

ON SOME EARTHWORMS FROM THE BUITENZORG MUSEUM.

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Three species of earthworms are now known from the island of Krakatau; *Pheretima dammermani*, *P. indica* and *Dichogaster bolawi*. On the island of Sebesi there have been collected worms belonging at least to four, possibly five, species; *P. capensis*, *falcata*, *indica*, *posthuma* and *quadragenaria*. Unfortunately the taxonomic status and (or) the correct nomenclature of three of these is, at present, unknown. The pantropical *Pontoscolex corethrurus*, apparently, has not yet reached either Krakatau or Sebesi.

The writer is indebted to the Director of the Buitenzorg Museum for the privilege of examining the earthworms from his Museum.

Genus *Drawida* MICHAELSEN.

Drawida MICHAELSEN 1900, Das Tierreich, vol. 10, p. 114. (Genotype, *Moniligaster barwelli* BEDDARD 1886).

Drawida nepalensis MICHAELSEN.

Drawida nepalensis MICHAELSEN 1907, Mitt. Mus. Hamburg, vol. 24, p. 146. (Type locality, Gowchar, near Katmandu, Nepal. Types in the Indian Museum).

Drawida nepalensis MICHAELSEN 1924, Treubia, vol. 5, p. 387. (Buitenzorg).

Material examined. — One dissected specimen from which the internal organs had been partly removed, labelled, "*Drawida nepalensis* MICH. Buitenzorg, Java. VI.1922. Leg. KONINGSB."

Each male porophore has a characteristic genital marking. Within the porophore is the characteristic, genital-marking gland.

The prostates are elongate and slenderly club-shaped. The central body is of approximately the same shape, almost rod-like.

Genus *Pheretima* KINBERG.

Pheretima KINBERG 1867, Ofv. Ak. Forh. vol. 23, p. 102. (Genotype, by subsequent designation-MICHAELSEN 1907, *P. montana* KINBERG 1867).¹⁾

Pheretima capensis (HORST).

Megascolex capensis HORST 1883, Notes Leyden Mus. vol. 5, p. 195. (Type locality, Cape of Good Hope ? Type in the Leyden Museum ?).

Pheretima quadragenaria MICHAELSEN 1924 (part), Treubia, vol. 5, p. 391. Specimens with 16 - 20 spermathecal setae on viii).

Material examined. — Two partially clitellate, undissected specimens from a tube labelled,²⁾ "*Pheretima variabilis* (E. PERR.). Sebesi, N. IV.1921. Leg. DAMMERMAN", and three partially clitellate or fully clitellate specimens from a tube³⁾ labelled, "*Pheretima variabilis* (E. PERR.). Sebesi, Zuid. 27.IV.1921. Leg. DAMMERMAN".

External characteristics. — Length, 90-120 mm. Diameter, 4 mm.

The setae begin on ii on which segment there is a complete circle. The setal formulae are shown below.

viii.	xvii.	xviii.	xix.	iii.	viii.	xii.	xx.
18	13	7	13	33	43	48	52
20	12	6	12	37	45	50	48
19	12	8	12	39	47	50	52
16	12	10	13	42	45	54	56
18	13	2	12	38	45	50	49

The first dorsal pore is located as follows: 9/10 (1), 9/10 but with a pore-like marking on 8/9 (1), 10/11 (1), 10/11 but with pore-like markings on 8/9 - 9/10 (1), pore-like markings on 8/9 - 12/13, none definitely recognizable as functional pores (1).

The clitellum does not extend either to 13/14 or to 16/17; intersegmental furrows and dorsal pores lacking, no setae visible. On the two specimens from the first tube the clitellar glandularity is only faintly indicated, intersegmental furrows and dorsal pores present, setae present only ventrally, on all three clitellar segments of one worm, on xvi only on the other worm.

¹⁾ MICHAELSEN has lately (1934, p. 12) divested *P. montana* of its dignity as the type species of the genus *Pheretima* and redesignated as the genotype, *P. californica* KINBERG 1867, a procedure which is, of course, a violation of the International Code (Article 30, g.).

²⁾ In addition to these two specimens, the tube contained three clitellate specimens of *P. indica*, 1 juvenile specimen of *Pheretima* and a posterior fragment of a *Pheretima*.

³⁾ In addition to these three specimens, the tube contained two worms referred to hereinafter as *P. falcata* and *P. quadragenaria*.

The spermathecal apertures are very tiny, perhaps not quite minute slits, on 7/8 - 8/9.

The apertures of the male invaginations are crescentic, transversely placed, the concave side facing anteriorly, each aperture about two intersetal intervals wide.

Genital markings are lacking.

Internal anatomy. — Septum 8/9 is represented by a ventral rudiment only; 9/10 probably lacking; none of the septa thickly muscular.

