

On Some Earthworms from East Perak and Christmas Island

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Genus	<i>Drawida</i> Michaelsen
	<i>Drawida</i> species
Genus	<i>Pheretima</i> Kinberg
	<i>Pheretima cameroni</i> Stephenson	1932
	<i>Pheretima campanulata</i> (Rosa)	1890	..	..
	<i>Pheretima houlletii</i> (E. Perrier)	1872	..	..
	<i>Pheretima indica</i> (Horst)	1883	..	..
	<i>Pheretima polytheca</i> (Beddard)	1900	..	..
Genus	<i>Perionyx</i> E. Perrier	..	..	..
	<i>Perionyx violaceus</i> Horst	1893	..	..
Genus	<i>Glyphidrilus</i> Horst	..	..	..
	<i>Glyphidrilus</i> species	..	..	..
List of species known from the Malay States, Singapore and Penang	..	..	..	..
List of species known from Christmas Island	..	..	..	..
References	..	..	..	..

The Director of the Raffles Museum has forwarded for examination a small collection of earthworms which contains representatives of but few species and, with only one exception, no novelties. The opportunity has been taken to incorporate in the report on this collection comments on a few of the Peninsular species together with a list of the forms known from this portion of the world.

The author's thanks are due to the Director of the Museum for the opportunity of examining the collection.

Genus *Drawida* Michaelsen.

Drawida species.

Kuala Legap, Plus Valley, E. Perak. March 1933.
1 juvenile specimen.

External characteristics.—Length, 29 mm. Diameter, 2 mm. Unpigmented.

The prostomium is prolobous, attached to the roof of the buccal cavity beneath intersegmental furrow 1/2.

The setæ begin on ii and are closely paired; $ab=cd$, in the midbody segments, $aa<bc$.

The spermathecal pores are minute, in 7/8, in or just median to c.

The male pores are minute, in bc but much nearer to b than c , on the ventral ends of small, conical porophores on which intersegmental furrow 10/11 is lacking. The porophore is formed by a protuberance from the posteriormost margin of x and the anteriormost margin of xi and extends from mid bc to b . The male pores are about in line with 10/11.

The nephridiopores are in d or just dorsal to d .

Genital markings are lacking.

Internal anatomy.—The gizzards are three, in segments xiv to xvi. The gut is very narrow in xx , abruptly widened to full intestinal diameter in xxi . The last hearts are in ix .

The testis sacs are firm and small, in 9/10, projecting equally into both ix and x . The vas deferens is, relative to the size of the worm, fairly thick and very long. It is twisted into a considerable mass of loops in ix at the side of the oesophagus, the massed loops in contact with both 8/9 and 9/10. There are further massed loops in x . The vas passes into the prostate well below the ental end of the latter. The prostates are erect, *i.e.*, not sessile or bound to the parietes and each comprises an ental, thickly sausage-shaped portion slightly bent into a crescentic curve and a narrower, much shorter stalk. The coelomic surface of the outer layer has an appearance suggestive of fine granulations but the layer is closely adherent to the central body and can be scraped off therefrom only with difficulty. The shape of the central body is approximately the same as that of the prostate before removal of the external layer. The central body is tough, with a thick wall and very narrow lumen which is circular in section. The prostates are large, relative to the size of the worm, that of the right side passes under the gut and into the left side of x ; that of the left side passes through the periesophageal annulus mesial to the ovarian chamber and into xii .

The ovarian chamber is probably horseshoe-shaped but is empty, *i.e.*, without free ova. The ovisacs are confined to xii and are also empty.

The spermathecal ampullæ are smallish but are filled with whitish material with a brilliant iridescence. The atria are tubular, shortly finger-shaped, erect on the anterior face of 7/8, with very short and slender stalks just at the parietes into which the spermathecal ducts pass. The atrium on the left side is probably abnormal (cyst-like bodies in its tissues) while the atrium of the right side may not have attained its definitive form.

Remarks.—The erection of a new species, especially in the genus *Drawida*, for a single, juvenile specimen of uncertain age, in which the spermathecal atria may be deformed as a result of the presence of parasites, cannot be justified. The worm

described above does, however, appear to be distinct from all of the Burmese Drawidas.

