

Earthworms from the Malay Peninsula

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Genus DRAWIDA Michaelsen 1900

Drawida malayana sp. n.

Drawida sp. "C", Gates 1936, Bull. Raffles Mus., 12, p. 90. (Kuala Terla, Telom Valley, Pahang).

Material examined.—34 specimens, some of which are mature, labelled, "Cameron Highlands, Pahang, F. M. S.", and 1 acitellate specimen labelled, "Ginting Kial, Cameron Highlands, Pahang. 5/37."¹

External characteristics.—Length, to 95 mm. Diameter, to 4 mm. The worms have a nondescript brownish appearance relieved by an occasional patch that appears to be unpigmented and whitish, but a blue pigment is visible in the parietes at cut surfaces.

The setæ certainly begin on ii but not all of the setæ of that segment are recognizable. On xx, *ab* and *cd* about equal,

¹ The material collected in the Cameron Highlands was obtained mostly at altitudes between 4,500 and 5,500 feet.

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aa about equal to or slightly smaller than *bc*; setæ small and closely paired.

The nephridiopores of iii-ix are usually dorsal to *d* but the distance from *d* varies segmentally and individually. The pores of x and xii have not been found. On xi the pores are usually on *b* quite definitely posterior to 10/11, about a quarter of the distance from 10/11 to the transverse setal line: both pores on *b* (11 specimens); one pore on *b*, the other pore on *cd* (2 specimens) or not found (1 specimen). From xiii posteriorly the pores may be on or close to *b*, on or near to *cd*, or dorsal to *d*. On the Ginting Kial specimen the left pore of xiii is on *d*, the right pore dorsal; the left pore of xiv dorsal, the right on *b*; both pores of xv dorsal; the left pore of xvi on *d*, the right pore on *b* (position of pores with relation to longitudinal setal lines approximate, not exact).

Clitellar colouration is not recognizable on any of the worms. One specimen that was suspected of being clitellate was found on dissection to have the epidermis thickened on a region extending from the postsetal secondary furrow of ix to 14/15. Some of the specimens are certainly mature sexually, and probably would have shown a clitellar colouration had preservation been satisfactory.

The spermathecal pores are minute and superficial, on 7/8, in mid *bc* but probably a trifle nearer to *b* than to *c*, exact location rather hard to determine because of difficulty in recognizing the setæ. The margins of the apertures are very slightly tumescent.

The secondary male apertures are small, transversely placed slits, on 10/11, just lateral to *b*. The posterior margin of x and the anterior margin of xi from *a* or *b* to or nearly to mid *bc* swollen and lip-like, the lips not definitely demarcated except at 10/11. On separating these tumescences the secondary male aperture becomes visible, the aperture just lateral to *b*, on 10/11, usually transversely slit-like, occasionally longitudinally placed. The apertures open into small parietal invaginations. On the anterior wall of the invagination in favourable specimens there is visible a tiny, rather conical protuberance on the pointed tip of which is a minute, greyish translucent spot. As the vas deferens has been traced into the conical protuberance, the translucent spot at the tip may be assumed to mark the site of the primary male pore.

The female apertures are probably within transversely placed, slit-like depressions on xii, just lateral to *b*, the depression usually about a quarter of the distance from 11/12 towards the transverse setal line, occasionally about half way, rarely nearer to the transverse setal line than to 11/12.

The genital markings, recognizable even on the juvenile specimens, are nearly circular, paired, segmental, each marking with a greyish translucent, central area and a fairly wide, slightly protuberant, opaque, marginal band. Of the worms on which genital markings are definitely recognizable 32 have a pair of markings on viii, the markings on the anterior half of the segment and in the median portion of *bc*, the lateral margin of the marking often in or about in line with the spermathecal pore. Three of these worms have one or two additional markings as follows: one marking on the anterior half of ix, right side, middle portion of *bc* (1 specimen); one marking on the anterior half of x, left side middle portion of *bc* (1 specimen); one pair of markings on xi, primarily postsetal, about in line with the secondary male pore tumescences (1). One mature specimen lacks genital markings.

Internal anatomy.—Septa 5/6–8/9 are thickly muscular; 9/10 thin and displaced posteriorly.

The gizzards are in xiii–xx as follows: xiii–xvi (2 specimens); xiv–xvii (4), xiv–xvii but gut whitish and muscular in xii–xiii (1); xiv–xviii (1), xiv–xx, rudimentary in xiv (1). The intestine is without any trace of a typhlosole.

The last pair of hearts is in xiii (9).

