii posterior to the midventral setae which, at least in *M. dubius*, are dislocated anteriorly. The type of *M. dubius* is likewise acitellate. The differences between the male field of *M. dubius* and the male field of fully clitellate specimens of *P. macintoshii* can accordingly be interpreted as due merely to difference in age.

Referring again to the type of *M. dubius*. The setal numbers according to Stephenson's count (v/91, ix/88, xix/ca, 81) are nearer to those of Prof. Sharma's specimens of *P. macintoshii* than are the setal numbers of either of Stephenson's 1917 or 1924 specimens and are also somewhat nearer than are the setal numbers of Beddard's specimen (*vide* Stephenson 1931). Furthermore: the gut is slender, long and bent in xviii, the intestine commencing in xix; the last pair of hearts is in xiii; the seminal vesicles of xi and xii are horseshoe-shaped and attached to the posterior faces of 10/11 and 11/12; the prostates are confined to xviii—the ducts short, straight, muscularly thickened and glistening ectally; penial setae, lacking. So far as all these characteristics are concerned the worm is like *P. macintoshii*. In *M. dubius* according to Stephenson the gizzard is in v and vi. Actually it is the thickened septum 6/7 that passes mesially to the gizzard. Quite possibly this septum can be dissected off from the posterior portion of the gizzard though this was not attempted because of the importance of the specimen. If the septum can be dissected off the location of the gizzard in segment vi will be another point of agreement with *P. macintoshii*. The spermathecae of *M. dubius* are not visible internally according to Stephenson so that comparison with the spermathecae of *P. macintoshii* is not possible. However it is quite evident that there is a very remarkable similarity in many points of systematic importance between *P. macintoshii* and *M. dubius*.

The latter species was placed in the genus *Megascolex* because of the presence of "micronephridia." Bahl (*Q. J. M. S.* LXX, 1926) has shown however that the excretory tubules in the holotype of *M. dubius* are open, exonephric nephridia. In *Perionyx* the excretory organs (with the single rather dubious exception of *P. annulatus*) are open and exonephric but are large and there is only a single pair per segment. The differences in size and number of the nephridia do not appear to be as important as the similarities (*i.e.*, the possession of integumentary nephridiopores and preseptal funnels).

Perionyx sp. ?

Material examined.—Gurjung, Khare and Phoktoy villages, Nepal, August and September, Prof. K. N. Sharma, 15 acitellate specimens with spermathecal pores. (21 specimens without spermathecal pores possibly belong also to the same species.)

External characteristics.—Length, to 60 mm. Greatest diameter, to 5 mm. As a rule dorso-ventrally flattened, widest portion the middle

of the body. Anterior to xii or xi the worms are reddish, dark reddish, or blueish ; posterior to those segments, unpigmented, greyish.

The setae begin on segment ii. The setal numbers are shown below.

v.	vii.	viii.	ix.	xii.	xx.
37	21	20	45	41	44
40	18	18	47	51	45
46	25	26	49	51	47
39	19	20	49	48	46
	17	19			
	22	24			

(vii-viii spermathecal setae.)

The first dorsal pore is in 4/5 (8), 5/6 (3), in 5/6 but with a pore-like marking in 4/5 (3), in 7/8 (1).

Segments xii-xvii are whitened on some of the specimens but the clitellar glandularity is probably not fully developed on any of these.

The spermathecal pores are minute, widely separated, three pairs, in 6/7-8/9 ; the body wall in the immediate vicinity of the pores variously swollen.

The female pores are paired on xiv, presetal, about in line with or very slightly median to *a*.

The male pores were not positively identified but what appear to be vestiges of the male pores are about 5-6 intersetal intervals apart (as measured on xix).

The genital markings are transversely oval, whitened areas, paired on xviii, almost in contact at the midventral line and protuberant in a convex fashion. The setal circle of xviii may be continued in a straight line across these areas or the setae may be zigzagged in such a way as to produce an appearance of two rows.

Internal anatomy.—Septa are present from 5/6 posteriorly.

The rudimentary gizzard is anterior to 5/6. The intestine begins rather gradually in xvi. The gut in xv is narrow, unusually long for the length of the segment and consequently bent.