The intestinal caeca are simple, extending through 3-4 segments, the margins constricted slightly by the septa through which the caeca pass.

The last pair of hearts is in xiii (5). All hearts of ix-xiii pass into the ventral vessel. The hearts of x are smaller than the hearts of xi.

The testis sacs are paired and fairly widely separated mesially. The testis sacs of x are ovoidal, erect, with the larger, bluntly rounded end ventrally and the more pointed end dorsally, reaching upwards nearly to the level of the dorsal face of the gut and partially imbedded in the mesial faces of the seminal vesicles of xi. The testis sacs of xi are crowded against the anterior face of 11/12 by the anterior testis sacs and may push septum 11/12 posteriorly so that the sacs appear to be partially or wholly within xii. The seminal vesicles are fairly large, in contact dorsally with the dorsal blood vessel. The anterior vesicles dislocate 10/11 (?) which is closely adherent to the vesicles, forward into contact with the posterior margin of the gizzard. The septum can be dissected off, without rupture, from the vesicles. In addition to the adherence of 10/11 to a considerable portion of the mesial and lateral faces of the vesicles, delicate strands of connective tissue pass from the vesicles to the gut, the anterior face of 11/12 and to the parietes. After cutting this tissue and pushing the vesicles in a lateral direction away from the gut, the testis sacs of x can be seen to be imbedded in the mesial faces of the vesicles. With some care it is possible to dissect off the vesicles from the testis sacs without opening the latter. The vesicles may be slightly adherent to the roofs of the testis sacs of xi but can be dissected off without opening these posterior sacs. It scarcely seems likely that the testis sacs of x are actually within the coelomic cavity of xi, in spite of the appearances, hence it would appear to be possible that septum 10/11 is reduced to the connective tissue strands passing from the vesicles to

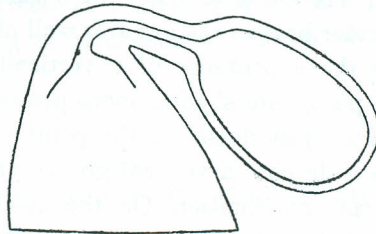


Fig. 1. *Pheretima capensis*. Ental end of spermathecal diverticulum, showing seminal chamber, neck and entalmost portion of the stalk, \times ca. 95.

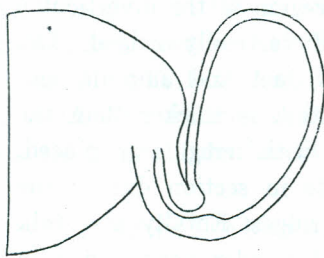


Fig. 2. *Pheretima capensis*. Ental end of another spermathecal diverticulum, \times ca. 95.

the gut and parietes and that the septum immediately in front of the vesicles of xi is in reality 9/10. However, the hearts of x are actually on the anterior face of the first post-gizzard septum and though bound to that septum by connective tissue, can be dissected off without rupturing the septum. Some distance in front of the hearts of x is the single asymmetrical heart of ix which should be closer to the first post-gizzard septum if the latter is, in reality, 9/10.

In xiii there is a pair of small pseudovesicles and in xiv there is a pair of rudimentary pseudovesicles.

The prostates extend through xvi or xvii to xix, xx, or xxi and are, apparently, normal (not rudimentary) in all of the specimens. The prostatic duct is about 2 mm long, with muscular sheen, bent into a u-shaped loop, and passes, within the parietes, into the male invagination anterolaterally. The male invagination is hemi-spheroidal, the dorsal wall slightly protuberant into the coelom, at the level of the lining of the coelomic cavity, or within the parietes and covered over from view by nephridia. From the anterior wall of the invagination there protrudes into the lumen a rather indefinite porophore on the dorsal face of which, within a tiny transverse slit, is the minute male pore. In some of the specimens the male porophore is more conspicuously protuberant than others and has the appearance of a short, posteriorly directed cone, attached by its broader base to the anterior wall of the invagination. In one worm the porophore has the appearance of a vertically placed protuberance on the anterior wall, the porophore slightly more protuberant dorsally than ventrally, the male pore located just dorsal to the point of greatest protuberance. From slightly below the male pore a vertical groove passes on the porophore nearly to the aperture of the invagination. On the median wall of each of two invaginations there is what appears to be a disc-like marking with a translucent face, slightly protuberant, a structure which was not recognized in other chambers and may be merely fortuitous.