The testis sacs are spheroidal or ovoidal or flattened, mainly in x, a small portion in ix, the sac not constricted by 9/10. The vas deferens is quite short, 6–9 mm. long, in two long hairpin loops, or in several shorter loops. The vas passes into the parietes at the anteromedian margin of the prostate (8) or (1 specimen) definitely median to the margin of the prostate. Deep within the musculature of the body wall the vas passes, without notable widening, into the tiny papilla on the anterior wall of the male pore invagination. The prostate is an acinous patch of circular outline of small ovoidal or pear-shaped bodies scarcely protuberant into the coelomic cavity.

Segment xi is reduced to a horseshoe-shaped ovarian chamber. The chamber is distended with ova (one specimen with juvenile ovisacs, two specimens with distended ovisacs), or collapsed (three specimens with distended ovisacs). The ovisacs extend into xiv (3 specimens), xv (2), xvi (1), or are juvenile and in xii or xii–xiii only.

The spermathecal ampullæ of mature specimens are filled with an opaque whitish material in which spermatozoal iridescence is unrecognizable. The duct, 5–6 mm. long, is twisted into several loose loops just underneath the ampulla and then passes straight ventrally bound against or actually within septum 7/8. Within the parietes the duct is only very slightly widened so that an atrium may be said to be lacking.

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A tough body with a greyish translucent appearance is protuberant into the coelomic cavity of viii above each genital marking, apparently interrupting the longitudinal musculature.

Remarks.—*D. malayana* is somewhat like *D. rara* Gates 1925 from Burma from which it is distinguished by the more median location of the spermathecal pores, the invaginate male pores, the location of genital markings on viii, and the genital marking glands.

Genus PHERETIMA Kinberg 1867

Pheretima brinchangensis Stephenson

Pheretima brinchangensis Stephenson 1932, Bull. Raffles Mus., 7, p. 42. (Type locality Brinchang Road, Cameron Highlands, Pahang. Types in the British Museum).

Pheretima brinchangensis Gates 1936, Bull. Raffles Mus., 12, p. 92. (Diagnosis).

Material examined.—10 juvenile and 7 clitellate specimens labelled, "Cameron Highlands, Pahang, F. M. S.", and 6 acitellate and 3 clitellate specimens labelled, "Ginting Kial, Cameron Highlands, Pahang, 5/37."

Clitellate specimens are 27-90 mm. long, 2-4 mm. thick. A juvenile specimen 19 mm. long (incomplete posteriorly?) and 1 $\frac{3}{4}$ mm. thick is identifiable as a result of the presence of rudiments of spermathecal pores.

The gut, in x-xiii, is provided internally with a series of vertically placed ridges, lacking only at the mid-dorsal and mid-ventral regions where there are low, longitudinally placed ridges. In the anterior portion of xv the gut is narrow, the inner wall provided with a series of low longitudinally placed whitish ridges. A typhlosole is practically unrecognizable in one worm, except in the first six postcaecal segments. In the largest worm the typhlosole is a very low ridge, only slightly accentuated in the postcaecal segments, that terminates abruptly in segment 1. In two other specimens the typhlosole terminates in xlvi and xxxiv.

The left copulatory chamber of one of the Ginting Kial specimens is completely everted, the minute male pore visible on the rather bluntly pointed tip of the everted chamber.

Pheretima cameroni Stephenson.

Pheretima indica var. *cameroni* Stephenson 1932, Bull. Raffles Mus., 7, p. 47. (Type locality Tanah Rata, Cameron Highlands, Pahang. Type in the British Museum).

Pheretima cameroni Gates 1936, Bull. Raffles Mus., 12, p. 96. (Diagnosis).

Material examined.—Two clitellate specimens labelled "Cameron Highlands, Pahang, F.M.S.

Mus. 14, 1938.

External characteristics.—Length, 174–192 mm. Diameter, 6–7 mm. Pigmentation of dorsum red. Setæ: vi/19+?, vii/17+, viii/16+, xvii/21, xviii/12, xix/22, 12/ii, 28/iii, 54+/viii, 65/xii, 66/xx, 4/xiv, 1/xv, 8/xvi; vi/20, vii/16+, viii/21, xvii/20, xviii/13, xix/21, 20+/ii, 24/iii, 52+/viii, 65/xii, 60/xx, 0/xiv, 0/xv, 8/xvi (+ indicates presence of gaps in which setæ are lacking). Clitellar setæ are not all ventral on the second specimen.

The first dorsal pore is on 12/13 (2).