The last pair of hearts is in xii in each specimen.

The male funnels and testes are naked, in x and xi. The seminal vesicles of xi and xii are horse-shoe-shaped, attached firmly to the posterior faces of 10/11 and 11/12 and in the anterior portions of their segments. The prostates are confined to xviii. The prostatic duct is 2-4 mm. long, the ectal portion stronger than the ental portion and usually glistening.

The spermathecal duct is bulbous, almost spheroidal. The ampulla is rudimentary, shorter and slenderer than the duct.

Remarks.—The rudimentary appearance of the spermathecal ampullae seems to indicate that the worms are not fully developed. There are numerous protozoan cysts and nematodes in the coelom of the segments behind xviii. Possibly in *Perionyx*, as in *Pheretima*, a heavy infestation is able to affect or retard the development of some of the secondary reproductive organs.

Subfamily **Octochaetinae.**Genus **Octochaetoides** Michaelsen.**Octochaetoides birmanicus** Gates.

1926. *Octochaetus (Octochaetoides) birmanicus* Gates, *Ann. Mag. Nat. Hist.* (Ser. 9) XVI, p. 55.

Material examined.—"From the edge of a tank near Kinchana," near Amingaon, Kamrup Dist., Assam, April 5, 1924, S. L. Hora, 139 clitellate and 2 acitellate specimens.

External characteristics.—The length varies up to 110 mm., and the maximum diameter up to $4\frac{1}{2}$ mm. The brown colouration characteristic of the Burmese specimens is lacking but this may be due to solution of the pigment by the preservative.

The setae begin on segment ii; $ab < cd < bc < aa$ represents the setal ratios most frequently observed, cd and bc may however approximate to equality, though both remain smaller than aa .

The clitellum is annular, extending from 12/13 to 16/17 or onto xvii, occasionally reaching to 17/18. On xvii the clitellar glandularity is developed only dorsally and dorsolaterally. Intersegmental furrows and dorsal pores are lacking, except that the pore belonging to 16/17 is often functional even when the clitellar glandularity extends posterior to 16/17. All setae are present on the clitellar segments.

The first dorsal pore is in 12/13 in all cases noted (25).

The female pores are closely paired, in aa on small circular areas of especial whiteness, 125 specimens; a single, median, female pore at the centre of the whitened area, 16 specimens.

The minute spermathecal pores are on viii and ix; each pore in the transverse setal line and about in ab though setae a and b of viii and ix are displaced, a usually median and posterior to its normal location, b often anterior and lateral to its normal location. Each spermathecal pore is at the centre of a tiny, transversely oval to circular area which is removed when the spermathecal duct is pulled out of the parietes.

The genital shield (male area) is protuberant and convex, or protuberant but flat or with two definite, transverse depressions on the shield as previously figured (Gates, 1930, p. 326). The latter more nearly approximates the appearance in the living Burmese worms, the protuberant conditions doubtless the result of varying reactions at time of killing and preserving. The seminal grooves are as in the Burmese specimens. One worm has an unusually long seminal groove on the right side, the groove extending onto segment xx. (In this worm there are three prostates and three bundles of penial setae on the right side, the extra prostate is in segment xx.)

Genital markings are often lacking as in the Burmese forms but when present are posterior to the genital shield and usually unpaired. Each marking represents a slight thickening of the epidermis only (no glandular material extends through the parietes into coelom).

A marking is transversely oval or with more bluntly rounded or more finely pointed ends, with a greyish, translucent centre and an opaque, slightly more protuberant, cream-coloured rim. The markings are regarded as postsetal but intersegmental furrows are lacking or not clearly indicated on the midventral region so that in some cases the markings appear to extend posteriorly onto the next segment and

almost to the setae of that segment. Anteriorly seta *a* or both *a* and *b* may be incorporated in the margin of the marking. Laterally the markings extend to *a*, *b* or slightly lateral to *b*. The number varies. On 44 specimens the markings are as follows: Unpaired: on xx, xxi and xxii—18 specimens; on xx and xxi—13 specimens; on xx—7 specimens; on xxi—2 specimens. Paired: on xx—4 specimens.