Species of *Drawida* which at present appear to be endemic are known from China, French Indo-China, Burma and India. One, apparently endemic species is known only from Victoria Point in the southernmost portion of the province of Burma. Although endemics may not be as frequent east of the occidental margin of the Shan Plateau as to the west, yet there is no reason immediately obvious for the absence of such species from the Peninsula and mainland Siam. Michaelsen would, of course, explain the absence of *Drawida* from the areas just mentioned in accordance with his theory of *Pheretima*-dominance, but the evidence for this theory is, at present, nothing more than the very fragmentary character of our knowledge of the earthworm fauna of south-eastern Asia. The failure of collectors hitherto to secure representatives of this important Asiatic genus in the Peninsula and in mainland Siam is due probably to a restriction of collecting to densely populated areas, cultivated land or other unfavourable localities.

Genus *Pheretima* Kinberg.

Pheretima cameroni Stephenson.

Pheretima indica var. *cameroni* Stephenson 1932, Bull. Raffles Mus. No. 7, p. 47. (Type locality, Tanah Rata, Pahang. Type in the British Museum).

Variety *cameroni* differs from *P. indica* (Horst) 1883 as follows.—(1) Larger setal numbers: vii/24; 49/v, 65/ix, 76/xii in contrast with vii/12-15; 32-42/viii, 40-44/xii, 38-43/xx. (2) Absence or rudimentary character of septum 8/9. (3) The annular, unpaired testis sac of x, in contrast to paired, ventral testis sacs in *indica*. (4) The unpaired, cylindrical testis sac of xi, in contrast to paired, suboesophageal testis sacs in *indica*. (5) The inclusion of the anterior seminal vesicles within the testis sac of xi. (6) Absence of copulatory chambers. (7) Junction of the diverticulum with the spermathecal duct close to the parietes, rather than near the ampulla. (8) Absence of a nephridial "fur" on the spermathecal duct.

There may be further differences in the male genital terminalia of xviii in the two forms, but the type of *cameroni* was "in very bad condition" and Stephenson did not indicate whether the male pores of his variety are to be regarded as superficial or invaginate. In either case the differences noted above certainly and clearly differentiate *cameroni* from *indica*.

Pheretima campanulata (Rosa) 1890.

Pheretima campanulata Stephenson 1930, J. F. M. S. Mus. vol. 16, p. 273.

Stephenson was not quite certain as to his identification of a specimen from Kuala Lumpur referred to this species.

Through the kindness of Dr. C. C. A. Monro this particular specimen which is in the British Museum has been examined by the writer. As a result it is possible to confirm Stephenson's identification. The Kuala Lumpur specimen is characterized by the biglandular arrangement in connection with each spermatheca, the trilobed ventral end of the penial body or male porophore in the copulatory chamber, and by the presence of penial setae in the wall of the copulatory chamber. Stephenson noted that "penial setae were not searched for" (p. 273). Penial setae are very rare in the genus *Pheretima* and in this particular case serve, at least so far as normal specimens are concerned, to differentiate *P. campanulata* from *P. houlleti* with which it has been confused.

Pheretima houlleti (E. Perrier) 1872.

Pheretima houlleti Stephenson 1932, Bull. Raffles Mus. No. 7, p. 45.

Stephenson notes, after a description of a specimen from Kuala Lumpur, and a reference to the two species *P. houlleti* and *P. campanulata*, that "The present specimen is about half way between the two; I choose the older name for it. It would seem to be still slightly doubtful whether the distinction between the two is as clear cut as Gates supposes." (p. 47). The three major characteristics distinguishing *houlleti* from *campanulata* are (1) the monoglandular apparatus in connection with each spermatheca, (2) the absence of penial setae in the wall of the copulatory chamber, and (3) the absence of the trilobulation of the ventral end of the penial body or male porophore within the copulatory chamber. Examination of long series of specimens has shown quite clearly that there is no intraspecific variation with respect to these three characteristics, at least so far as normal specimens are concerned. It is evident from Stephenson's description (note, monoglandular apparatus on each spermatheca and absence of penial setae) that his worms are to be referred to *P. houlleti*. No information is given as to the shape of the penial body but this is, perhaps, not of great importance in view of the definite evidence of the other two characters. The specimens as to which Stephenson was doubtful can be considered "half way between the two" species only so far as characteristics of minor specific importance which are known to vary within both species, are concerned.

