ON SOME EARTHWORMS FROM THE BUITENZORG MUSEUM. II.

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Since publication of the previous article in this journal (GATES 1936) several tubes of earthworms have been received from the Buitenzorg Museum. Examination of this material has made possible more accurate characterisation of certain structures of taxonomic importance such as spermathecal pores, spermathecae, male genital terminalia and testis sacs and consequently more nearly satisfactory diagnoses of several species of *Pheretima*. Unfortunately none of the material is in good condition and certain characteristics and structures that may furnish information useful in diagnosis and determination of interspecific relationships are still unknown or inadequately described.

The author's thanks are extended to the Director of the Buitenzorg Museum for the opportunity of studying this material.

Family MEGASCOLECIDAE.

Genus **Pheretima** KINBERG.

Pheretima baweanensis MICHAELSEN.

Pheretima baweanensis MICHAELSEN 1924, Treubia, vol. 5, p. 389. (Type locality Bawean Island, Java Sea. Type in Buitenzorg Museum.)

Material examined. — 1 undissected, clitellate specimen labelled, "*Pheretima baweanensis* MICH. (Type!) Bawean, N., H. C. DELSMAN, No. 10".

External characteristics. — The setae begin on ii and appear to be enlarged on ii-v. Ventrally on vi-vii setae are retracted so that the tips are just visible in the parietes, hence an appearance of smallness in these segments may only be a result of retraction although spacing is closer than anteriorly. Setal formula: v/10, vi/13(?), xvii/18, xviii/9 +, xix/20, 15/ii, 25/iii, 36/viii, 44/xii, 56/xx.

The first dorsal pore is on 12/13.

The clitellum is annular, extending from 13/14 to 16/17; intersegmental furrows and dorsal pores lacking, setae lacking or invisible.

Spermathecal pores are superficial, large, transversely slit-like, one pair, on 5/6.

The single female pore is median.

Male pores are minute and invaginate, each pore on the posterior face near the base of a bulb protuberant from the roof into a copulatory chamber. The bulb probably narrows to a rather bluntly rounded tip but is softened so that accurate characterisation is impossible. Apertures of the copulatory chambers are transversely slit-like with finely wrinkled margins.

Internal anatomy. — Septum 8/9 is present and complete but delicate and transparent, adherent to the gizzard in a posteriorly directed funnel-like fashion, clearly visible on first opening the wall by a mid-dorsal incision but ruptured when the body wall is pinned out and after rupture recognizable only as a ventral rudiment. Septum 9/10 is lacking; 10/11-12/13 muscular, 13/14 slightly muscular.

The intestine begins in xvi just at 15/16. Intestinal caeca are simple, the right caecum with smooth (?) dorsal and ventral margins, the left caecum with six very short lobes of the ventral margin, failure to recognize lobes on the right caecum perhaps the result of softening.

There is a pair of hearts belonging to ix. The last hearts are in xiii; all hearts of ix-xiii passing into the ventral trunk.

Testis sacs are paired, the sacs of a segment not in contact mesially. The smaller posterior sacs are not in contact anteriorly with 10/11 but are crowded against the anterior face of 11/12 by the ventral portions of the anterior seminal vesicles. An opaque cord passes from the apex of each testis sac to the posterior face of 10/11. Seminal vesicles are fairly large and in contact transversely above the dorsal trunk. Each vesicle is provided with a finger-shaped dorsal ampulla which is one to two mm long. Prostates extend through xvi-xix. The prostatic duct is about 2½ mm long.

The copulatory chamber is large, approximately spheroidal, reaching into the coelomic cavity of xviii to a height of two mm. The lumen is nearly filled by the penial bulb previously mentioned. On the posterior face of this bulb, near the roof of the copulatory chamber is a deep, quite definite, slit-like depression. Close to this slit is a tiny, rather conical protuberance with a slightly greyish translucent spot on the tip. The prostatic duct cannot be traced to a male pore as a result of the maceration but appears to pass within the bulb only to the region of the slit and tubercle.