The spermathecal duct is narrowed within the parietes, rather spindle-shaped to bulbous within the coelom, the ampulla bound down slightly around the ectal end of the duct so that the latter has the appearance of being invaginated into the ampulla. The lumen is narrow, straight and with smooth wall in the parietal portion, abruptly widened in the region of the diverticular junction and in the coelomic portion with the wall vertically ridged. The diverticulum is longer than the combined lengths of duct and ampulla and is bent, on each spermatheca, into a c-shape. The stalk is thicker than the duct and with thick wall, with no muscular sheen, with irregularly placed, very slight, annular constrictions, with lumen stellate in section due to the presence of five to seven or more high, longitudinal ridges. Entally the stalk is connected to the seminal chamber by a short and slender neck region in which the lumen is very narrow and with smooth wall. The seminal chamber is ovoidal to nearly spheroidal, small, narrower than the stalk, the lumen large

and with smooth wall. There is no spermatozoal iridescence in the seminal chambers of worms from the first tube but the iridescence is present in the seminal chambers of worms from the second tube.

Remarks. — The specimens described above are referred to *P. capensis* simply because the spermathecal diverticulum appears to be more like that described by HORST than that figured by PERRIER for *quadragenaria*. These two species, *capensis* and *quadragenaria*, have never been adequately defined and cannot, in spite of MICHAELSEN'S efforts, be satisfactorily distinguished from each other. It will be necessary in the future, to indicate clearly the characteristics of specimens referred to any of these or related species until such time as the various forms can be adequately defined and correctly named.

In view of our present lack of knowledge of so many important characteristics of the different forms involved in the *capensis-quadragenaria* complex, it will be of little value to attempt a detailed consideration of the synonymies. It may be noted, however, that characteristics by which MICHAELSEN (1922, p. 55-57) distinguishes *P. capensis* from the related forms, are found in the present specimens which MICHAELSEN himself referred to *quadragenaria*. (Vide also remarks under *P. quadragenaria* hereinafter).

The specific label in the tube is quite incorrect. *P. variabilis* was erected by HORST in 1893, and not by PERRIER. According to MICHAELSEN (1922, p. 59) *variabilis* is a synonym of *quadragenaria*.

***Pheretima dammermani* MICHAELSEN.**

Pheretima dammermani MICHAELSEN 1924, Treubia, vol. 5, p. 391. (Type locality, Krakatau. Types in the Buitenzorg Museum).

Material examined. — Two clitellate, undissected specimens labelled, "*Pheretima dammermani* MICH. (Type!) Krakatau. IV.1920. Leg. DAMM. No. 9.", two clitellate, undissected specimens labelled, "*Pheretima dammermani* MICH. (Type!) Krakatau, O. 25.IV.1919. Leg. SUNIER. No. 4.", one partially clitellate, undissected specimen labelled, "*Pheretima dammermani* MICH. (Type!) Krakatau, O. \pm 600 m 26.IV.1919. Leg. DC. v. LW. No. 5.", one clitellate, undissected specimen labelled, "*Pheretima dammermani* MICH. (Type!) Krakatau, O. 24.IV.1920. Leg. DAMM. No. 8.", four macerated, aclitellate specimens labelled, "Krakatau, O. I.33. Leg. DAMM.", eleven macerated, clitellate specimens from a tube labelled, "Krakatau, O. IV.34. Leg. DAMM."

External characteristics. — Length, 45-90 mm. Diameter, 3-4 mm.

The setae begin on ii on which segment there is a complete circle. The setal formulae are shown below.

vii.	viii.	xvii.	xviii.	xix.	iii.	viii.	xii.	xx.
18	18	12	6	11	36	46	48*	48*
18	16	12	8	12	39	48*	45*	52
17	19	11	6	12				
17	17	12	9	13				
17	17	11	7	12				
17	16	12	7	11				
17	19	14	8	14				

* Small gaps in the setal circles but in the gaps pits from which the setae have dropped or been pulled out.

The spermathecal pores are superficial, tiny, transverse slits, three pairs, on 6/7 - 8/9.

The male pores are minute and invaginate, each pore on a small, shortly conical body, protuberant into the lumen of a parietal invagination in a mesial direction from the lateral wall near the roof.

External genital markings are lacking.

Internal anatomy. — Septum 10/11 is membranous but, apparently, complete; 7/8 thin; 5/6 - 6/7 slightly thicker; 11/12 slightly thickened, more so than 12/13.

The intestine begins in xv. The intestinal caeca are simple, the margins slightly constricted by the septa through which the caeca pass.

The last pair of hearts is in xiii (5). All hearts of ix to xiii pass into the ventral vessel. The single heart of ix is on the right side (5).