Pheretima indica (Horst) 1883.

Perichaeta floweri Benham 1897, J. Linn. Soc. London, vol. 26, p. 217. (Type locality, Bukit Timah, Singapore. Types in the British Museum).

Pheretima floweri Michaelsen 1900, Das Tierreich, vol. 10, p. 267. *Pheretima floweri* Gates 1934, Rec. Indian Mus., vol. 36, p. 258 (After examination of the types).

Amyntas peregrinus Beddard 1900 (part), Fauna Hawaiiensis, vol. 2, p. 414. Proc. Zool. Soc. London, 1900, p. 644. (Excluding *peregrina* and *molokaiensis*).

Christmas Island. Aug.-Sept. 1932. 8 clitellate specimens.
Kuala Legap, Plus Valley, E. Perak. March 1933.
9 clitellate specimens.
River Yum, Plus Valley, E. Perak. March 1933.
3 clitellate specimens.

External characteristics.—Length, 75–170 mm. Diameter, 3–5 mm.

The setæ begin on ii on which segment there is a complete circle; more or less obviously enlarged on ii–ix or iii–viii, usually more conspicuously protuberant on iii–viii, gradually decreasing in size passing posteriorly. The setal numbers are indicated in the table below.

		SETAL FORMULÆ								
		vi	vii	viii	xvii	xviii	xix	xiii	xii	xx
1.	..	14	16	16	13	8	15	38	43	43
2.	..	12	13	14	13	10	**	37	40	40
3.	..	5(+4?)	15	14	14	8	13	42	44	41
4.	..	13	14	12	14	9	13	33	**	**
5.	..	12	14	16	13	8	14	37	44	41
6.	..	12	12	11	14	8	14	37	43	38
7.	..	10	6+	11	13	9	14	32	42	41
8.	..	12	12	13	13	10	15	40	40	**
9.	..	12	13	12	12	9	14	—	—	—
10.	..	11	13	12	13	9	14	—	—	—
11.	..	13	14	13	16	10	15	—	—	—
12.	..	11	14	13	—	8	—	—	—	—

(+4?)—4 setal pits in which no setæ are visible.

+—gaps in setal circle, no setal pits recognizable.

**—setæ not counted because of wide gaps in setal circle.

Formulæ 1 to 7 are of Peninsular specimens, 8 from a Christmas Island specimen, 12 from a type of *floweri*, 9 of a specimen from Lawai, Obi Island, Moluccas, 10 of a specimen from Ovalau, Levuka, Fiji Islands, 11 of a specimen from Batoran, Luzon, Philippine Islands.

The first dorsal pore is in 11/12 (1), 12/13 (10).

The clitellum is annular, extending from 13/14 to 16/17 or not quite reaching to 13/14 or 16/17 (3 specimens); setæ (except ventrally on xvi on the type of *floweri*), dorsal pores and intersegmental furrows lacking.

The external apertures of the spermathecal battery are small, less than 1 intersetal interval in width, transversely placed, slit-like to oval; 4 pairs, in 5/6–8/9.

There is but one female pore.

The apertures of the copulatory chambers are transversely slit-like to roughly circular; margins crenate.

Genital markings are lacking, externally.

Internal anatomy.—(Examined 15 specimens). Septum 8/9 is present and complete but membranous, almost perfectly transparent; 9/10 lacking; 10/11–13/14 slightly muscular.

The intestine begins in xv just anterior to 15/16 or in xvi immediately posterior to 15/16. The intestinal cæca are simple, extending from xxvii into xxiii, xxiv or xxv; margins smooth except for septal constrictions. In one specimen there are, posteriorly, three very small lobulations of the ventral margin of each cæcum.