Internal anatomy.—(Opened 25 specimens.)

Septum 4/5 is present, muscular, funnel-shaped, the mesial point of the funnel directed posteriorly. The next septum definitely present is 8/9, septa 5/6-7/8 lacking or represented only by very fragmentary rudiments.

The intestine begins in xvii (25). The typhlosole, for 10-12 segments extending from xxiv or xxv to xxxiv or xxxvi, projects conspicuously into the gut lumen, the ventral portion separated more or less deeply into two lamellae. Behind this region the typhlosole continues posteriorly as a much less prominent ridge with only a faint line on the ventral face to mark the two lamellae.

Each specimen has a pair of calciferous glands in 15/16 extending into both xv and xvi. The gland is so placed that a larger and more dorsal portion is in xv with a smaller more ventral portion in xvi or *vice versa*. The condition on one side of the gut is the reverse of that on the opposite side.

The last pair of hearts is in xiii (25). There are paired hearts in each of segments ix-xii (25). Anterior to 8/9 the commissures and the longitudinal trunks except the ventrolaterals are usually empty and difficult to trace. In specimens in which the anterior vessels are filled with blood the following conditions have been noted. Anterior to the gizzard the dorsal trunk gives off a pair of vessels which have been traced to the ventral parietes but not to the ventral trunk. Posterior to the gizzard the dorsal trunk gives off two pairs of commissures. The anterior commissures have been traced to the ventral parietes but not to the ventral trunk. The posterior commissures can, as a rule, be traced readily to the ventral trunk. Just median to each of these posterior commissures (hearts of viii) is a commissural vessel which passes from the supra-oesophageal trunk nearly to the ventral parietes and then anteriorly as the ventrolateral trunk of its side. The supra-oesophageal trunk ends abruptly just anterior to these commissures. In two worms a definite pair of vessels passing from the dorsal trunk to the posterior margin of gizzard anterior to the commissures of vii has been observed.

The testis sacs are cylindrical formed by a thin, shortly cylindrical sheet of tissue passing from 9/10-10/11 or 10/11-11/12, testis sacs not opened by a careful mid-dorsal dissection. The hearts of x and xi are imbedded in the testicular material. The seminal vesicles are paired, in ix and xii (25). The vasa deferentia are conspicuously looped on the ventral parietes. In xvii the vasa pass lateral to the prostatic ducts, in xviii turning mesially and passing into the parietes about in line with the prostatic ducts. Deep within the parietes the vasa of a side unite.

In several specimens two setae, doubtless representing *a* and *b* of xviii have been found within the parietes on the median face of the

vasa. These setae are 0.31-0.36 mm. in length, ornamented with short, transverse rows or ridges of fine teeth, the bluntly rounded, ectal tip bent very slightly towards one side. These setae could not be found in the majority of the specimens but whether this is due to poor dissection or absence of the setae is not quite clear.

The penial setae are contained within connective tissue bands which are on the median faces of the prostatic ducts, the ental ends of the bands passing to the parietes dorsolaterally. Each seta has a bluntly rounded tip and is usually ornamented by longitudinal rows of 4, 5, 8 or more triangular teeth. Rarely a seta may be quite smooth (*i.e.*, without dental ornamentation). Occasionally only 1, 2 or 3 teeth can be recognized.

Just behind each spermathecal duct is a Y-shaped mass of connective tissue inverted so that the paired arms pass to the ventral parietes, one just lateral to and one just median to the spermathecal duct while the tail of the Y passes to the parietes dorsolaterally. In the paired arms of the Y are the copulatory setae. The ectal tip of a copulatory seta is sharply pointed and rather diamond or spear-head-shaped. The shape of the setae is such that when they are placed on a slide they rest thereon with the ornamented portions laterally. The ornamented portions are very refractive. After treatment with strong corrosives two longitudinal, closely placed rows of thorny or spinous projections can be readily seen, at either side of the shaft. Occasionally slight traces of transverse membranes between pairs of spines can be seen. If these membranes are actually parts of the setae the ornamentation at the sides can probably be described as a longitudinal row of pouch or stirrup-like pockets, the apertures of which face towards the ectal tip of the shaft.