The testis sacs are suboesophageal. In x there is usually a pair of testis sacs, separated from each other midventrally or in contact mesially but without communication. In one specimen in which the sacs are in apposition, an oval fenestra about as large as the testis is present in the midventral wall between the two sacs, the aperture with a smooth margin, the wall very slightly thickened around the margin of the aperture. In xi there is an unpaired testis sac (4) but in one specimen there is a pair of midventrally separated sacs each of which protrudes slightly in xii. The seminal vesicles are fairly large and in contact mesially above the dorsal blood vessel. The posterior vesicles push 12/13 back into contact with 13/14. The dorsal margins of the anterior vesicles are slightly incised by 10/11 which can be dissected off, with proper care, at least from the dorsal part of the vesicles. In two specimens septum 10/11 was successfully dissected off without rupture from the ventral portions of the vesicles. In this specimen at least, 10/11 is dislocated anteriorly into contact with the posterior margin of the gizzard by the vesicles of xi. Whether the failure to dissect off 10/11 from the ventral portions of the vesicles in other specimens is due to the poor preservation or to the penetration of 10/11 by the vesicles is not clear. A pair of small pseudovesicles in xiv, is present in two specimens, each pseudovesicle containing a brownish, granular material.

In xiii, in one specimen, there is a pair of smaller but whitish pseudovesicles. The prostatic duct is about 2 mm long, bent into a u-shaped loop, the ectal limb thicker than the ental limb. The duct passes into the lateral wall of the male invagination within the parietes. The roof of the invagination may be very slightly protuberant into the coelomic cavity but the lumen of the invagination is restricted to the parietes.

The spermathecal duct is shorter than the ampulla. The lumen is narrow and with smooth wall, slightly widened in the ectalmost portion and in the region of the diverticular junction. The diverticulum which is much longer than the combined lengths of duct and ampulla, passes into the coelomic portion of the duct just ectal to the ampulla. The diverticular stalk is longer than the seminal chamber and coiled in a regular, close helical (corkscrew) fashion. The wall of the stalk is thick, two distinct layers recognizable in cleared spermathecae, ridged internally, the ridges thick, longitudinal, 5 - 7 or more, the lumen stellate in section or the ridges may be less obvious or scarcely recognizable in which case the lumen is circular in section. The seminal chamber is shorter and thicker than the stalk and with thinner wall, looped irregularly or in part approximating to a regular zigzag arrangement, but not helically coiled like the stalk. Spermatozoa were found only within the seminal chamber.

Parasites. — Cysts are present and numerous within or on the nerve cord anteriorly.

Diagnosis. — Sexthechal, spermathecal pores superficial, very small, transversely slit-like, three pairs, on 6/7 - 8/9. Male pores minute and invaginate, each pore on a small, conical, mesially directed protuberance into the lumen of a parietal invagination from the lateral wall near the roof. Setae: VII/17-18, VIII/16-19, XVII/11-14, XVIII/6-9, XIX/11-14, 36-39/iii, 44-48/viii, 45-48/xii, 48-52/xx. First dorsal pore on 12/13. Length, 45-110 mm. Diameter, 3-5 mm. Segments, 83-90.

Intestinal caeca simple. Testis sacs ventral; of x paired, of xi unpaired. Spermathecal diverticulum passes into the ental portion of the duct just below the ampulla, diverticular stalk longer than combined lengths of duct and ampulla, helically coiled, seminal chamber shorter and slightly thicker, looped irregularly or in an approximation to zigzag.

***Pheretima fakfakensis* COGNETTI.**

Pheretima fakfakensis COGNETTI 1908, Bull. Mus. Torino, vol. 23, No. 584, p. 1. (Type locality, Fak-Fak, Dutch New Guinea, Types, two acelitellate specimens, in the British Museum).

f. *tetratheca* MICHAELSEN.

Pheretima fakfakensis f. *tetratheca* MICHAELSEN 1910, Abh. Senck. Ges. vol. 33, p. 254. (Origin? from Aru and Kei Islands. In the Senckenberg Museum?).

Material examined. — One clitellate, dissected and macerated specimen labelled "*Pheretima fakfakensis* Cogn. f. *tetratheca* MICH. Gn. Daab, Gr. Kei. 300 m IV.1922. Leg. H. C. SIEBERS.". Many of the internal organs had been removed.

External characteristics. — The pigmentation is a dark, purplish red, the unpigmented, setal bands clearly recognizable.

The setal formula is; vii/31, xvii/30, xviii/23, xix/32, 30/iii, 52/viii, 54/xii. The numbers are only approximate as setae have fallen out, to some extent at least, as a result of the maceration. Empty follicular pits were counted as setae. The segmental numbers were obtained by counting the setal follicles or follicular gaps in the musculature (but not the setae) visible on the coelomic face of the parietes.

The first dorsal pore is on 10/11 but is much smaller than the pore on 11/12.

The male pores are minute and superficial, each pore near the lateral margin of a translucent, nearly circular area. Each male pore area is on the concave median side of a thickly crescentic, whitish area with very sparsely distributed flecks of pigment.

