

PHERETIMA TUMULIFACIENS (OLIGOCHAETA, MEGASCOLECIDAE)
A NEW SPECIES OF EARTHWORM FROM THE SEPIK DISTRICT,
NEW GUINEA

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SUMMARY

Pheretima tumulifaciens, a new species of earthworm, belonging to the family Megascolecidae, is described. It was found in the Sepik River Valley, northern New Guinea, where it is associated with unusual forms of micro-relief that have been attributed to the earthworms' burrowing and casting. The species is most closely related to *P. sangitensis* (Michaelsen), from Indonesia, but in some respects resembles *Megascolex*. The inadequacy of generic distinctions and of the criteria for distinction of groups of genera are discussed.

INTRODUCTION

Haantjens (1965) recorded micro-relief in the form of irregular pits, trenches, mounds and ridges, not unlike some periglacial phenomena, from the humid tropical grass-covered plains bordering the Sepik River valley, south of Wewak, in New Guinea. Populations of a large earthworm species were always associated with the micro-relief and Haantjens (1965) considered that they were responsible for the formation of the micro-relief features.

In October, 1965, the author visited four sites in the vicinity of Yangoru, where Haantjens had observed micro-relief features, to collect earthworms and examine the relationship between their activities and the micro-relief features attributed to them. At each of the sites, large earthworms belonging to an undescribed species of *Pheretima* Kinberg were collected. The earthworms were closely associated with the micro-relief features, as recorded by Haantjens, but it seemed unlikely that they were directly responsible for the micro-relief. A discussion of the micro-relief features and their possible origin will be published elsewhere (Lee (in press)). The large earthworm associated with the micro-relief features has been named *Pheretima tumulifaciens*, and is described below.

Pheretima tumulifaciens n.sp.

Collection Data. (1) About 1½ mi S of Kworu Village, 20 mi SW of Yangoru, District, New Guinea; 0-33 cm in soil under kunai grassland; 2 clitellates; K.E.L. 22/10/65. (2) About ½ mi SW of Watibi no. 2 Village, 15 mi SW of Yangoru; 0-30 cm in soil under secondary forest; 1 a clitellate; K.E.L. 22/10/65. (3) About 1 mi N of Watibi no. 2 Village, 14 mi SW of Yangoru; 0-55 cm in soil at edge of deep trenches, under kunai grassland; 1 clitellate; K.E.L. 22/10/65. (4) About 1 mi SW of Haripmor Village, 15 mi SE of Yangoru; 0-45 cm in and under low mounds and ridges covered by kunai grassland; 6 clitellates; K.E.L. 23/10/65.

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Type Material. Holotype and two syntypes lodged in South Australian Museum.

Dimensions. Mature specimens are 500-600 mm in length, 9-10 mm in diameter (in ethyl alcohol) and have 550-600 segments. Detailed measurements of the holotype are: Length 590 mm; segments 587; diameter 10.5 mm at vii, 9.5 mm at xiii, 9.5 mm at clitellum, tapering gradually to 6 mm at about half length and fairly uniform to posterior end. Posterior to iii the segments have secondary annulations, two to five per segment.

Colour. Pale greyish-brown with pale brownish-red clitellum.

Chaetae. Absent on i, otherwise about 140 per segment, evenly spaced on a slight ridge around each segment, nearer the anterior than the posterior margin of the segments; without a mid-dorsal gap, but with a small mid-ventral gap, about twice the normal chaetal interspace; a few chaetae missing immediately adjacent to each male pore, on xviii, and across the mid-ventral line adjacent to the female pores, on xiv.

Prostomium prolobous.

First dorsal pore at 10/11.

Clitellum covering entire body surface from slightly posterior to the chaetal ring on xiii to the line of the chaetal ring on xvii.

Spermathecal pores: one pair, at 7/8, each on a prominent, transversely elongate papilla, about 2 mm x 1 mm, the pores each about 3 mm from the ventral mid-line.

Female pores: one pair of small pores on xiv, about 0.75 mm apart, one each side of the ventral mid-line, surrounded by a pale elliptical area, in line with the chaetal ring.