Both pairs of spermathecae are anterior to 8/9 (25). The spermathecal duct is elongate and barrel-shaped, narrowed just below the ampulla and just before passing into the parietes. The roughly spheroidal diverticulum passes by a short and slender stalk into the duct just ventral to the ampullary constriction.

Remarks.—In the coelom of one of the acelitellate specimens are large numbers of protozoan cysts. The reproductive organs of this worm are apparently fully developed and of normal appearance though there is no trace of clitellar glandularity.

O. birmanicus is most closely related, apparently, to *O. surensis* (Michaelsen) 1910, from which it is distinguished mainly by the absence of septum 7/8.

Genus **Eutyphoeus** Michaelsen.

Eutyphoeus assamensis Stephenson.

1926. *Eutyphoeus assamensis*, Stephenson, *Rec. Ind. Mus.* XXVIII, p. 262.

Material examined.—Seventeen specimens labelled "W 1951/1. *Eutyphoeus assamensis* Steph. Katlicherra, S. Cachar, Assam. S. I. Hora. March 1925."

A.

The spermathecal pores are small, transverse slits in 7/8, about in *b* or very slightly lateral to *b*. On xvii there is a pair of smooth, glisten-

ing, circular areas that extend from *a* into *bc*. At the centre of each of these areas and about in *b* there is a very small, transversely slit-shaped aperture through which, on some of the specimens, penial setae project.

The transversely oval, postsetal genital markings are on xvi, each marking just behind *ab*, reaching slightly median to *a* and slightly lateral to *b*, the median margin slightly nearer to the midventral line than the median margin of a marking on xvii. The genital markings are present on 12 of the 13 specimens under consideration.

The dorsal blood vessel is continued anteriorly into the pharyngeal region with fairly large commissures in v and paired hearts belonging to vi at the anterior end of the gizzard.

Lateral intestinal caeca are lacking (2). The unpaired ventromedian intestinal caeca are in xxxvi-xlvi (1).

Segment xi is apparently not closed off from the parietes laterally and ventrally though 10/11 and 11/12 are in contact dorsally. The testicular material surrounds the gut and the dorsal blood vessel.

The spermathecal duct is glistening and barrel-shaped. On the lateral and median side of each duct near the ental end is a small diverticulum.

The bulbous ejaculatorius is definitely coelomic.

Remarks.—The clitella are not well developed on any of the specimens, as was noted by Stephenson.

B.

On three specimens including the single dissected specimen the circular areas on xvii are lacking but in their place is a narrow, transversely elongated depression that extends laterally nearly to *c*. Towards each lateral margin of this depression there is a very small slit through which the penial setae project. At each end of the depression there is a u-shaped, rather conspicuously protuberant ridge, the limbs of the u short and reaching midventrally only to *a*.

The dorsal blood vessel is continued anteriorly at least to 5/6 with hearts belonging to vi at the anterior end of the gizzard.

The unpaired, ventromedian, intestinal caeca are in xxxvi-xlv (1).

The spermathecal ducts are not so well developed in these specimens and the bulbous ejaculatorius projects less conspicuously into the coelom.

Remarks.—Stephenson's description of the species is based on specimens with u-shaped ridges. So far as can be determined from an examination of segment xi these specimens are not as mature as those without the ridges. The reason for the statement that the dorsal blood vessel "ends behind the gizzard" is not obvious.

It is possible that two distinct but closely related species are represented in these two groups.

Eutyphoeus gigas Stephenson.

Material examined.—One specimen labelled, "W 73/1. *Eutyphoeus gigas*. Rangamati, Chittagong Hill Tracts, Bengal. R. Hodgart. Type."

On 19/20 there are slight indications of special glandularity that may represent genital markings, extending from *a* or slightly lateral to *a* into mid *bc* on each side.

The ventral intestinal caeca are in xxxiii, xxxiv (?), xxxv-xlvii. The lateral caeca are well developed ; the caecum of one side directed dorsally, of the other side anteriorly into xxv.

The hearts of xi are bound down to the gut but the testicular material is ventral to the oesophagus.