The spermathecal pores are minute and superficial, transversely oval apertures, half way between the setae of their segments and the anterior intersegmental furrows, on vii and viii. Each pore is at the centre of a transversely oval, translucent area. Pigment is lacking on the presetal portions of vii and viii median to the lateral margins of the spermathecal pore areas though the postsetal portions of vii and viii are pigmented to a point median to the median margins of the spermathecal pore areas. There is a single female pore.

Genital markings are not recognizable.

Internal anatomy. — The spermathecal diverticulum is shorter than the combined lengths of duct and ampulla, passes into the duct ectally, at or within the parietes, and is slenderly club-shaped. The duct is narrowed within the parietes and entally has a wide lumen and rather thin wall. The spermatozoal mass appears to extend throughout the whole length of the diverticulum.

Remarks. — *P. fakfakensis* f. *tetratheca*, *P. invisita* COGNETTI 1913 and *P. kochii* COGNETTI 1913 (in part?) may all be synonyms of *P. annulata* (HORST) 1883. The description of the latter is very brief and, unfortunately, has never been amplified.

***Pheretima falcata* (HORST).**

Perichaeta falcata HORST 1893, Notes Leyden Museum, vol. 15, p. 316. (Type locality, Sikka, East Flores. Types in Rijks Museum, Leiden).

Pheretima quadragenaria MICHAELSEN 1924 (part), *Treubia*, vol. 5, p. 391. (Specimens with more than 20 spermathecal setae on viii and with 18 male setae on xviii).

Material examined. — One clitellate, undissected specimen from a tube labelled, "*Pheretima variabilis* (E. PERR.) Sebesi, Zuid. 27.IV.1921. Leg. DAMM."

External characteristics. — Length, 196 mm. Diameter, 7 mm.

The setae begin on ii on which segment there is a complete circle. The formula is; viii/23 + 3 (?), xvii/24, xviii/18, xix/23, 41/iii, 62/viii, 68/xii, 77/xx. Ventrally on segment viii there are three small gaps in the setal circle, each gap containing a pit from which the seta has been lost.

The first dorsal pore is on 12/13. There are no pore-like markings anterior to 12/13.

The clitellum is annular, not protuberant, extending from 13/14 nearly but not quite to 16/17; intersegmental furrows lacking, dorsal pores occluded but pit-like depressions still visible at the sites of the pores, no setae visible.

The spermathecal pores are small, transversely placed, crescentic slits, with the concave side of the slit facing anteriorly, two pairs, on 7/8 - 8/9.

The apertures of the copulatory chambers are transversely slit-like apertures with finely wrinkled margins.

Genital markings are lacking externally.

Internal anatomy. — Septum 8/9 is represented by a ventral rudiment only; 5/6 - 6/7 slightly muscular; 11/12 - 12/13 thickly muscular; 13/14 muscular; 7/8 membranous but slightly strengthened; 10/11 apparently absent or represented only by strands of connective tissue passing from the anterior seminal vesicles to the gut and the body wall; 9/10 probably present, rather membranous, displaced posteriorly.

The intestinal caeca are simple, the margins constricted slightly by the septa through which the caeca pass.

A pair of fairly large vessels pass from the dorsal trunk to the gizzard. Just in front of the first postgizzard septum is an unpaired heart, that of ix. On the posterior face of the first postgizzard septum but bound to the septum is a pair of hearts which must be the hearts of x. These hearts can be dissected off without rupturing the septum. Since these hearts are on the posterior face of the first postgizzard septum it appears to be necessary to regard this septum as 9/10 but displaced posteriorly. This septum is adherent to the anterior portion of the vesicles of xi. The last pair of hearts is in xiii. (Note. The relationship of the hearts of x to 9/10 is not quite normal as the hearts are usually some distance posterior to the anterior septum of their segment).

The testis sacs are paired. The sacs of x are ovoidal, vertically placed, with the larger, bluntly rounded end ventrally and the more pointed end reaching up nearly to the level of the dorsal face of the gut, located immediately behind the first post-gizzard septum, deeply indenting the mesial (that next to the gut) faces of the anterior seminal vesicles. The testis sacs of xi are smaller, suboesophageal, crowded by the anterior testis sacs against the anterior

face of 12/13. The vesicles are large and in contact mesially above the dorsal blood vessel. The anterior vesicles (covered by the first postgizzard septum) are in contact with the posterior margin of the gizzard. In xiii there is a pair of small pseudovesicles. In each of these vesicles there are small masses of brownish material similar in appearance to that of two, elongate, flat, thin, brown discs which were also found in xiii. In xiv there is a pair of rudimentary