The spermathecal duct is shorter than the ampulla, rather top-shaped, thickest entally, a slight muscular sheen visible only after a thin layer of tissue (and associated nephridia?) has been dissected off. The wall is not especially thick, provided internally with fairly high longitudinal ridges except in the region of the diverticular aperture which is surrounded by an annular ridge peripheral to which are several short ridges. The saccular, thin-walled ampulla opens into the duct through a tiny, transversely slit-like aperture at the centre of the dorsal face of the duct. The diverticulum which passes into the median face of the duct slightly below the ental end comprises an unusually slender

stalk and a simple, ellipsoidal seminal chamber of about the same length as the stalk. The seminal chambers have a spermatozoal iridescence.

Remarks. — Although the specimen described above bears a type label it had not been opened by MICHAELSEN. The other worm from which the internal structures were characterized presumably is in the Hamburg Museum.

Diagnosis. — Bithecal; spermathecal pores large, superficial, transverse slits on 5/6. Male pores minute, each pore on the posterior face near the base of a rather large penis pendent from the roof of a large copulatory chamber. Setae enlarged on ii-v: v/10, vi/13, xvii/18, xviii/9, xix/20, 15/ii, 25/iii, 36-44/viii, 44/xii, 56/xx. First dorsal pore on 12/13. Length 160-170 mm. Diameter 5 mm.

Septum 8/9 complete but membranous. Intestinal caeca simple but with small lobes on the ventral margin. Testis sacs paired and ventral. Spermathecal duct shorter than ampulla, rather top-shaped and narrowed ectally; diverticulum with simple ellipsoidal seminal chamber and slender stalk passing to median face of duct entally.

Distribution. — Known only from the type locality, Bawean Island in the Java Sea.

Pheretima halmaherae MICHAELSEN.

Perichaeta halmaherae (part only?) MICHAELSEN 1896, Abh. Senck. Ges. vol. 23, p. 208. (Type locality Halmahera Is. Types in Frankfort Mus.?)
Pheretima halmaherae MICHAELSEN 1934, Arch. Neerl. Zool. vol. 1, p. 111.

Material examined. — Two clitellate specimens labelled, "*Pheretima* (*Ph.*) *halmaherae* (MICH.). Goegoeti, Morotai. vi. 26, H. J. LAM."

External characteristics. — The setae begin on ii, on which segment there is a complete circle, and are small, closely spaced. Formulae: viii/8, xvii/11, xviii/4, xix/12, 66/viii, 70/xii, 76/xx; viii/7, xvii/13, xviii/2, xix/3.

The first dorsal pore is on 11/12 (1) or 12/13 (1).

Spermathecal pores are superficial, large, transversely slit-like, two pairs, on 7/8-8/9. The anterior margin of the spermathecal aperture is tumescent, the tumescence continued into an ectal portion of the duct. On the tumescence there is a vertical groove.

The single female pore is median (2).

Male pores are minute and superficial, each pore very slightly posterior to the setal circle, on the anterior wall of a very slight depression of nearly circular outline.

Genital markings are small, in part recognizable with difficulty. On one worm there are paired postsetal depressions on xvii and xix (in line with male pore depressions) in each of which there is a marking, an additional marking

possibly present in each depression of xvii. In each of the depressions of xviii there are two more markings (or rudiments of markings), one just median to the male pore and one on the posterior wall, a further marking just lateral to the depression on each side and in line with the male pore. On the left side of xvii and on the right side of xix there is a presetal marking. On the second specimen there are paired, presetal markings on xvii-xix and paired postsetal depressions on xvii and xix each of which contains two tiny markings. In addition there are three further markings on each side of xviii located about as on the other worm, one just median to the male pore, one on the posterior wall of the depression and one in the setal circle just lateral to the depression.

Internal anatomy. — Septum 8/9 is lacking; 9/10 probably present, membranous, bulged posteriorly, adherent to the parietes and the anterior face of 10/11 and there covering over the hearts of x.

The intestine begins in xv (2). Intestinal caeca are simple but with several short incisions of the ventral margins (2).

The single heart of ix is on the right side (1) or on the left side (1). The last pair of hearts is in xiii (2), all hearts of ix-xiii passing into the ventral trunk (1).

Testis sacs are unpaired and suboesophageal, the ventral blood vessel in the roofs of the sacs. In spite of maceration walls of the sacs are strong so that the condition is easily determined. Seminal vesicles are medium-sized, vertically placed bodies on the posterior faces of their septa, each vesicle continued dorsally into a finger-shaped appendage that appears not to be constricted off from the ventral lamina. Prostates are small; in xvii only, xvii-xviii or xvi-xviii. The prostatic duct is 2 - 3 mm long, muscular, thick and rather spindle-shaped.