The last pair of hearts is in xiii (15). There is a pair of hearts belonging to segment ix (1) or a single heart on the right side (7) or on the left side (7). There are no hearts or dorso-ventral commissures belonging to segment x. The hearts of ix, xi–xiii all pass into the ventral vessel.

The testis sacs of x and xi are ventral and paired, the members of a pair usually fairly widely separated but in several specimens the sacs of xi are separated by a distance only very slightly greater than the diameter of the ventral blood vessel. The seminal vesicles of xi and xii are each provided with a dorsal ampulla which has a bluntly round base sunk into a deep cleft in the dorsal margin of the ventral lamina, the ampulla tapering dorsally to an almost pointed termination. The pseudovesicles of xiii vary in size from rudimentary to about half the size of the seminal vesicles of xii. In number 3 each of the pseudovesicles of xiii has a dorsal ampulla with shape and attachment as in the vesicles of xii. The pseudovesicles of xiv are lacking or are represented only by tiny rudiments.

The prostates vary considerably as to size and segmental extent and are confined to xviii (2) or extend through xvii–xviii only (2) or xvi–xviii (1) or from xviii into xix, xx, xxiii or xxv. The duct is short, only about 2 mm. in length; straight or almost straight. The appearance of the copulatory chambers varies according to the degree of retraction or eversion. When fully retracted the chambers are rather conspicuously protuberant into the cœlum and elongately ovoidal but with both ends bluntly rounded. The chamber is partially imbedded in the parietes but can be dissected out rather easily except for a short stalk from the midventral face that encloses the passage to the exterior. From the roof of the copulatory chamber there hangs down into the lumen a slenderly conical penis about 2 mm. long. There is no pore at the ventral tip of the penis but on the posterior face of the penis, at the base near the roof of the chamber there is a very slight, vertical fissure the margins of which are in contact. On separation of the margins of this cleft the male bore becomes visible in a dorsal portion of the fissure. The male pore fissure is not easily distinguished at first glance from purely adventitious wrinkles on the surface of the penis but after examination of several specimens the fissure can be identified by slight differences which are extremely difficult to describe. The prostatic duct passes through the roof of the

copulatory chamber into the dorsal portion of the penis and this part of the male organ is firm and usually with a smooth surface. Ventral to the male pore the penis is softer, flabby, often with a semi-collapsed appearance and folded back on itself. In several specimens from the Peninsula the prostatic duct of one or of both sides passes into the copulatory chamber on the lateral face close to the parietes rather than into the middle of the dorsal face. In such chambers the penis is 'erected' or inverted and dorsally directed, the tip in contact with the roof of the chamber, the base of the penis attached ventrally and laterally to the wall of the chamber. In another specimen, also from the Peninsula, each penis has been compressed against the roof of the chamber and there flattened out into a disc-shaped body of longitudinally oval outline with little resemblance to a normal penis. If this particular specimen were an unique type, the species, almost certainly, would be erroneously characterized.

A large part of the copulatory chamber is taken up by two glands, one located in the anterior wall, the other in the posterior wall of the chamber. The external apertures of these glands are located in slight depressions at the centres of two, circular genital markings. The marking may be indistinctly delimited from the wall of the chamber or sharply demarcated; in the latter case the marking may be only slightly protuberant or conspicuously protuberant into the lumen and held out, as it were, from the wall on a broad but very short stalk. In a specimen in which the markings all have this stalked appearance the disc of each marking is folded lateromesially along a central axis into a deep vertical groove. The two grooves thus formed from the anterior and posterior genital markings are in contact in the middle of the chamber and surround the penis as a sort of sheath. The pore in the depression at the centre of each genital marking leads anteriorly or posteriorly into a small but irregular lumen at the centre of the gland. In a completely retracted copulatory chamber the glands do not appear to be different from those in the same locations in *P. montana*.