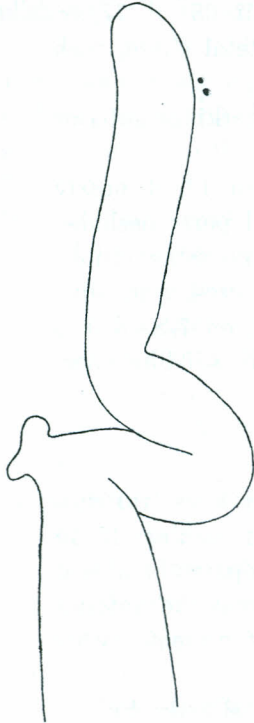


Fig. 3. *Pheretima falcata*. Spermathecal duct and diverticulum, \times ca. 95.

pseudovesicles. The prostates are small, almost restricted to xviii but reaching slightly into xvii and xix. The prostatic duct is about 2 mm long, bent into two shortly u-shaped quirks, and passes into the centre of the dorsal face of the copulatory chamber. The copulatory chamber is rather dome-shaped, elongately hemiovoidal, protuberant into the coelomic cavity to a height of $1\frac{1}{2}$ mm. The male pore is a tiny, triradiate aperture at the ventral tip of a very shortly conical protuberance into the lumen from the roof near the posterior wall. In the anterior wall of the chamber is a vertically columnar body, circular in section, with a softish centre that appears to be glandular. The column is slightly protuberant into the lumen of the chamber and along the centre of this protuberant portion there is a narrow, band-like, vertically placed, translucent genital marking.

The spermathecal duct is of about the same length as the ampulla, the latter bound down slightly around the ental end of the duct so that the duct has the appearance of being invaginated into the ampulla. The duct is gradually widened ectal to the diverticular junction and within the parietes. The lumen of the duct, ectal to the diverticular junction is transversely crescentic in section due to the projection into the lumen of a protuberance in the form of a half (vertical) column. The protuberance has a smooth, glistening appearance and terminates at one end just ectal to the diverticulum while at the other end it gradually diminishes in size in the parietal portion of the duct. Within the parietal portion of the duct the lumen gradually widens passing ectally. The diverticulum passes into the duct just ectal to the ampulla, opening into the duct lumen by a vertically slit-like aperture which can be revealed by carefully pulling the diverticulum off from the duct. The diverticulum is slightly longer than the combined lengths of duct and ampulla and is elongately sausage-shaped, with one or two bends. There is no definite external demarcation into stalk and seminal chamber. The wall is thickish and with a slight iridescence or sheen. Two diverticula were cleared and examined. One of these is bent twice, while the other is nearly straight. In the latter the sperm mass is elongate and with serrate margins. The lumen in the ectal portion of the diverticulum is empty, narrow and with

fairly smooth wall. In the other diverticulum, the lumen of the ental half (approximately only) is occupied by an elongate sperm mass with serrate margins as before but this mass is continuous through a narrow, short, rod-like portion with an almost ovoidal mass which occupies the lumen of the next quarter-length of the diverticulum. In this portion of the diverticulum the wall of the lumen is nearly smooth, the width of the lumen greater than the thickness of the wall. In the ectal quarter-length of the diverticulum the width of the lumen is less than the thickness of the wall. Although the inner face of the diverticular wall in this ectal portion at first appears to be fairly smooth, more careful examination shows what appear to be annular ridges. The sperm mass is not continued into the ectal quarter-length of the diverticulum.

Remarks. — *P. falcata* is known only from the types. HORST's description (1893) of course left much to be desired according to modern standards. MICHAELSEN later (1922, p. 57) examined two specimens from the Rijks Museum which are quite probably the types of *falcata* and filled in some of the gaps in the original description. MICHAELSEN agrees with HORST that septa 9/10-10/11 are lacking, points out that the copulatory chambers are "kreisrund" and notes that the Samen-raum of the spermathecal diverticulum is large, and "ganz einheitlich gestaltet", but fails to describe the interior of the copulatory chamber or to mention the stalk of the spermathecal diverticulum. The species cannot be adequately defined until we have further information with regard to the spermathecae, septa, and especially the copulatory chamber.

The Sebesi specimen described above appears to differ from *falcata* in the presence of 9/10, the reduction of 10/11, and the lack of an externally demarcated, diverticular stalk, but these differences can scarcely be regarded as sufficient justification for the erection of a new species at least at present.

P. floresiana MICHAELSEN 1934 cannot be satisfactorily distinguished from *P. falcata*. Both of these species are known (aside from the Sebesi specimen) only from Flores and from the types.

***Pheretima indica* (HORST).**

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

Pheretima quadragenaria MICHAELSEN 1924 (part) Treubia, vol. 5, p. 391. (Oothecal specimens only).