The spermathecal pores of one specimen are definitely on the intersegmental furrows, each pore on a tiny almost circular, slightly protuberant area. One of the pores on this specimen is covered over by a thin, almost transparent lid-like membrane from the posterior margin. On the other worm the spermathecal pores appear to be slightly though definitely behind the intersegmental furrows, each pore slit-like or crescentic in appearance with the concave side of the crescent directed anteriorly. Each pore is covered or nearly covered by a lid-like membrane attached at the posterior margin of the aperture.

Each male pore is within a very tiny, transversely placed fissure at the centre of a male pore area, the central portion of the area very slightly protuberant.

Internal anatomy.—Septa 5/6–6/7 and 10/11–12/13 are slightly muscular, 13/14 very slightly muscular but more opaque than 7/8 which has but few muscular fibres and is almost transparent; 8/9–9/10 lacking.

Masses of nephridia are present on the anterior face of 5/6 and 6/7. Blood glands were not recognized. Lymph glands are not recognizable until at xlii, apparently intermittent until liii from whence posteriorly the glands are larger and readily visible.

The gut, in x–xiii, is provided internally with a series of vertically placed, conspicuous, reddish ridges, lacking only at the mid-dorsal and mid-ventral regions where there are low, longitudinally placed, whitish ridges. The intestine is not clearly marked off from the œsophagus, the gut in xiv and the anterior portion of xv distended with food, thin walled and without ridges. The typhlosole begins rather abruptly in the cæcal segment, gradually decreasing in height posteriorly.

The single heart of ix is on the right side (1) or the left side (1). The hearts of xii and xiii are quite clearly latero-intestinal.

The ventral portion of the annular testis sac of x is distended conspicuously and bulged anteriorly so that there appears to be, at first glance, a rather large subœsophageal testis sac. After

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removal of parasites the dorsal portion of the annular sac is recognizable but is nearly empty. The nerve cord is included within the sac of xi. The prostate duct is about 4 mm. long, muscular, nearly straight.

The lumen of the spermathecal duct is small, transversely slit-like in cross section, gradually narrowed passing ectally, ectal to the diverticular junction very narrow and nearly uniform in width. The diverticular stalk is straight or nearly so, slightly or variously bent, passing into the anterior face of the duct at the parietes, just reaching up onto the spermathecal ampulla. The simple, ellipsoidal seminal chamber is sharply marked off from the stalk. The diverticulum of the left posterior spermatheca of one specimen is abnormal the seminal chamber represented only by an opaque knob sharply marked off from but only slightly thicker than the stalk. The seminal chambers of one worm are characterized by a strong spermatozoal iridescence. The seminal chambers of the other worm have only slight traces of spermatozoal iridescence and are thickly spotted with minute black flecks.

On the celomic face of the parietes of v and vi are circles of brownish spots, one spot within or close to each setal gap in the longitudinal musculature.

Pheretima eluta Gates.

Pheretima eluta Gates 1936, Bull. Raffles Mus., 12, p. 99. (Type locality Gunong Brinchang, Pahang. Type in the Raffles Museum).

Material examined.—5 clitellate specimens labelled "Cameron Highlands, Pahang, F. M. S."

External characteristics.—Length 36-49 mm., Diameter 2-3 mm. Pigmentation red on the dorsum (? alcoholic preservation).

The setal formulæ are shown below:—

vi	xvii	xviii	xix	ii	iii	viii	xii	xx
10	7	5	10	20	29	32	34	38
11	8	3	8	18+	25+	39	40	38
10	9	7	17	17+	23+	30	32	34
10	8	0	11	37	34	37
11	8	6	8	16+	27	36	38	33

The first dorsal pore is on 12/13 (5).

The annular clitellum extends from 13/14 to 16/17; intersegmental furrows, dorsal pores and setæ lacking. There is a single female pore (5).

The genital markings are located as shown below.—

- No. 1.—One pair of markings on viii, primarily postsetal but interrupting the setal circle; 1 pair, postsetal on xvii but interrupting the setal circle; 1 marking on 17/18 (?) just median to the male pore line, left side; 1 marking on the right side in the setal circle of xviii, just median to the male porophore.
- No. 2.—One pair of postsetal markings on xvii, interrupting the setal circle, just median to the male pore lines; one marking on xviii, on the left side just lateral to the mid-ventral line, mainly postsetal; 1 marking on xix, right side, in the setal circle just median to the male pore line.
- No. 3.—One pair of markings on viii, 1 postsetal and the other in the setal circle; 1 marking on 17/18 on the left side just median to the male pore line; 1 marking on the right side of xvii, in the setal circle; 1 pair on xix, primarily presetal but interrupting the setal circle.
- No. 4.—One pair of postsetal markings on viii, the markings separated by a mid-ventral distance equal to 3 intersetal intervals; 1 pair of postsetal markings on xvii, interrupting the setal circle; 1 pair of markings on xviii, just median to the male porophores and extending nearly to the mid-ventral line.
- No. 5.—One pair of markings in the setal circle of viii; 1 pair of markings in the setal circle of xvii; 1 pair of markings on xix, presetal but interrupting the setal circle.