The spermathecal duct is slightly shorter than the ampulla and not especially thick. The diverticulum which passes into the anterior face of the duct near the parietes is longer than the main axis, with a (muscular?) stalk and a simple, sausage-shaped seminal chamber of about the same length as the stalk. Ectally the diverticular stalk is nearly as thick as the duct. The latter has a rather thin wall and is provided internally with low longitudinal ridges. The diverticular aperture is located on a small tubercle on the anterior wall.

Genital marking glands are sessile on the parietes.

Remarks. — The diagnosis below is only tentative. Several formae or subspecies have been named by MICHAELSEN but the status of all of these is uncertain. There is considerable intraspecific variation as to location of the genital markings if all of the forms are to be included in one species. Some of the supposed variations as to spermathecal characteristics may be pathological or even the result of maceration.

Diagnosis. — Quadrithecal; spermathecal pores large, superficial, transverse slits on 7/8 - 8/9. Male pores minute and superficial, each pore slightly postsetal and on the anterior wall of a slight depression of circular outline.

Genital markings small; paired and presetal on xvii-xix, two markings in each male pore depression, one median and one posterior to the male pore, one marking just lateral to the depression and in or just behind the setal circle, paired postsetal depressions on xvii and xix in line with and of same size as male pore depressions, each containing one or two markings. Setae: viii/7 - 8, xvii/11 - 13, xviii/0 - 4, xix/13, 66/viii, 70/xii, 72 - 76/xx. First dorsal pore on (11/12) 12/13. Length 130 - 220 mm. Diameter - - 8 mm.

Septum 9/10 present but membranous. Intestinal caeca simple but with shortly lobed ventral margins. Testis sacs unpaired and ventral. Spermathecal duct shorter than the ampulla; diverticulum with simple ellipsoidal seminal chamber and stalk passing to anterior face of duct near the parietes. Genital marking glands sessile on the parietes.

Pheretima indica (HORST).

Megascolex indicus HORST 1883 (part), Notes Leyden Mus. vol. 5, p. 186. (Types with copulatory chambers. Type locality unknown. Types in the Leiden Museum?).

Material examined. — 3 clitellate specimens from a tube labelled, "*Pheretima capensis* (HORST). Buitenzorg. 6. 1912. KONINGSBERGER."

The worms are quite characteristic and with secondary seminal chambers on the spermathecal diverticula.

Pheretima javanica (KINBERG).

Rhodopis javanica KINBERG 1867, Öfv. Ak. Förh. vol. XXIII, p. 102. (Type locality Java. Types in the Stockholm Museum.)

Pheretima capensis + *P. quadragenaria* GATES 1936, Treubia, vol. 15, pp. 380 and 391.

Material examined. — One aclitellate, one partially clitellate, eleven clitellate specimens and two clitellate anterior fragments from which internal organs had been removed, labelled, "*Pheretima capensis* (HORST). Buitenzorg. 6. 1912. KONINGSBERGER", and one clitellate specimen labelled, "*Pheretima capensis* (HORST). Kananggar, Soemba. 700 m. 5. 1925, K. W. DAMMERMAN."

External characteristics. — Setae begin on ii. On many of the specimens there are gaps in the setal circles. In such gaps there may be visible pits from which setae have fallen out, while other gaps (doubtless the result of the same process) have no pits or pit-like markings. In the formulae below, the second figure, that following the + sign, indicates the number of setal pits from which setae appear to have fallen out but recently while an interrogation mark indicates that the number of pits is unknown.

Setal formulae.

viii	xvii	xviii	xix	iii	viii	xii	xx
17 + 2	11	5	12	25 + 3	39 + 3	33 + 5	43 + 5
16	11	4	12	35	43	45	45
14 + 2	10	3	11	34	37	42	44
10 + 7	7 + 4	1 + 7	6 + 4	24 + ?	30 + ?	39 + ?	37 + ?
6 + 10	11	0 + 3	8 + 3	32	29 + ?	42	39 + ?
3 + ?	6 + 4	5	9 + 2	—	—	—	—
12 + 5	13	7	14	30	38	44	46
6 + 6	13	5 + 2	12	—	—	47	—
9 + 7	8 + 3	4 + 2	9 + 2	—	—	—	—
16	—	5	—	—	—	—	—

Counting the pits as setae, leaving out of consideration those numbers in which setal pits are not included, the setal figures do not differ markedly from those of specimens previously examined (GATES, 1936). The specific setal formula can be expressed as follows: — viii/12 - 20, xvii/10 - 13, xviii/0 - 10, xix/10 - 14, 30 - 42/iii, 37 - 47/viii, 42 - 54/xii, 44 - 56/xx.