Several specimens have one or both copulatory chambers in various stages of eversion. An anterior or posterior portion of the stalk of the chamber may be everted as a rounded "tag", the anterior or the posterior genital marking may be protruded, or the penis and one of the markings may be visible externally. Both chambers of one worm are completely everted. Each male porophore on this worm has the appearance of a longitudinally placed, conspicuously protuberant disc, oval in outline and with a flattened ventral surface from which project two stalked genital markings and the penis. The markings are towards the median side of the porophore, the penis towards the lateral side and about equidistant from each of the markings. Internally, in

this specimen, there is no evidence of the existence of copulatory chambers, the prostatic duct passing directly into the parietes as in species with superficial male pores.

The spermathecal ampulla is small and joined to the apparently thicker and actually longer duct by a narrow neck. Mixed throughout the whitish material within the ampulla are soil particles. The neck and an ental part of the duct including the diverticulum-duct junction is covered over by a "fur" of nephridia. The thickness of this fur is variable. The nephridia and associated connective tissue can be dissected off from the duct and must be removed in order to demonstrate the neck. An ental portion of the duct is barrel-shaped. Deep within the parietes the duct is usually abruptly narrowed, the narrowed portion anteroposteriorly compressed. In one, slightly macerated specimen the duct is not, apparently, abruptly narrowed in the outermost portion of the parietes. After separation of the longitudinal muscle fibres the duct can be pulled out from the parietes leaving a transversely oval aperture with smooth margin in the epidermis. In specimen four the margins of the spermathecal pores are swollen and conspicuously protuberant, the aperture between each pair of tumescences transversely crescentic but here too the aperture left in the epidermis after pulling out the duct is oval.

The wall of the duct is thick, the lumen eccentric, small and in section crescentic. The position and shape of the lumen results from the development of a strong vertical thickening of a portion of the wall into an internal ridge that is bluntly rounded. A cross section through the duct entally shows the ridge on the lateral wall.

Further ectally a section through the duct shows the ridge or thickening anterolaterally while still nearer the parietes the thickening may be almost if not quite anterior.

The diverticulum is small and consists of an ovoidal, terminal seminal chamber and a longer but very slender stalk. The latter passes into the duct below the neck but quite definitely dorsal to the parietes. Supernumerary seminal chambers (lateral) are present in all of the Christmas Island specimens that were opened, the number of these chambers varying from one to three. An occasional spermatheca may have only the terminal chamber. There are no accessory chambers in the specimens from the Moluccas, the Fiji Islands and the Philippines that were compared with the Raffles Museum specimens. The Peninsular forms may be characterized by either of the conditions just mentioned or by various phases of a condition intermediate between these two extremes, as shown below. (Peninsular specimen # 1). Two lateral seminal chambers on each diverticulum of the spermathecae of viii and ix, no extra chambers on

the diverticulae of spermathecae of vi and vii. (2) Extra chambers present on the diverticula of some spermathecae, lacking on others. All lateral chambers are small, transparent or with spermatozoal iridescence. The ental end of the main seminal chamber is normal, bilobed or trilobed. (3) Terminal seminal chambers unusually large, ental ends normal; no lateral seminal chambers. (4) Each diverticulum has one or two extra seminal chambers; none of the chambers, either lateral or terminal, with spermatozoal iridescence. (5) Each diverticulum has one, two or three accessory chambers. (6) Each diverticulum has one, very small, scarcely recognizable, lateral seminal chamber. (7) No lateral seminal chambers, stalks of lateral seminal chambers present but without trace of terminal dilation.

The supernumerary chambers appear at first glance to be very shortly stalked, almost sessile on the stalk of the terminal chamber. Removal of connective tissue is, however, usually possible, thereby disclosing more ectal portions of the secondary stalks that pass ventrally for varying distances on the main stalk. Two or three lateral seminal chambers are always arranged in a vertical row on the main stalk just below the terminal chamber. No instances of alternate arrangement of the lateral chambers were found.

One or both of the ovaries may be hypertrophied as the result of the presence of numbers of small parasites, the enlarged gonads reaching to or nearly to the dorsal parietes. The oviducal funnels are narrowly ribbon-shaped strips placed vertically on the anterior face of 13/14. Toward the ventral end of the band or strip is a depression which is, presumably, the opening of the funnel.