Internal anatomy.—Septum 8/9 is present and complete but membranous, very delicate (5); on pinning out the opened specimen the septum is ruptured and after rupture may be entirely unrecognizable.

The gut, in x-xiii, is provided internally with a series of vertically placed, conspicuous, reddish ridges, lacking only at the mid-dorsal and mid-ventral regions where there are low, longitudinally placed, whitish ridges. The intestine begins, apparently in xv (1), xvi (1), xvii (1) xviii (1). In the latter specimen the gut is narrow in xvi-xvii, with a few, low, longitudinally placed, whitish ridges on the internal wall in xvi-xvii. The typhlosole begins rather abruptly in the caecal segment (3) and fades out rather gradually passing posteriorly, unrecognizable posterior to lxxxvii. On the oesophagus just behind the gizzard there is a low, lobed, glandular collar.

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There are masses of nephridia on the anterior faces of 5/6 and 6/7. The acinous masses of blood glands in v are larger than those in vi. Lymph glands are first clearly recognizable from 3-4 segments behind the caecal segment.

The single heart of ix is on the right side (3) or the left side (1). The last pair of hearts is in xiii (4). The hearts of xii are clearly dorso-intestinal.

The testis sac of x is annular (3) but is unusually distended and protuberant anteriorly in a ventral suboesophageal portion. The dorsal blood vessel is included and imbedded in the testicular coagulum, the nerve cord excluded. The testis sac of xi is cylindrical, dorsal blood vessel, hearts, seminal vesicles and gut included; nerve cord excluded (1), included (2). In xii a cylindrical sheet of tissue like that which forms the wall of the testis sac of xi shuts off a portion of the coelomic cavity and encloses the gut, hearts, seminal vesicles and the nerve cord, (definitely recognized in 3 specimens probably present in the other specimen). In one worm a cylindrical sheet of tissue passes anteroposteriorly from 12/13 to 13/14 shutting off a portion of the coelomic cavity as in xii and enclosing the hearts, dorsal blood vessel and gut (nerve cord not noted). The prostates extend through some or all of xvi-xx. The prostatic duct is $1\frac{1}{2}$ mm. long, slightly arc-shaped, whitish.

The spermathecal duct is nearly circular in cross section, the lumen abruptly narrowed at the diverticular junction, ectal to which the lumen is very narrow. The spermathecal diverticulum passes into the median face of the duct close to the parietes. The simple seminal chamber may be ellipsoidal or shortly ellipsoidal and shorter than the stalk, or longer than the stalk and zigzag looped, the loops short and in the same plane, the limbs of loops in apposition. The lumen in the diverticular stalk is irregular as if there are annular ridges on the wall. Spermatozoal iridescence in the seminal chambers is bright, but each chamber contains only a few clumps of spermatozoa.

Glandular material is sessile on the parietes of xvii-xix over the genital markings.

Pheretima flavellana sp. n. Fig. 1

Material examined.—2 clitellate specimens labelled, "Cameron Highlands, Pahang, F. M. S."

External characteristics.—Length 184 mm. Diameter 6 mm. One worm, 112 mm. long, has a regenerated tail of 2 segments. Pigmentation red (? alcoholic preservation). The larger specimen has a spiral abnormality involving segments vi-vii.

Setæ: vi/15, vii/16*, viii/14*, xvii/12, xviii/9, xix/11, 15/ii, 26/iii, 39*/viii, 42/xii, 54/xx, 1(?) /xvi; vi/14*, vii/13*, viii/15*, xvii/14, xviii/11, xix/18, 20/ii, 16*/iii, 37*/viii, 48/xii, 51/xx, 11/xvi. (* empty setal pits counted as setæ).

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

The clitellum is annular and extends from 13/14 nearly to 16/17 (2); intersegmental furrows and dorsal pores lacking.

The spermathecal pores are minute and invaginate, in small parietal invaginations with transversely slit-like apertures; 4 pairs, on 5/6-8/9.

There is a single female pore (2).