The first dorsal pore is on 7/8 (3 or possibly 4 specimens), 8/9 (1), 9/10 (1), 10/11 (2), 13/14 (1).

The clitellum is annular, extending across xv and portions of xvi and xiv but not reaching to 13/14 or 16/17 on any of the specimens; dorsal pores and intersegmental furrows lacking, setae lacking or invisible.

Spermathecal apertures are transversely placed, usually slit-shaped, on one specimen crescentic, usually very small, but on one specimen large and one intersetal interval wide.

Apertures of the copulatory chambers are rather crescentic in shape and with the appearance of being slightly diagonal. Copulatory chambers are usually slightly relaxed, relaxation indicated by a slight eversion of the anterior wall of the chamber as a rounded bulb.

Genital markings are lacking.

Internal anatomy. — Septum 8/9 is either lacking or unrecognizable. As in the previous specimens (GATES 1936) the characteristics and relationships of septa 9/10 and 10/11 have not been definitely determined. Anterior and adherent to the first pair of seminal vesicles is a membrane which in some specimens at least appears to be double mesially (towards the gut). Between this membrane and 11/12 and especially between the seminal vesicles and the gut are strands of delicate tissue. All of the specimens are too soft to permit of more adequate characterization.

The intestine begins in xv (8) or xvi (1). The intestinal caeca are simple, the margins smooth or with slight septal constrictions.

The single heart belonging to ix is on the right side (6) or the left side (3).

The last pair of hearts is in xiii (9), all hearts of ix-xiii passing into the ventral vessel (3).

Testis sacs are paired, the sacs of a segment separated midventrally (3). Seminal vesicles are fairly large, the vesicles of a segment in contact with the dorsal blood vessel and nearly filling the coelomic cavity (9). Prostates are well developed in all specimens, extending through xvi or xvii to xx, xxi or xxii. The prostatic duct is about two mm long, fairly stout, straight or nearly straight or bent into a U-shaped or S-shaped loop, passing into the copulatory chamber anterolaterally (rarely laterally) close to the parietes. Copulatory chambers are usually recognizable as hemispheroidal protuberances into the coelomic cavity of xviii. In the partially clitellate specimen the copulatory chamber is quite unrecognizable internally, the prostatic duct passing into the parietes as if there were no chamber (seminal vesicles, prostates and spermathecae fully developed, testis sacs small). An invagination containing the primary male pore is however present in the parietes and recognizable after removal of strands of longitudinal musculature.

The wall of the chamber is fairly thick, perhaps thicker anteriorly and dorsally than posteriorly. On removal of the roof or after opening the chamber from the dorsal side there comes into view a protuberance from the floor of the chamber immediately anterior to the slit-like passage to the exterior through the parietes. On this protuberance there is always present a very tiny slit within which is the primary male pore. As a result of softening the male pore protuberance cannot be definitely characterized. In one specimen the male porophores have more of an appearance of being projections from the anterior wall than from the floor of the chamber but in this worm as well as in the previous specimens (GATES 1936) the male pore is on the dorsal side of the porophore. As has already been noted above, copulatory chambers appear to be slightly relaxed, especially the anterior wall which appears to be in the initial stage of eversion. In previous specimens the male porophores were described as protuberant into the lumen of the copulatory chamber from the anterior wall. Presumably in such specimens the chambers were less relaxed than in the present worms, possibly fully retracted.