Parasites.—In number three (Peninsular) there are numerous, very small, whitish, ovoidal cysts in the coelomic cavities of several segments. Ovarian parasites have been noted above.

Diagnosis.—*Pheretima indica* can now be defined as follows. Octothecal: external apertures of the spermathecal battery transversely oval, less than 1 intersetal interval in width, 4 pairs, in 5/6-8/9. Setae: vi/9-14, vii/12-16, viii/12-16, xvii/12-16, xviii/8-10, xix/13-15; 32-42/viii, 40-44/xii, 38-43/xx. First dorsal pore in 12/13. Male pores invaginate, each pore in a vertical fissure on the posterior face and near the base of a slenderly conical penis protuberant into the lumen of the copulatory chamber from the roof. No external genital markings, an anterior and a posterior, circular, genital marking within each copulatory chamber.

Septum 8/9 present, membranous. Intestinal caeca simple. Hearts of x lacking. Testis sacs of x and xi paired and ventral.

Genital marking glands imbedded within the anterior and posterior walls of the copulatory chamber. Spermathecal ampulla shorter than the barrel-shaped, thick-walled duct. Diverticulum small; seminal chamber ovoidal and shorter than the slender stalk, lateral seminal chambers present or absent, stalk into duct entally.

Remarks.—Octothecal forms with spermathecal pores in 5/6-8/9, well developed copulatory chambers, without external genital markings have been referred by various authors to different species; *cingulata* Schmarda 1861, *darnleiensis* Fletcher 1886, *vallanti* Beddard 1890, *martensi* Michaelsen 1892, *padasensis* Beddard and Fedarb 1895, *coa* Rosa 1896, *madelinae* Benham 1897, *floweri* Benham 1897, *belli* Rosa 1898, *decipiens* Beddard 1912, *kuchingensis* Stephenson 1916. Michaelsen (1922 and 1928) has suppressed all of these names except *floweri*, *belli* and *decipiens*. Now that the characteristics of the male genital terminalia of xviii in *indica* are known there is no longer any justification for the retention of *floweri*. *P. belli* cannot be distinguished at present from *indica* by any characteristics of specific importance and probably should be suppressed. *P. decipiens* is inadequately characterized but is almost certainly, in part, if not entirely, synonymous with *indica*. Both Michaelsen and Ude regard *atheca* Rosa 1896 as a synonym of *indica*, but it might be regarded with almost equal justification as a synonym of *campanulata*. Stephenson's variety of *indica* is specifically distinct (*vide P. cameroni* on a previous page).

Pheretima polytheca (Beddard) 1900.

Amyntas minutus Beddard 1900, Proc. Zool. Soc. London, 1900, p. 906. (Type locality Aring, Kelantan. Holotype in the British Museum).

Pheretima minuta Stephenson 1932, Ann. Mag. Nat. Hist. ser. 10, vol. 9, p. 222. (After examination of the holotype).

No differences of specific importance are apparent in the original descriptions of *polytheca* and *minuta*. Beddard's definitions of the two forms are almost identical. Stephenson, after examination of the types of both species was, apparently, unable to record any characteristic that might enable discrimination between the two forms. *P. polytheca* has page priority over *P. minuta*.

Genus *Perionyx* E. Perrier.

Perionyx violaceus Horst 1893.

River Yum, Plus Valley, E. Perak. March 1933. Under wet leaves on a flat rock by the edge of the River Yum. 10 clitellate specimens or anterior fragments.

River Yum, Plus Valley, E. Perak. March 1933. 5 clitellate specimens.

External characteristics.—Length, 37–65 mm. Diameter, 2 mm. Colour, reddish with a dark, blueish tinge dorsally. The first dorsal pore is in 4/5.

The clitellum is whitish, annular and extends from 12/13 to 16/17; intersegmental furrows and setæ present but dorsal pores occluded.

The spermathecal pores are two pairs, in 7/8–8/9, the pores close to the midventral line; on segment viii one or two setæ between the spermathecal pore lines. The single female pore is presetal and median on xiv.