There is a definite but short and stoutish spermathecal duct, probably narrowed in the parietes.

Remarks.—The type is hard and strongly contracted and in this condition the determination of certain important characteristics involves risk of damaging or breaking the specimen.

E. gigas is probably close to *E. longiseta* and *E. rarus* and may actually be conspecific with one of the Burmese forms but the relationships cannot be determined until further material from Rangamati is available for study.

***Eutyphoeus lippus*, sp. nov.**

Material examined.—“ In dark brown soil intermixed with rocks and stones ”
Gurjung, Khare and Phoktey villages, Ramechap District—East 2, Nepal, August and September, Prof. K. N. Sharma, 2 clitellate, 6 partially clitellate and 133 acitellate specimens.

Description: External characteristics.—Length, to 120 mm. Diameter, 4-6 mm. Unpigmented, clitellum reddish.

The setae begin on ii ; on segment xx the setal distances can usually be represented by the formula $ab < cd < bc < aa$, but cd and bc may occasionally be equal or nearly equal ; bc may be one half, two thirds, or three fourths of aa .

The first dorsal pore is located as follows : in 7/8 (1), in 8/9 (3), in 8/9 but with a distinctly pore-like marking in 7/8 (3), in 9/10 (4), in 9/10 but with a definitely pore-like marking in 8/9 (3) or with pore-like markings in 7/8-8/9 (4), in 10/11 (4), in 10/11 but with a pore-like marking in 9/10 (8) or with pore-like markings in 8/9-9/10 (3) or with a pore-like marking in 7/8 only (2) or with markings in 7/8-8/9 (4).

The clitellum extends from mid xiii to 16/17 or dorsally and laterally only to mid xvii ; intersegmental furrows and dorsal pores lacking.

The spermathecal pores are transverse slits, in ab or extending from a or from mid ab into bc or mid bc .

The female pores are paired on xiv, each pore just anterior and median to a .

On xvii, on each side there is a shallow, rather slit-like depression, about in ab . The whitish margin of this depression may be slightly protuberant as a smooth or lobulated circumferential lip. In the depression but really a part of the anterior lip is a shortly transverse tubercle or papilla. The median margin of the tubercle reaches practically to the median margin of the depression but the lateral margin may not quite reach to the lateral margin of the depression. On this tubercle there are either two penial setae or two setal pits. The penial setae are almost but not quite as widely spaced as setae a and b on xvi or xviii. The peni-setal tubercle is always definitely marked off by a slight furrow. At the bottom of the transverse depression and usually towards the lateral side there can be seen on favourable specimens two pores,

one of which is slightly lateral to the other. These pores are presumably the male and prostatic pores. Just anterior to each peni-setal tubercle is a small, transversely oval genital marking (probably on the anterior portion of xvii). Immediately posterior to each depression is a similar marking, probably on the posterior portion of xvii. Every specimen has these two pairs of markings though the markings may be only faintly indicated on the smallest of the acelitellate specimens.

The preclitellar genital markings are a pair of nearly circular areas on x, each area in *ab* and delimited by a slight furrow or (acelitellate specimens) by a fine greyish line (140 specimens). On one specimen the marking of the right side is lacking. A posterior portion of x including the ventral setae on its anterior margin and also including the genital markings may be protuberant as a transversely placed, dumb-bell-shaped area.

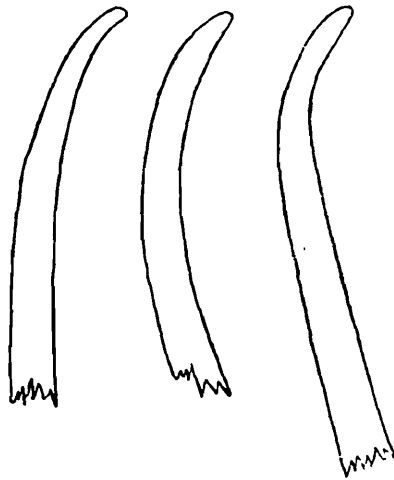


FIG. 9.—*Eutyphoeus lippus*. Tips of penial setae. $\times ca. 80$.

Internal anatomy.—(Opened 95 specimens.)