The male pores are minute and invaginate, each pore on a slenderly conical penis with glistening surface and pointed tip that is protuberant to the exterior through the transversely slit-like aperture of the invagination; the invaginations slightly relaxed and possibly slightly everted, the apertures with wrinkled margin.

The genital markings of the larger specimen are in two transverse rows of four, one row on 17/18, the other on 18/19. The lateral markings are three intersetal intervals wide, transversely elliptical in outline, the median markings two intersetal intervals wide and circular in outline. Each marking has a greyish translucent, slightly depressed central area surrounded by an opaque, slightly protuberant, sharply demarcated, marginal band. On the smaller specimen the lateral genital markings are present but there is only one median marking and that rudimentary, on the left side of 17/18, about 1 intersetal interval wide.

Internal anatomy.—Septum 4/5 is present, membranous; 5/6-7/8 and 10/11-12/13 are muscular; 13/14 very slightly muscular; 8/9 present and complete but membranous and transparent (2), after pinning out the opened specimen not a trace of the septum can be found; 9/10 absent.

There are masses of nephridia on the anterior face of 5/6 and 6/7. Blood glands were not found. Lymph glands are recognizable from the caecal segment posteriorly.

The intestine begins in xv. The intestinal caeca are simple, with fairly deep septal constrictions. The oesophagus, in x-xiii, is provided internally with a series of vertically placed, conspicuous, reddish ridges, lacking only at the mid-dorsal and mid-ventral regions where there are low longitudinally placed, whitish ridges. The gut is narrow in the posterior portion of xiv and the anterior part of xv and the wall is provided internally with low, longitudinally placed, whitish ridges. The typhlosole

begins rather abruptly in the cæcal segment and gradually decreases in height passing posteriorly, unrecognizable posterior to xliii, the latter half of the ridge rather translucent.

The single heart of ix is on the left side (2). The last pair of hearts is in xiii (2). The hearts of xii-xiii are clearly latero-intestinal. All hearts of ix-xiii pass into the ventral trunk (1).



Fig. 1. *P. flavellana*.—Ectal portion of a spermatheca cleared in lactophenol, to show the primary spermathecal pore (a) and the secondary spermathecal pore at (b).

The testis sac of x is annular. The testes appear to be undischarged (1), no spermatozoal iridescence on the male funnels, only a small amount of coagulum within the sac. The testis sac of xi is cylindrical, the dorsal blood vessel, hearts, seminal vesicles and nerve cord included, the seminal vesicles imbedded in the testicular coagulum. The seminal vesicles of xii are small, vertically placed bodies, flattened against 11/12. The prostates extend through some or all of xvii-xx. The prostatic duct is nearly 3 mm. long, muscular, bent into a "c"-shaped loop. There is no evidence of a protuberance of the male pore invagination into the cœlomic cavity.

The spermathecal duct is shorter than the ampulla, whitish, with no sheen, distinctly marked off from the ampulla, not very thick, nearly circular in cross section, the wall thickish, the lumen transversely slit-like in cross section but rather irregular, very abruptly narrowed at the diverticular junction, ectal to the junction very narrow and of uniform width. The duct does not appear to be narrowed ectally but is marked off by a slight constriction, recognizable in the cleared spermatheca, from the parietal invagination. The duct is widened on the anterior face close to the parietes at the region where the diverticular stalk

enters. The diverticular stalk is unusually slender, twisted or looped or sinuous, slightly longer than the duct or about the same length, abruptly marked off from a pear-shaped to roughly spheroidal, simple seminal chamber which is much smaller than the ampulla but unusually large relative to the thickness of the diverticular stalk. There is no spermatozoal iridescence.

The genital marking glands are flat masses of circular outline, sessile on the parietes, the numerous, very slender stalks practically restricted to the body wall.

There are a few scattered cysts near the nerve cord in the postclitellar segments, each cyst containing small, spindle-shaped (pseudonavicellæ?) spores.

In the last old segment of the smaller specimen there are, in the coelomic cavity, four brown discs. One of these discs contains 72 (+?) setæ of several distinctly different sizes. In each of segments vi-xii there is a circle of small brown spots, each spot in or close to a setal gap in the longitudinal musculature. In the clitellar segments the brown spots are scattered.

Remarks.—*P. flavellana* cannot be distinguished with certainty from *P. baruana* Stephenson 1932 as a result of the authors' failure to characterize the male genital terminalia and the spermathecal apertures. In *baruana* there is a single genital marking on the inner (median) slope of the male porophore (latter not described). Presumably this indicates the presence of a single segmental genital marking on xviii (or an invaginate marking on an everted chamber?). For the present the segmental location of the genital marking may be considered to distinguish *baruana* from *flavellana* on which the markings are definitely intersegmental. It is possible however, if the cuticle was not removed prior to examination of the types of *baruana*, that genital markings may have been overlooked or incorrectly described, as has happened in other species. The so-called "accessory prostate" is quite possibly the gland (s?) of one or more genital markings. The extension of the gland through xviii-xxii presumably indicates that the gland is different from that of *flavellana* or else that there are more markings than were noted.