Midventrally on segment xviii there is a relatively deep, depressed area. The depression may be longitudinally oval in outline but when most sharply demarcated is diamond shaped, the long axis of the depression in the midventral line. The depression extends across the entire length of xviii. The equatorial band on which the setæ are located is continued, on each side, into the depression as a slight ridge, the ridges reaching almost to the midventral line. On some specimens the medianmost portion of each of these ridges appears to be cut off as a circular protuberance, almost a papilla. At the centre of each of these papillæ or the corresponding portion of the uninterrupted ridge is a tiny aperture, presumably the male pore.

There are no other genital markings.

Internal anatomy.—(Examined four specimens). The gizzard is rudimentary. The gut is narrow and not clearly differentiated from the œsophagus through segment xviii, widening rather gradually in xix, attaining its maximum diameter only in xx.

The last pair of hearts is in xii.

The testes and male funnels are free, in x and xi. Segment x is filled with a testicular coagulum closely compacted into a single whitish mass that is adherent to the parietes, gut and septa and which resembles an annular or horseshoe-shaped testis sac. Segment xi is similarly filled by a closely compacted adherent mass of coagulum in which are imbedded the small, lobulated, seminal vesicles of the segment. The coagulum must be broken up to find these vesicles. The seminal vesicles of xii are larger and without marked lobulation, in contact middorsally above the gut; either extending into xiii or pushing 12/13 back into contact with 13/14. The prostates are confined to xviii. The prostatic duct is about 1½ mm. long, slightly looped or spirally twisted, slender entally, thickened ectally, a small portion just at the parietes almost conical in shape.

The spermathecae are relatively large and reach to the dorsal parietes but do not come into contact middorsally. The ampullæ

which are distended by a dull, whitish material within are almost sessile on the parietes, near which they are gradually narrowed; a duct scarcely recognizable as such until just at the parietes at the diverticular junction. The diverticulum is of the same shape and about half as large as the spermatheca. There is no definite, external demarcation into stalk and seminal chamber except for a very short, stalk-like portion close to the duct. The seminal chamber is filled with a whitish material characterized by a brilliant iridescence. The diverticulum of each spermatheca is on the lateral (opposite to median) side.

Genus *Glyphidrilus* Horst.

Glyphidrilus species.

River Yum, Plus Valley, E. Perak, March 1933. Under wet leaves on a flat rock by the edge of the River Yum. 9 tail portions or fragments from the posterior portion of the body.

The characteristic conformation of the body and the setal distribution enables the reference of these fragments to the genus *Glyphidrilus*. Only one species of this genus has been recorded from the Peninsula, *G. Malayanus* Michaelsen 1902, erected for two specimens only one of which is complete. In spite of the fact that these worms "zu Millionen unter Wasser lebend" only the two types have been available for study. The species doubtless is, like others of the genus, extremely variable and in consequence cannot be adequately characterized until more is known of the extent of variation of certain important characteristics. In connection with this species Michaelsen remarks (1902, p. 37) "Es muss bei dieser Sachlage bedauerlich erscheinen, dass der Sammler dieser Art von den Millionen Thieren, die ihm zur Verfügung standen, nur zwei mitnahm; aber auch für diese zwei Exemplare sei ihm Dank gesagt."

G. malayanus is distinguished, at present, from the Burmese *G. papillatus* by the absence of the seminal vesicles of ix, the restriction of the spermathecae to paired groups of two rather than paired groups of five and the absence of spermathecal pores in 13/14.

LIST OF THE SPECIES OF EARTHWORMS HITHERTO RECORDED FROM THE MALAY STATES, SINGAPORE AND PENANG

Megascolex mauritii (Kinberg) 1867.

Kuala Lumpur, Selangor; Singapore.

Pheretima

**aridgeana* (Beddard) 1900.

Aring, Kelantan. (Known only from the types).