Material examined. — Three clitellate specimens from a tube labelled, "*Pheretima variabilis* (E. PERR.) Sebesi, N. IV.1921. Leg. DAMMERMAN.", three clitellate specimens labelled, "Krakatau, O. IV.34. Leg. DAMMERMAN.", and one clitellate specimen labelled, "Krakatau, IV.33. Leg. DAMMERMAN."

The setal formula of one of the specimens is: vi/13, vii/12, viii/13, xvii/12, xviii/8, xix/12, 26/iii, 39/viii, 37/xii, 41/xx.

On each spermathecal diverticulum, in addition to the usual, terminal seminal chamber, there is an extra, lateral seminal chamber.

The specimens from the tube labelled *P. variabilis* are quite characteristic and normal in all respects. (Vide GATES 1935, p. 83 - 89).

***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 the Amsterdam Museum).

Pheretima keiana MICHAELSEN 1924, Treubia, vol. 5, p. 394. (Type locality, Mount Daab, Groot Kei, Kei Islands. Types in the Buitenzorg Museum).

Material examined. — One specimen, opened by a ventral dissection, much macerated, possibly clitellate or partially clitellate, from a tube labelled, "*Pheretima fakfakensis* COGN. f. *tetratheca* MICH. Gn. Daab, Gr. Kei. 300 m IV.1922. H. C. SIEBERS."

External characteristics. — There are 6 spermathecal setae on viii. On xviii between the male pores there are four tiny pits that look like unusually small, setal pits but even with high magnification (32 mm objective) and brilliant illumination, setae cannot be definitely identified.

The first dorsal pore is on 12/13.

A region extending from 13/14 to 16/17 is quite different in appearance from the neighbouring segments and on the clitellar segments setae are not visible.

The male pores are minute, transversely placed, oval apertures and are not located on propophores or special areas.

The spermathecal apertures are tiny, transversely placed, oval openings, two pairs, on 7/8 - 8/9. Just within each aperture there are visible two tiny tubercles, one lateral and one median which give to the duct lumen, just within the parietes, a longitudinally slit-like appearance.

The genital markings are small, very slightly protuberant, with deep, concave faces that give each marking a crater-like appearance. Within the concave portion 2 - 4 transversely placed rows of fine pores are recognizable, so that the marking has a sieve-like appearance. Just behind each spermathecal pore, except on the right side of 7/8, there is a transversely oval marking. Just in front of the right spermathecal pore on 7/8 there is a transversely placed, crescentic marking. On the postsetal portion of x there is another transversely oval marking. The number of pores on these markings appears to be about half or less that of the postclitellar markings. Some of the postclitellar markings cannot be accurately located as the intersegmental furrows are no longer visible. There is a pair of markings on or near to each of intersegmental furrows 17/18, 18/19, and 19/20, a marking on the right side, on or near to 20/21, and another asymmetrical marking on or near to 16/17. These markings are all slightly lateral to the male pore lines but are not in regular longitudinal rows. On xviii there is a further pair of markings, postsetal, each marking just median and very slightly posterior to a male pore. The postclitellar markings are slightly larger than the preclitellar.

I n t e r n a l a n a t o m y. — The intestinal caeca are simple, apparently with the margins slightly constricted by the septa.

The prostatic duct is 2-3 mm long, the main portion spindle-shaped, with muscular sheen, a very short, ental portion bent into a tiny u-shaped quirk.

The spermathecal duct is somewhat shorter than the ampulla and sharply demarcated therefrom. The diverticulum is about as long as the combined lengths of duct and ampulla, is slenderly club-shaped and passes into the ental portion of the duct just below the ampulla.

R e m a r k s. — As a result of the maceration, important characteristics of internal structures, and in particular of the reproductive organs, cannot be ascertained. The specimen may possibly be one of the two types of *P. keiana*, at least the worm was collected at the same place, at the same time and by the same person as the types of *keiana*.

The specific name *omtrekensis* is, of course, etymologically absurd but certainly cannot be regarded as an error of transcription, a *lapsus calami*, or a typographical error (Article 19 of the code) as the word was deliberately formed from what appeared to the author to be the name of the locality from which the worm was secured. Since, "a specific name, once published, cannot be rejected, even by its author, because of inappropriateness" it is necessary to reject *homoeotrocha* which COGNETTI later (1914) substituted for *omtrekensis*.

***Pheretima posthuma* (L. VAILLANT).**

Perichaeta posthuma L. VAILLANT 1868, Ann. sci. nat. Ser. 5, vol. 10, p. 228.

(Type locality, Java? Types in the Paris Museum).

Pheretima posthuma MICHAELSEN 1924, Treubia, vol. 5, p. 394.

M a t e r i a l e x a m i n e d. — One clitellate, dissected specimen labelled, "*Pheretima posthuma* (VAILL.) Sebesi, N. IV.1921. Leg. DAMMERMAN.", and one clitellate, macerated specimen labelled, "*Pheretima posthuma* (VAILL.) Soemenap. 1906. Leg. v. KAMPEN."