The thick-walled ectal portion of the diverticulum, which may as well be called the stalk, is well developed in all specimens but may be either C-shaped or spirally coiled. Correlation of differences in the diverticular stalk with numbers of spermathecal setae on viii or other external characteristics is impossible. A specimen with sixteen spermathecal setae on viii and no setal gaps has diverticular stalks tightly coiled in a spiral fashion, while one specimen with C-shaped diverticular stalks has but few setae on viii. The shape of the seminal chamber is variable; shortly ellipsoidal, pear-shaped, almost spheroidal. The seminal chamber may be separated from the stalk by a slender neck that is short, as long as or slightly longer than the seminal chamber, or the neck region may be entirely lacking, the seminal chamber marked off from the stalk only by a slight constriction. Spermatozoal iridescence is visible in a number

of seminal chambers provided with necks but no iridescence has been seen in diverticula without definite necks. The partially clitellate specimen (setal circles present on all clitellar segments) has seminal chambers with spermatozoal iridescence and unusually short necks.

Parasites. — In two specimens seminal vesicles are almost entirely masses of gregarine cysts that fell apart on the slightest traction.

Remarks. — As a result of maceration characterization of wall and lumen of the spermathecal diverticulum is scarcely worth while. The Soemba specimen is coiled and brittle.

MICHAELSEN (1922) distinguished *quadragenaria* from *capensis* by the absence of a neck region between stalk and seminal chamber of the spermathecal diverticulum, length of the diverticulum, thinness of the circular muscle layer in the diverticular stalk, presence of a network of ridges on the lining of the seminal chamber, ventral restriction of the testis sacs of x, and certain unimportant characteristics of the post-gizzard septa. These criteria have to do only with internal organs. In the previous paper it was pointed out that some of the specimens identified by MICHAELSEN as *variabilis* (= *quadragenaria*) have *capensis* characteristics and it is now equally clear that the specimens identified as *capensis* by MICHAELSEN may have *quadragenaria* characteristics. A previous attempt to distinguish *capensis* and *quadragenaria* (GATES 1936) by the number of spermathecal setae on viii and the method of coiling of the spermathecal diverticula is now demonstrated to be unsuccessful. So far as the material from the Buitenzorg Museum is concerned the two species cannot be distinguished by any external or internal characteristics and obviously must be united.

The type locality of *quadragenaria* is unknown, that of *capensis* probably has been mistakenly given as Cape of Good Hope, while that of *javanica* is Java! MICHAELSEN (1899) examined the originals of *javanica* and found that the particular specimen to be regarded as KINBERG's type was, so far as could be determined in absence of an anterior portion containing the spermathecae, probably *capensis* ("scheint dieses Stück der Art *Amyntas capensis* HORST anzugehören", MICHAELSEN, 1899, p. 439). So far as can be discovered from the literature the species under consideration appears to be the most common in Java of any of its size and the one most likely to have been collected by the Eugene expedition. It is unlikely that any of the type material (of *javanica*, *capensis* or *quadragenaria*) is in a condition to be of use today. In these circumstances the species under consideration may as well have the name *javanica*.

According to MICHAELSEN many of his specimens of *quadragenaria* are characterized by peculiarities such as absence of prostates, rudimentary or stunted prostates, adiverticulate spermathecae, rudimentary spermathecal diverticula or diverticula with incompletely developed seminal chambers and neck regions. All of these conditions are clearly abnormalities and further of those types that may be produced by infestation of parasites during juvenile stages. Thinness of the circular muscle layer in the diverticular stalk and the stunting

of the testis sacs of x (restriction to a ventral location) are quite probably abnormalities as may also be the unusual length of spermathecal diverticula and the network of ridges on the lining of the spermathecal chamber.

Diagnosis. — Quadrithecal; spermathecal apertures on 7/8 - 8/9. Male pores minute, each pore within a tiny slit on the dorsal face of a penial protuberance into a copulatory chamber from the anterior wall. Setae: viii/12 - 20, xvii/10 - 19, xviii/0 - 10, xix/10 - 19, 30 - 42/iii, 37 - 47/viii, 52 - 54/xii, 44 - 56/xx. First dorsal pore on or between 7/8 - 13/14. Length 70 - 220 mm. Diameter 3 - 6 mm.

Septum 10/11? Intestinal caeca simple. Testis sacs paired, of x vertical, of xi ventral. Spermathecal duct shorter than ampulla; diverticulum longer than the main axis, thicker than the duct; elongate stalk separated from the shortly ellipsoidal, pear-shaped, or spheroidal seminal chamber by a short and slender neck.

Pheretima omtrekensis COGNETTI.