- **baruana* Stephenson 1932.
Khota Baru, Kelantan. (Known only from the types).
- bicineta* (E. Perrier) 1875.
Penang.
- **bipora* (Beddard) 1900.
Malay Peninsula. (Type locality unknown. Known only from the types).
- **brinchangensis* Stephenson 1932.
Brinchang Road, Pahang. (Known only from the types).
- **cameroni* Stephenson 1932.
Tanah Rata, Pahang. (Known only from the holotype).
- campanulata* (Rosa) 1890.
Kuala Lumpur, Selangor.
- **dunckeri* Michaelsen 1902.
Lubok Paku, on the Pahang River. (Known only from the types).
- hawayana* (Rosa) 1891.
Kuala Lumpur, Selangor; Singapore.
- houletti* (E. Perrier) 1872.
Aring, Kelantan; Kuala Lumpur, Selangor.
- indica* (Horst) 1883.
Aring, Kelantan; Batu Caves, Selangor; Fraser's Hill, Pahang; Gunong Pulai, Johore; Plus Valley, E. Perak; Singapore.
- **malayana* (Beddard) 1900.
Aring Kelantan. (Known only from the types).
- morrisi* (Beddard) 1892.
Penang.
- peguana* (Rosa) 1890.
Singapore and Penang.
- planata* Gates 1926.
Kuala Lumpur, Selangor.
- **polytheca* (Beddard) 1900.
Aring, Kelantan. (Known only from the types).

- posthuma* (L. Vaillant) 1868.
(Recorded by Beddard from the Malay Peninsula, no definite locality stated).
- **pulauensis* (Beddard) 1900.
Pulau Bidan, Kedah. (Known only from the types).

Perionyx

- excavatus* E. Perrier 1872.
Kuala Lumpur, Selangor; Tanah Rata, Pahang; Taiping.
- violaceus* Horst 1893.
Fraser's Hill, Pahang; Plus Valley, E. Perak.

Octochaetoides

- fermori* (Michaelsen) 1907.
Kuala Lumpur, Selangor.

Dichogaster

- bolau* (Michaelsen) 1891.
Kuala Lumpur, Selangor.
- modiglianii* (Rosa) 1896.
Kuala Lumpur, Selangor.
- saliens* (Beddard) 1892.
Singapore and Penang.

Ocnerodrilus

- occidentalis* Eisen 1878.
Singapore.

Eukerria

- kükenthali* Michaelsen 1908.
Batu Caves, Selangor.

Pontoscolex

- corethrurus* (Fr. Müller) 1857.
Kuala Lumpur, Sungei Buloh, Selangor; Tanah Rata, Pahang; Gunong Pulai, Johore; Taiping Hills; Penang and Singapore.

Glyphidrilus

- malayanus* Michaelsen 1902.
Lubok Paku, Pahang River.

Listed above are twenty-nine species. Of this number, twenty must be considered, according to present standards, as having very little or no zoogeographical significance. The remaining nine species (marked with an asterisk) all belong to the genus *Pheretima*. Each of these species is known only

from the types and from the type localities. The absence of *Drawida* from the list has already been commented upon in an earlier portion of this paper. That there is much yet to be done in connection with working out the earthworm fauna of the region under consideration must be obvious. It may perhaps be permissible to express the hope that this can be attempted before the growth in population, the increase of cultivation and the extension of other unfavourable influences have too greatly affected the character of this fauna.

Although Christmas Island is included politically within the Straits Settlements it is at some distance from the mainland and intervening between it and the mainland is the island of Java. The species from Christmas Island are accordingly listed separately. With the single possible exception of *Pheretima brevis*, all species on this list are widely spread, peregrine forms.

EARTHWORMS OF CHRISTMAS ISLAND

Pontodrilus

- bermudensis* Beddard 1891.
matsushimensis Iizuka 1898.

Pheretima

- bicineta* (E. Perrier) 1875.
 **brevis* (Rosa) 1898.
 (Known only from the types and only from
 Christmas Island.)
indica (Horst) 1883.
posthuma (L. Vaillant) 1868.
rodericensis (Grube) 1879.

Ramiella

- cultrifera* Stephenson 1931.

Dichogaster

- bolau* (Michaelsen) 1891.
papillata (Eisen) 1896.
saliens (Beddard) 1892.

Eukerria

- kükenthali* (Michaelsen) 1908.

Pontoscolex

- corethrurus* (Fr. Müller) 1857.

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