In species with invaginate spermathecal pores the minute aperture is usually located on a slight protuberance into the invagination. In *flavellana* such a protuberance appears to be totally lacking.

Diagnosis.—Octothecal, spermathecal pores minute and invaginate, the invaginations small, transversely elliptical in section and (probably) confined to the parietes, with transversely slit-like apertures; 4 pairs, on 5/6-8/9. Male pores minute and

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invaginate, each pore at the ventral end of a short, slenderly conical penis within a parietal invagination with a transversely slit-like aperture. Genital markings on 17/18 and 18/19, in two transversely placed rows between the male pore lines. Setæ: vi/14-15, vii/13-16, viii/14-15, xvii/12-14, xviii/9-11, xix/11-18, 15-20/ii, 16-26/iii, 37-39/viii, 42-48/xii, 51-54/xx, 1-11/xvi. First dorsal pore on 11/12-12/13. Length 184 mm. Diameter 6 mm.

Septum 8/9 complete but membranous. Intestinal cæca simple. Testis sacs unpaired: of x annular; of xi cylindrical, seminal vesicles included. Spermathecal diverticulum with unusually slender diverticular stalk and simple seminal chamber, pear-shaped to spheroidal, much thicker than the stalk. Genital marking glands sessile on the parietes.

Pheretima ralla Gates

Pheretima ralla Gates 1936, Bull. Raffles, Mus., 12, p. 104, (Type locality Gunong Brinchang, Pahang. Types in the Raffles Museum).

Material examined.—One clitellate specimen labelled, "Ginting Kial, Cameron Highlands, Pahang. 5/37."

External characteristics.—Length, 51 mm. Diameter, 2 mm. Setæ: vi/15, xvii/9, xviii/7, xix/10, 24/ii, 26/iii, 41/viii, 44/xii, 40/xx. First dorsal pore possibly on 11/12, a non-functional pore-like marking on 10/11.

The spermathecal pores are quite definitely posterior to the intersegmental furrows though nearer the furrows than the setæ. The female pores are paired as on the types.

Internal anatomy.—No traces of septa 8/9-9/10 have been found. The intestine begins in xv. The intestinal cæca are simple, the margins smooth; cæca small, extending only to 25/26. The last hearts are in xiii.

The testis sacs of both x and xi are horseshoe-shaped, the dorsal blood vessel, the hearts of x and xi and the seminal vesicles included within the sacs, the dorsal trunk imbedded within the testicular coagulum. It has been possible to open both testis sacs at the mid-dorsal line and remove the testicular coagulum so that the blind ventral ends of the sac are clearly demonstrated. The ventral trunk is between the ends of the testis sacs, the nerve cord on the parietes beneath. The prostates extend through xvii-xx; the duct bent into a C-shape, slender but with a slight muscular sheen.

The spermathecal duct is shorter, both actually and relative to the length of the ampulla than in the types. The ampulla is distended by whitish material. The diverticulum which passes into the anterior face of the duct at the parietes is, in this worm,

quite definitely shorter than the combined lengths of duct and ampulla. The shortly ellipsoidal seminal chamber is not as sharply marked off from the longer stalk as is shown in fig. 4 of the type description (Gates 1936, p. 105) and is filled with a whitish material in which no spermatozoal iridescence is visible.

Pheretima sp.

Material examined.—One clitellate specimen labelled, "Sungai Kayu; swamp forest near River Sedili, Johore. 2/37." The worm is in fairly good condition externally but from 7/8 to some distance posterior to the clitellum the segments are filled with a closely packed coagulum, the organs embedded in the coagulum macerated.

External characteristics.—Length, 250 mm. Diameter, 7 mm. The dorsum pigmented and blueish in appearance.

The setæ begin on ii on which segment there is a complete circle: vi/?, vii/5 or 6, viii/7, xvii/12, xviii/2, xix/15, 37/ii, 52/iii, 55 + 1/viii, 55 + ?/xii, 66/xx. (Spermathecal setæ in this formula are the setæ between the medianmost spermathecal pores of a furrow. The 1 and the ? following the + sign in the fraction for segments viii and xii indicates 1 and several gaps in the setal circle in which 1 or more setal pits are recognizable).