The intestine begins in xv (95). The lateral intestinal caeca are paired, in xxiv, each caecum a dorsally directed flap with a bluntly rounded tip, flattened against the oesophagus (67). The median caeca are located in segments xxx-xxxvii as shown below.

Segments.	Specimens.
xxx-xxxiv	7
xxx-xxxv	7
xxx-xxxvi	1
xxxi-xxxiv	5
xxxi-xxxv	15
xxxi-xxxvi	5
xxxi-xxxvii	1
xxxii-xxxv	2

The dorsal blood vessel is continued into the pharyngeal region (95). Paired commissures belonging to v-xiii are present (94). In one worm the right commissure of v is lacking. All commissures of v-xiii pass into the ventral blood vessel (5).

There are no male funnels in x or seminal vesicles in ix (95). The seminal vesicles of xii push 12/13 and 13/14 back into contact with

14/15. The testis sac (xi) is in the form of a horse-shoe on the oesophagus, the dorsal blood vessel and the hearts imbedded in the testicular coagulum (95). In several specimens dissected from the ventral side no transverse communications between the ventral ends of the limbs of the horseshoe were visible but this may not always be the case. The prostates are in xvii-xviii. The prostatic duct is 3-5 mm. in length. The bulbus ejaculatorius is small, short and softish but coelomic. The penial setae pass into the parietes median to the prostatic duct while the bulbus passes into the parietes immediately posterior to the prostatic duct.

The spermathecal duct is short but stout, easily pulled out from the parietes within which it is not narrowed. Each spermatheca (189) has a median and a lateral diverticulum. In one specimen the median diverticulum of the left spermatheca is lacking. The diverticula are usually elongate, and may be said to be finger shaped but in a number of specimens the ental end of the diverticulum is bilobed. The diverticula are usually bent posteriorly, but in very small specimens may project straight out from the lateral and median faces of the duct.

There is a whitish (glandular?) material projecting slightly into the coelom through the parietes over each genital marking on x and also but less conspicuously, xvii.

Remarks.—The worms are rather brittle and break easily. In a number of specimens the gut is macerated in the region immediately behind the prostates. The handling of specimens in such condition is not easy; the determination of the position of the first dorsal pore is especially difficult. Very slight pressure is sufficient to force fluid out through the dorsal pores in the region just anterior to the clitellum. In front of the first dorsal pore, as indicated by the exertion of very slight pressure, there are usually several pore-like markings. Further pressure often breaks the worms without indicating whether or not these additional markings are also pores.

The position of the lateral intestinal caeca could not be determined in a number of specimens because of the decay of the intestine.

A number of aclitellate specimens appear to be otherwise fully sexual. The seminal vesicles are well developed; the testis sacs are filled with testicular coagulum; within the spermathecal ducts are masses of iridescent material (spermatozoa?) which extend externally through the spermathecal pore and internally into the lumen of the spermathecal ampullae. In the smallest aclitellate specimens the seminal vesicles are well developed but the prostates and spermathecae are small.

In some of the smallest aclitellate specimens there are numbers of parasites scattered throughout the coelom of the segments behind the prostatic region. Each parasite is surrounded by a thickish layer of a pearly iridescence and contains a single ovoidal nucleus within which is an eccentric endosome.

Aclitellate specimens of *Eutyphoeus* from Jata Pokhrie and Panch Pokhrie in Ramechap District may perhaps be also referable to *E. lippus*. These particular specimens were collected at an altitude of 13,000-15,500 feet and were found in a thin layer of mud on rocks covered

over by lichens. In this thin layer of "mud" there were also found some clitellate Lumbricids. The latter were very badly preserved and were not identified.

E. lippus is probably close to *E. nepalensis* but is distinguished from the latter by the absence of postclitellar markings, by the presence of preclitellar markings and by the simpler, undivided condition of the paired spermathecal diverticula.

Eutyphoeus manipurensis Stephenson.

Material examined.—One undissected and two dissected specimens labelled "W 555/1. *Eutyphoeus manipurensis* Steph. Swamps round Thanga Island in Loktak Lake, Manipur. Manipur Survey."