Pheretima omtrekensis COGNETTI 1911, Boll. Mus. Torino, vol. 26, No. 641, p. 3. (Type locality, Humboldt Bay, Dutch New Guinea. Type in Amsterdam Museum.)

Pheretima omtrekensis GATES 1936, Treubia, vol. 15, p. 390.

Material examined. — 1 much macerated perhaps partially clitellate specimen, labelled, "*Pheretima keiana* MICH. (Type!) Gn. Daab. 300 m. Groot Kei. iv. 1922. H. C. SIEBERS."

External characteristics. — There are four spermathecal setae on viii. Three of the spermathecae had been removed but the left pore on 7/8 is still recognizable. There is a tiny genital marking just anterior to and just posterior to this pore.

The parietes in the clitellar region has a slightly different appearance than elsewhere, but setae are visible in all clitellar segments.

Genital markings are small tubercles with protuberant, narrow rims and concave central areas, located as follows. — A pair of presetal markings on x, separated from each other by a midventral distance equal to 3 intersetal intervals. A transverse row of three markings on 16/17 (or presetal on xvii), two markings just to the right of the midventral line, one marking left of the midventral line and at about the same distance as the more lateral of the right markings, all three median to the male pore lines. One pair of markings each on 17/18 and 18/19, each marking slightly lateral to the male pore lines. Just median to the male pore lines, a postsetal pair on xviii, a presetal marking on xix-right side, intersegmental pairs on 19/20 and 20/21.

Internal anatomy. — The prostatic duct is straight, 1½ - 2 mm long.

The seminal chamber is spheroidal, only slightly wider than the rest of the spermathecal diverticulum and one-fourth to one-fifth as long. The diverti-

culum passes into the median face of the duct below the ental end. On the parietes close to the ectal end of the duct are two tiny, sessile glands, one rather anterolateral, the other rather posteromedian.

Glands of the genital markings appear to be sessile on the parietes.

Remarks. — Most of the internal organs had been removed by MICHAELSEN. The body wall is transparent, intersegmental furrows usually unrecognizable.

Spermathecal pores cannot yet be characterized. They may be large and superficial or minute and invaginate, the presence of tiny tubercles within the spermathecal openings of the previous specimen (GATES 1936, p. 390) perhaps indicative of parietal invaginations into which minute pores open. Relationships of testis sacs and seminal vesicles of xi are also unknown.

Diagnosis. — Quadrithecal; spermathecal apertures transverse slits on 7/8 - 8/9. Male pores minute and very slightly postsetal. Genital markings paired: lateral to the male pore lines on 16/17 - 20/21 and postsetal on xix-xx; median to or about on male pore lines on 16/17 - 23/24, presetal on viii-x, xvii-xix, postsetal on x, xvii-xxi; one marking just in front of and one just behind each spermathecal aperture. Setae: viii/6, xvii/7, xviii/0 - 5, xix/7, 72/xiii, 75/xxv. First dorsal pore on (11/12) 12/13. Length 60 - 130 mm. Diameter 2½ - 6 mm.

Septum 9/10 present but membranous. Intestinal caeca simple but with ventral margins lobed. Testis sacs paired, vertical (?); seminal vesicles of xi included? Spermathecal duct about as long as ampulla; diverticulum about as long as main axis, to ental portion of duct, seminal chamber simple, ellipsoidal, a widened and pear-shaped middle region with thick wall and widened lumen constricted off from seminal chamber, and about as long as stalk. Genital marking glands stalked and coelomic?

Pheretima sangirensis (MICHAELSEN).

Perichaeta sangirensis MICHAELSEN 1891, Mitt. Mus. Hamburg, vol. 8, p. 36. (Type locality, Sangir. Types in the Hamburg Museum?)

Pheretima sangirensis MICHAELSEN 1934, Arch. Neerl. Zool. vol. 1, p. 113.

Material examined. — Two clitellate specimens labelled, "*Pheretima* (*Ph.*) *sangirensis* (MICH.) Lobo, Karakelong (Talaud), Juni 1926. H. J. LAM."

External characteristics. — Red pigment is still visible in the dorsum, especially anterior to the clitellum, in spite of the alcoholic preservation.