The first dorsal pore is probably on 12/13.

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

The spermathecal pores are minute and superficial, on or close to 5/6–8/9, in paired groups, a fairly wide mid-ventral space between the medianmost pores of each pair of groups. The numbers are as follows: on 5/6, 4 + 4; on 6/7, 5 + 5; on 7/8, 8 + 7; on 8/9, 10 + 9; the first of each pair of figures that of the left side. Each pore is on a tiny but clearly demarcated, circular porophore.

There is a pair of female pores.

The male pores are minute and superficial, each pore in a very slight and short, transversely placed furrow at the centre of a slightly depressed, greyish, translucent area of shortly elliptical outline, longitudinally placed. The porophore has a slightly protuberant, opaque, whitish rim external to which are several concentric furrows.

There are two genital markings, or more accurately two areas bearing markings. One of these areas is presetal on xviii, almost rectangular in shape, transversely placed, reaching

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laterally about to *d* or *e*, greyish translucent, slightly depressed. This area is surrounded by a slightly protuberant, opaque, whitish rim which reaches anteriorly across 17/18 and posteriorly includes the setæ of xviii. On the translucent portion of the area there is readily recognizable a transverse row of five, small, nearly circular tubercles, each with an opaque whitish rim and a greyish translucent central spot. The other area is presetal on ix, the rim not quite reaching either to 8/9 or to the setæ of ix but extending laterally on each side to *g*. On this area are recognizable with difficulty nine, small, whitish areas in a transverse row, the whitish areas more irregular in shape than the postclitellar tubercles.

Internal anatomy.—Septa 5/6-7/8 are thickly muscular; 8/9-9/10 apparently lacking; 10/11 and succeeding septa at least not thickly muscular. Last hearts probably in xii.

In xiii there is a pair of well developed pseudo-vesicles, each with a clearly marked off primary ampulla. The prostates extend through xvii-xx; the prostatic duct slender, but with muscular sheen, bent into a C-shape, about 4 mm. long.

The spermathecal duct is slender, shorter than, to longer than the ampulla and not sharply marked off therefrom. The diverticulum which passes into the anterior face of the duct at the parietes is much shorter than the combined lengths of duct and ampulla. The diverticulum is tubular, not sharply marked off into stalk and seminal chamber. An ectal portion is sinuous, with margins incised or very shortly and closely looped in an approximation to zigzag. The spermatozoal iridescence is restricted to the ental portion which may be termed shortly ellipsoidal to sausage-shaped and is not looped, or the spermatozoal iridescence may extend into the entalmost loop.

The parietes is uninterrupted over the genital markings.

Remarks.—As a result of the condition of the organs of viii posteriorly it is impossible to characterize certain parts of the digestive, vascular and reproductive systems.

Three multithecal species of *Pheretima* with spermathecal pores on 5/6-8/9 are known. These species are specifically distinguished from the worm described above as follows: *P. aruensis* Michaelsen 1910, by the presence of copulatory chambers and the paired genital markings; *P. koyana* Michaelsen 1934, by the presence of copulatory chambers and the paired genital markings; *P. polytheca* (Beddard) 1900 by the paired genital markings, the smaller setal numbers and the straight stalk of the spermathecal diverticulum. The Sungai Kayu worm accordingly belongs to a hitherto unknown species. In view of the lack of information with regard to structures of taxonomic

importance and the condition of the single specimen which is quite unfit to serve as a type, a new species is not erected.

Genus *DICHOASTER* Beddard

Dichogaster saliens (Beddard)

Dichogaster saliens Stephenson 1931, Proc. Zool. Soc. London, 1931, p. 65. Also Rec. Indian Mus. XXXIII, p. 199.

Material examined.—Thirteen clitellate specimens labelled, "Ginting Kial, Cameron Highlands, Pahang, 5/37."

External characteristics.—Several of the specimens are unusually large, 45–53 mm. long and 2½–3 mm. in diameter.

The clitellum is lacking or feebly developed ventrally on xiii and posteriorly just reaches onto xx laterally, the dorsal pore on 19/20 clearly indicated and probably functional on all specimens.

The female pores (paired) are in the transverse setal line of xiv, each pore slightly nearer to *a* than to the other pore. These pores are, on several specimens, included within a very definite, whitish area that is almost circular and which extends from 13/14 to 14/15 and laterally on each side about to *b*.