The circular to longitudinally oval male pore markings on xvii are more deeply retracted into the parietes than on the Burmese specimens (*vide* Gates, 1933, p. 583). The annular lip-like margins of the depressions produced by the retraction are in contact at the midventral line. Within each depression are two softish protuberances, the posterior rounded and much larger than the other which is anteroposteriorly flattened. On the anteroventral margin of the posterior protuberance there is a very small, transversely slit-like pore. At the bottom of the slit between the two protuberances is a transversely oval, smooth, glistening papilla on which two setal pits are visible.

The dorsally or ventrally directed, lateral, intestinal caeca are in xxvii on the anterior face of 27/28 except on one side of one specimen where the caecum is in xxvi.

The spermathecal diverticulum is on the lateral side of the duct which is fairly thick. The ampullae are filled by a greyish-brown, granular material.

Eutyphoeus nepalensis Michaelsen.

Material examined.—One specimen labelled, "*Eutyphoeus nepalensis* Michlsn. ZEV 2880/7. Chitlong, Nepal. Mus. Coll. (R. Hodgart) Type" and from the Hamburg Museum, two dissected and 1 undissected clitellate specimens labelled, "V 7131. *Eutyphoeus nepalensis* Michlsn. Hodgart. Nepal."

Vestibula and penes are lacking. The male porophores are transversely oval, thickened areas on xvii which are fairly widely separated midventrally. On each of these areas there is a transversely slit-like aperture. Within the slit are the penial setae which pass into the anterior wall of the invagination where they are separated from each other by a septum. At the bottom of the invagination there is a single, minute, but readily recognizable pore, in line with the lateral penial seta, the pore a trifle larger than the aperture of the setal pit.

The genital markings are transversely oval and protuberant in a convex fashion, paired, separated midventrally; on 19/20-20/21.

The lateral, intestinal caeca are small, dorsally directed; in xxiv. The ventral caeca are in xxxi-xxxv. The dorsal blood vessel is continued anteriorly into the pharyngeal region with paired hearts belonging to v, vi, vii and viii.

The testis sac is annular, the hearts of xi and the dorsal blood vessel surrounded by testicular material. The seminal vesicles of xii push 12/13 and 13/14 into contact with 14/15. The bulbus ejaculatorius is coelomic and passes into the parietes just posterior to the prostatic duct. Penial setae are present; the ectal ends ornamented but the tips softened and probably deformed.

The spermathecal diverticula are in two groups, one group on the lateral face of the spermathecal duct, the other on the median face.

Glandular material projects through the musculature into the coelom over the genital markings.

Remarks.—The penial setae were overlooked by Michaelsen.

E. nepalensis is probably close to *E. lippus* but can be distinguished at present by the characteristics of the genital markings and the spermathecal diverticula.

Eutyphoeus sp. ?

Material examined.—Happy Valley, near Shillong, Nov. 11, 1930, H. S. Rao, 1 acelitellate specimen.

Length, 190 mm. Maximum diameter, 8 mm. Unpigmented, no trace of clitellar glandularity.

The setae are very small and retracted, $aa > bc$. The first dorsal pore is in 13/14 but there is a tiny, dark spot, somewhat pore-like, in 12/13.

Tiny grey spots in 7/8 in *b* probably represent the rudiments of the spermathecal pores.

On the middle annulus of xvii there is a narrow, transverse depression with a rather tumid circumferential lip, extending laterally on each side to slightly beyond *b*. On the roof of this depression on each side and about in line with *b* is a tiny, transversely oval, slightly protuberant, whitish papilla at the centre of which is a pit or pore. There is a transversely depressed groove in the region of 19/20 much like the groove on xvii but without the tumid lip.

Lateral intestinal caeca are lacking; three tiny, whitish, ventral caeca were found in the region of segments xxxvi-xxxviii. The dorsal trunk ends with the hearts of vii.

The seminal vesicles are fairly large, the right vesicle confined to xii but folded in a pleated fashion, the left vesicle extending into xiii. The bulbus ejaculatorius is well developed, ovoidal.

The spermathecal ampulla is elongately saccular; the duct short but thickish; the diverticula are paired.