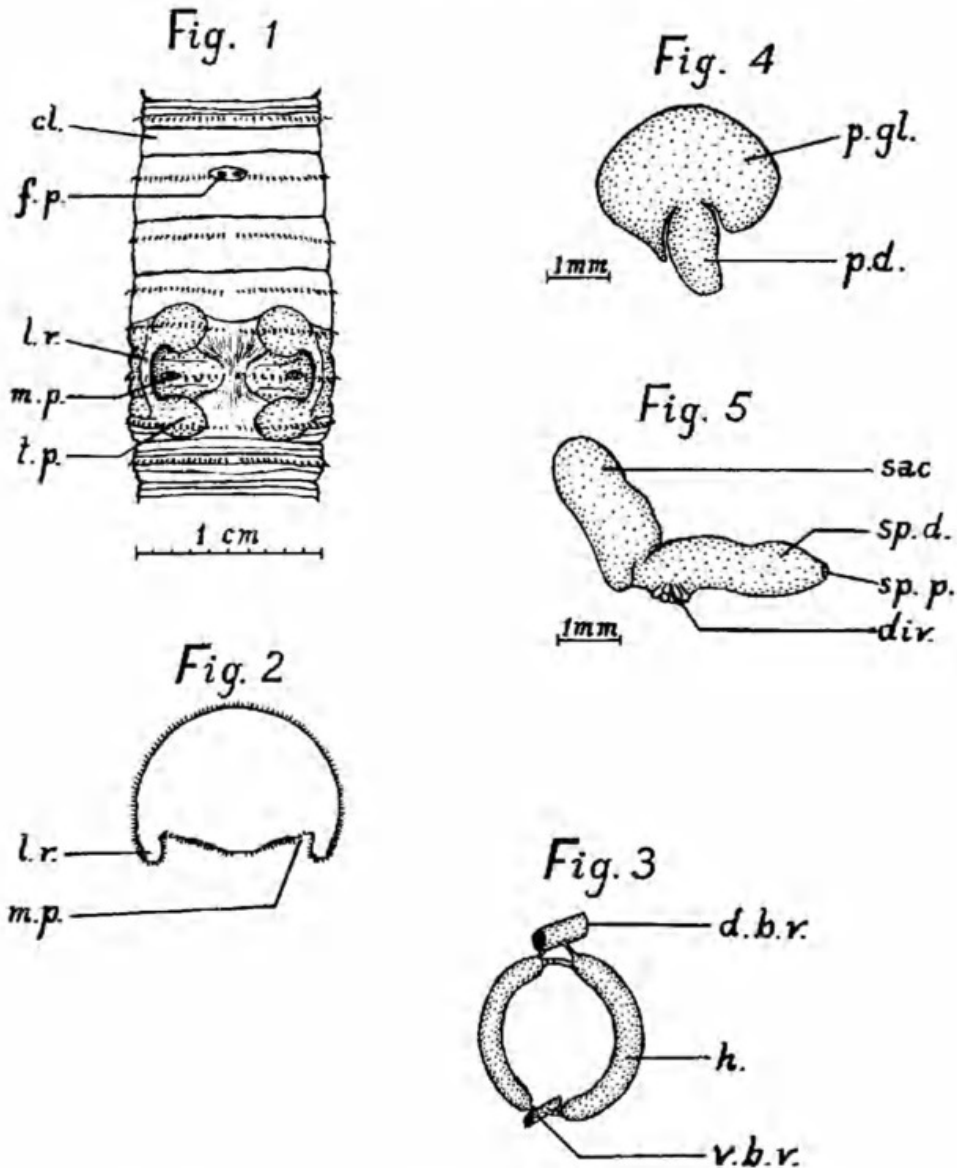
Male pores: ventral on xviii, one on each side, each about 3.5 mm from ventral mid-line, in line with chaetal ring, not on papillae; each pore medial to a deep longitudinal groove, overhung by a prominent ventro-lateral ridge that runs longitudinally from xvii to xix (Figs. 1, 2).

Tubercula pubertatis: two pairs of prominent, flattened papillae, a pair on xvii and a pair on xix, each papilla about 3 mm diameter, forming, together with the prominent ventro-lateral ridges on xviii, the edges of a deep depression that occupies the ventral surface of xviii (Figs. 1, 2).

Septa v/vi, vi/vii, vii/viii and viii/ix are thickened and strongly muscular. Thick muscle fibres arise from the body wall in segments vi-ix and run forward to an insertion on the posterior surfaces of the muscular septa; some of the fibres are attached anteriorly to the pharynx and not to the septa. Similar muscles have been observed previously in many earthworms, especially in large species; their purpose is apparently to produce unusually powerful contractions of the anterior segments, probably to facilitate burrowing and provide the traction necessary to move the large bulk of the earthworm's body. In most species of *Pheretima*, septa viii/ix or ix/x, or both of them, are absent or greatly reduced in size. This is not so in *P. tumulifaciens*.

The *pharynx* occupies most of i-iv, and has a diffuse glandular coating, with many fine muscle fibres attached to the body wall. In v-vii the alimentary canal is a thin-walled tube with large finely lobate salivary glands lying beside it and opening by narrow ducts into the pharynx. *Gizzard* strongly muscular, in viii. *Oesophagus* extends from ix to xv where it expands abruptly into the *intestine*, close to the anterior end of xv. There is no typhlosole. Many species of *Pheretima* have a pair of rounded or conical intestinal caeca, arising in xvi

PHERETIMA TUMULIFACIENS, NEW EARTHWORM SPECIES



- Fig. 1. *Pheretima tumulifaciens*, ventral aspect, segments xiii-xx.
 Fig. 2. *P. tumulifaciens*, diagrammatic transverse section at segment xviii, to show position of male pores in relation to ventro-lateral ridges.
 Fig. 3. *P. tumulifaciens*, arrangement of hearts of segment xiii in relation to dorsal and ventral blood vessels (diagrammatic).
 Fig. 4. *P. tumulifaciens*, left prostate, medial aspect.
 Fig. 5. *P. tumulifaciens*, left spermatheca, medial aspect.