The male genital shield is usually sharply demarcated (occasionally indistinctly delimited), more or less protuberant, broad anteriorly, narrowed posteriorly, extending antero-posteriorly from 16/17 onto xviii or to 18/19 and reaching laterally on each side in the widest part to slightly beyond *b*. At the mid-ventral line there may be a more or less slight furrow which may have the appearance of marking off the shield into two portions. The seminal grooves are clear cut, fairly deep, the margins occasionally slightly protuberant, in or about in *a*, not exactly straight but in general parallel to the mid-ventral line or very slightly diagonal with the posterior ends very slightly nearer to the mid-ventral line.

Prostatic and male pores are quite unrecognizable even with the 32 mm. objective and brilliant illumination. The penial setæ are retracted but occasionally the tips can be recognized within the seminal grooves, at the anterior end. Although the male and prostatic pores cannot be seen the approximate sites can be determined by tracing the prostatic and deferent duct through the parietes. The prostatic duct passes through the body wall at the anterior end of the seminal groove while the male deferent duct passes through the parietes at the posterior end of the groove. The posterior end of the groove is about at the region of 17/18 or the anterior margin of xviii and certainly well in front of the transverse setal line of xviii. (Setæ *a* and *b* of xviii apparently are lacking, with no trace of pits at the approximate sites of the setæ).

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On three specimens there is a well developed genital marking on 15/16, reaching to *a* on each side; the marking almost circular with an opaque whitish rim and a depressed, greyish, translucent central spot.

Internal anatomy.—The prostatic duct is about 1 mm. long, with muscular sheen, bent into an S-shape. The prostate is about 2½ mm. long, confined to xvii. The penisetal follicle, containing two setæ, passes into the parietes just median to the ectal end of the prostatic duct. The posterior portion of the vas deferens is whitened (and perhaps slightly widened) so that it is readily visible as it passes lateral to the prostatic duct and then turns mesially to pass into the parietes about in line with the prostatic duct.

The spermathecal diverticulum passes into the median face of an ental portion of the duct. This portion of the duct is soft and lacks the muscular sheen present below the diverticular junction.

Remarks.—The Ginting Kial specimens appear to belong to the same species as those worms which Stephenson (1931) referred to *D. saliens*.

Genus PONTOSCOLEX Schmarda

Pontoscolex corethrurus (Fr. Müll.) 1857

Material examined.—One acitellate and two clitellate specimens labelled, "Ginting Kial, Cameron Highlands, Pahang. 5/37.", and 1 acitellate specimen labelled, "Sungai Kayu; swamp forest near River Sedili, Johore. 2/37."

Genus GLYPHIDRILUS Horst

Glyphidrilus sp.

Material examined.—Two clitellate, softened specimens labelled, "Sungai Kayu; swamp forest near River Sedili, Johore. 2/1937.". Also in the same tube are a number of tail fragments.

External characteristics.—Diameter, ca 2 mm. Female pores on xiv, on *b*, slightly nearer to 13/14 than to the transverse setal line, quite obvious on one specimen.

The "wings" are high and thin, just lateral to *b*, extending from the posteriormost portion of xviii onto the anterior portion of xxiv (1) or from about 18/19 to the anteriormost portion of xxiv or 23/24 (1).

The genital markings are in two series, symmetrically paired laterals and unpaired medians, all postsetal; the medians in *aa* on xv-xviii and xxv-xxvi (1) or xiii-xiv, xvi, xviii (1); the laterals about in lines with the wings and just lateral to *b*, on xvii-xviii (2), xxiv (1) or xxiv-xxvi (1).

Internal anatomy.—(One specimen opened). The intestine begins in xviii. Last hearts in xi. Vesicles are present in ix, x, xi and xii. Testes and male funnels free, in x and xi. Spermatheca, six per segment, three on each side, in xv-xvii, ducts confined to the parietes, medianmost pore probably about on a.

Remarks.—Spermathecal pores and nephropores were not identified. As a result of maceration of the internal organs there is some doubt as to the accuracy of statements regarding internal anatomy excepting only that concerning the testes and male funnels.

So far as location of the genital markings, position of the "wings", number of spermatheca, and number of seminal vesicles are concerned, the Sungai Kayu worms differ from *G. malayanus* Michaelsen 1902. These differences may or may not prove to be of importance.

Genus BIMASTOS Moore

Bimastos parvus (Eisen) 1874

Material examined.—Six clitellate specimens labelled, "Ginting Kial, Cameron Highlands, Pahang. 5/37."

In addition to the six specimens mentioned above there is another tube (same locality) containing a number of Lumbricids of the same size and appearance as those which were identified as *B. parvus*, but which were not studied.

Lumbricid worms have not been found hitherto in the Malay Peninsula.

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