The setae begin on ii on which segment there is a complete or nearly complete circle. Formulae: vii/12, viii/13, xvii/14, xviii/5, xix/15, 21/ii, 31/iii, 37/viii, 32+/xii, 51/xx; vii/11, viii/14, xvii/13, xviii/7, xix/14, 26/ii, 26/iii, 40/viii, 44/xii, 60/xx. (Setal pits have been counted as if setae were present in several of the segmental enumerations). The tips of the ventral setae of vii are ornamented by transverse rows of fine spines, the rows of varying length.

The first dorsal pore is on 11/12 (2).

The clitellum is annular, extending from 13/14 to 16/17; intersegmental furrows and dorsal pores lacking, setae lacking or invisible.

Spermathecal pores are superficial, large, transversely slit-like, one pair, on 7/8.

The single female pore is median (1).

Male pores are minute and invaginate, each pore at the ventral tip (?) of a penis about 1 mm long pendent from roof of a large copulatory chamber with a transversely slit-like aperture. The penis has a rather bluntly rounded tip and is slightly thickened basally.

Internal anatomy. — Septum 8/9 is present and complete but membranous, recognizable on first opening the animal by a mid-dorsal incision as a posteriorly directed, rather funnel-shaped membrane investing the gizzard, but ruptured by pinning out the body wall so that only a ventral rudiment is then recognizable.

The intestine begins in xv (2). Intestinal caeca are simple but with 3 - 7 very short lobes on the ventral margins (2).

The single heart of ix is on the left side (2). The last pair of hearts is in xiii (2), all hearts of ix-xiii passing into the ventral trunk (1).

Testis sacs are paired and separated midventrally, fairly large and may reach upwards nearly to the level of the dorsal face of the gut. Seminal vesicles are rather small, vertically placed bodies on the posterior faces of their respective septa, each vesicle with a finger-shaped primary ampulla 1 - 1½ mm long. Prostates extend through xvii-xix and may be separated into two distinct lobes. The prostatic duct is three to four mm long, bent into a U-shaped loop, the thickened ectal limb passing into the centre of the dorsal face of the copulatory chamber. The latter is conspicuously protuberant into the coelomic cavity of xviii but is rather small, exceeded in size by two glands attached to the anterior and posterior faces. These glands are marked off from the chamber by deep, transversely placed dorsal clefts or grooves. The anterior gland is actually in xvii and reaches into contact with 16/17. The posterior gland appears to be in xviii, but pushing 18/19 back into contact with 19/20. Protuberant from the walls of the copulatory chamber and in contact with the penis are four or five tumescences that may perhaps be genital markings bearing gland pores.

The spermathecal duct is shorter than the ampulla and is not slender, the lumen rather large, the wall rather thin and provided internally with slight longitudinal ridges The diverticular aperture is on a tiny papilla on the posterior wall. The diverticulum comprises a very slender stalk which may be looped in a rather zigzagged fashion and a much thicker simple, ellipsoidal seminal chamber of about the same length as the stalk. The stalk passes to the posterior face of the duct apparently at or near the ental end but actually does not open into the duct until lower down nearer the parietes, an ectal portion of the stalk bound to the duct by tough tissue which may be continued entally along the

stalk to or nearly to the seminal chamber, the real width of the diverticular stalk and the relationship of stalk to duct not obvious until after removal of the tissue.

Remarks. — As a result of maceration structures within the copulatory chambers which may be of taxonomic importance cannot be satisfactorily characterized.

Diagnosis. — Bithecal; spermathecal pores superficial, transverse slits on 7/8. Male pores minute, each pore at ventral end of a 1 mm long penis pendent from the roof of a large copulatory chamber. Setae: vii/11 - 12, viii/13 - 14, xvii/13 - 14, xviii/5 - 10, xix/14 - 15, 21 - 26/ii, 26 - 31/iii, 37 - 40/viii, 40 - 44/xii, 51 - 60/xx. First dorsal pore on 11/12. Length 50 - 240 mm. Diameter 4 - 8 mm.

Septum 8/9 present, membranous. Intestinal caeca simple, with few short lobes on ventral margin. Testis sacs paired, vertical. Glands on anterior face and posterior faces of each copulatory chamber large (markings within the chamber?). Spermathecal duct shorter than ampulla; diverticulum with simple ellipsoidal seminal chamber and a slender stalk passing to ental end of and bound to posterior face of duct but opening ectally.

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