ABBREVIATIONS

cl. = clitellum; d.b.v. = dorsal blood vessel; div. = spermathecal diverticulum; f.p. = female pore; h. = heart; l.r. = ventro-lateral ridge; m.p. = male pore; p.d. = prostatic duct; p.gl. = prostatic gland; sac = spermathecal sac; sp.d. = spermathecal duct; sp.p. = spermathecal pore; t.p. = tuberculum pubertatis; v.b.v. = ventral blood vessel.

or thereabouts, and projecting forwards, sometimes through several segments, usually pressed tightly against the ventro-lateral or lateral aspects of the intestine. There are no such caeca in *P. tumulifaciens*.

Dorsal blood vessel unpaired; it can be traced forward to the posterior end of the pharynx, where it divides into several branches. Stout commissural vessels (*hearts*) in x-xiii, one pair in each segment, connecting the dorsal and ventral blood vessels; the two vessels of each pair have a short transverse connection across the oesophagus, independent of the connection of the two vessels to the dorsal vessel (Fig. 3). There is no independent supra-intestinal vessel connecting the hearts longitudinally. In vii-ix similar lateral vessels arise from the dorsal vessels, but divide into a number of branches leading to segmental organs and are not "hearts". The *testes* are in x, xi; those of xi are in testis sacs that occupy much of the coelomic cavity in the segment. *Ovaries* in xiii. One pair of small, racemose *vesiculae seminales*, in ix. *Prostates* in xviii, one on each side; laminar glandular portion with branching ducts, all discharging into a short, stout, strongly muscular prostatic duct (Fig. 4). *Spermathecae* in viii, one pair, each discharging through a thick, muscular duct at the anterior margin of the segment; the sac is cylindrical, a little wider than the duct, projecting backwards into the segment and set off from the line of the duct; a cluster of small diverticula opens into the duct close to its junction with the sac (Fig. 5). *Micronephridia* are small and numerous in each segment, irregularly scattered over the peritoneum.

DISCUSSION

P. tumulifaciens differs from most species of *Pheretima* in having well-developed, strongly muscular septa in the segments adjacent to the gizzard, a characteristic shared with many large megascolecid earthworms, especially those which, like *P. tumulifaciens*, make extensive burrow systems going down to considerable depths. In most species of *Pheretima* the anterior septa are not thickened and septa viii/ix or ix/x or both of these are absent, or much reduced. The absence of intestinal caeca also distinguishes *P. tumulifaciens* from many other species of the genus. The only character that decisively places this species in *Pheretima* is the position of the gizzard, in viii. If the gizzard were in v, vi, or vii, it would be placed in the genus *Megascolex*. There is need for a thorough re-examination of the criteria on which generic distinctions in megascolecid earthworms are based. Revised groupings of genera have been proposed by Gates (1959), Lee (1959) and Omodeo (1958). The proposed new groupings are based on slightly different bases, but none of the proposals has contributed greatly to the improvement of the state of confusion that has developed over the years since Michaelsen (1900) and Stephenson (1930) defined the genera and grouped them into sub-families and families on the basis of a supposed "family tree" of generic relationships, derived from a study of only a few anatomical characters. Sims (1966) has attempted to clarify the relationships between genera, using a computer to assess the affinities of 30 species, belonging to 29 megascolecid genera, on the basis of 43 attributes of each species. The results of his study favoured the scheme of classification proposed by Gates (1959) for taxonomic categories above the level of genera. Computer techniques may make a useful contribution to megascolecid taxonomy, as they make it possible to assess relationships on the basis of a larger number of attributes than can be handled by traditional taxonomic methods. However, if computer techniques are to be used, it is at the level of definition of genera that they can probably contribute most, and Sims' study assumes that the genera are adequately defined.

P. tumulifaciens shows closest affinities to *P. sangirensis* (Michaelsen), an Indonesian species. Similarities and differences between the two species are summarised below.

	<i>P. tumulifaciens</i>	<i>P. sangirensis</i>
Spermathecal pores	1 pair, at 7/8	1 pair, at 7/8
Female pores	paired, close to ventral mid-line	unpaired, median ventral
Septum viii/ix	present, muscular	present, membranous
First intestinal segment	xv	xv
Intestinal caeca	absent	sometimes present, very short
Vesiculae seminales	1 pair, in ix	2 pairs, in xi, xii
Spermathecal diverticula	cluster of small diverticula	1 ellipsoidal diverticulum

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