The first postgizzard septum in each of these specimens is 8/9 as in Burmese individuals of the species.

***Pheretima quadragenaria* (E. PERRIER).**

Perichaeta quadragenaria E. PERRIER 1872, N. Arch. Mus. Paris, vol. 8, p. 122.

Type locality unknown. Types, two, in the Paris Museum).

Pheretima quadragenaria MICHAELSEN 1924 (part), Treubia, vol 5, p. 391. (Specimens with few spermathecal setae on viii).

M a t e r i a l e x a m i n e d. — One clitellate, undissected specimen from a tube labelled, "*Pheretima variabilis* (E. PERR.). Sebesi, Zuid. 27.IV.1921. Leg. DAMMERMAN."

E x t e r n a l c h a r a c t e r i s t i c s. — This worm is so similar to those referred on a preceding page to *P. capensis* that it will be sufficient to point out the differences only.

Length, 116 mm. Diameter, 5 mm.

The setal formula is: viii/4, xvii/19, xviii/10, xix/19, 41/iii, 37/viii, 67/xii, 69/xx. The low number of spermathecal setae as well as the low segmental number for viii is due to the presence of two wide gaps in the setal circle of the segment, extending from the spermathecal pore lines mesially. In removing the cuticle several setae were pulled out from the body wall and in making the counts on xii and xx, three or four pits on each segment from which setae appeared to have been just removed were numbered as setae.

The first dorsal pore is in 12/13. There are no pore-like markings anteriorly.

The clitellum terminates posteriorly in front of 16/17, extending perhaps over half or slightly more of xvi, but reaches anteriorly to 13/14.

The male pores are transversely slit-like, not crescentic, the margins finely wrinkled.

Internal anatomy. — Septa 11/12 and 12/13 are muscular and thicker than in the forms referred to *capensis*.

The testis sacs and seminal vesicles are as in *capensis*, except that the testis sacs of x apparently do not indent the median faces of the anterior seminal vesicles. The prostates extend through xvii-xxi and appear to be normal, not rudimentary. The prostatic duct has a muscular sheen, is erect, rather spindle-shaped and passes into the copulatory chamber laterally, at or within the parietes. The

Fig. 4. *Pheretima quadragenaria*. Ental end of spermathecal diverticulum, showing seminal chamber, neck and entalmost portion of the stalk, \times ca. 95.

copulatory chambers are rather dome-shaped, circular in section, protuberant into the coelomic cavity to a height of $1\frac{1}{2}$ mm, the wall thick and with muscular sheen. From the wall of the chamber there project conspicuously into the lumen five protuberances with smooth, glistening surfaces. One of these protuberances, from the lateral wall but rather anteriorly, bears on its dorsal face a transverse slit within which is the male pore.

The spermathecal diverticulum is longer than in *capensis* and is not c-shaped but somewhat spirally or irregularly twisted. The seminal chamber is rather pear-shaped and externally is not demarcated from the neck as clearly as in *capensis*. The sperm mass is also pear-shaped and extends down into the narrow, neck region.

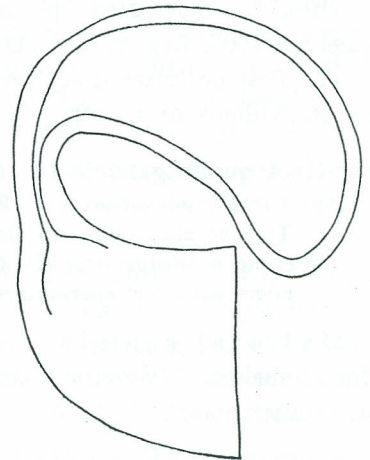


Fig. 5. *Pheretima quadragenaria*. Ental end of another spermathecal diverticulum, \times ca. 95.

R e m a r k s. — The specimen described above differs from the specimens referred, on a previous page, to *P. capensis* in several respects. These differences may or may not be of specific significance. As has been noted previously, *capensis* and *quadragenaria*, at present, cannot be satisfactorily distinguished from each other. MICHAELSEN's identification is accepted in this case simply because the spermathecal diverticulum appears to be more like that figured by PERRIER than that of *capensis*.

Many of the specimens which MICHAELSEN referred to *quadragenaria* (1922, p. 60) are quite obviously abnormal, lacking prostates and spermathecal diverticula or with stunted or deformed prostates, prostatic ducts, and spermathecal diverticula. Similar abnormalities are now known to be of rather frequent occurrence in certain species of *Pheretima*. It is at least possible that in the *capensis-quadragenaria* complex we have to do, at least in part, with a series of forms, each of which is more or less divergent from a specific norm that is not yet obvious.

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