

A New Earthworm Genus (*Oligochaeta*, *Megadrili*, *Megascolecidae*) from Japan

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Abstract Genus *Manus* is newly proposed with type and only species *Pheretima koellikeri* Michaelsen, 1928. Type specimens of the type species preserved in the Zoological Museum Hamburg are inspected and sketched. Distribution of the species is Japan (Kyushu?) with an unconfirmed Korean record. The new genus is diagnosed by a secretory diverticulum opening adjacent to each prostate gland and associated with a penial seta internally and, secondarily, on its manicate intestinal caeca.

Key words: *Pheretima*, new genus, Asiatic, prostates, conservation status, von Kölliker.

Introduction

Pheretimoids (*Pheretima* auct.) comprise at present 14 genera and ~940 valid species from ca. 1,400 nominal taxa (Blakemore, 2004, 2007, 2008a). The number of nominal taxa is nearly double the 746 nominal species including subspecies when reviewed and divided into manageable taxonomic groups by Sims and Easton (1972) and is raised considerably from Michaelsen's (1900a) list of just 167 valid *Pheretima* species. They form a large and ecologically important group of Oriental earthworms with a few peregrine members spread worldwide, especially in the tropics (see Blakemore, 2002, 2008b).

First emerging around 1903, *Pheretima koellikeri* Michaelsen, 1928 has had a varied taxonomic history, being sunk, elevated and transferred between several genera—this indicative of its unusual characteristics that merit it separate generic status. Michaelsen (1928, p. 12) grouped it with Japanese *Metaphire sieboldi* (Horst, 1883) by virtue of its manicate caeca, but also thought it unique in *Pheretima* as then defined. This paper aims to establish it firmly within bounds of ICZN (<http://iczn.org/>) stated aims for “standards, sense and stability for animal names in science.”

Materials and Methods

Classification follows the conventions, methodology and abbreviations of Blakemore (2000, 2008b). Tissue samples from type specimens were taken with the permission of the Zoological Museum Hamburg (ZMH), and submitted to the International Barcode-of-Life program (iBOL <http://ibol.org/>) for DNA sequencing which, if successful for such old material, will have its data entered into the BOLD database and to the GenBank online facility [<http://www.ncbi.nlm.nih.gov/genbank/>], as with samples in Blakemore *et al.* (2010). Abbreviations used: lhs, left hand side; rhs, right hand side.

Taxonomic results

Genus *Manus* Blakemore, nov.

Type and only species. *Pheretima koellikeri* Michaelsen, 1928.

Distribution. Japan (Kyushu?) and possibly Korea.

Diagnosis. Pheretimoid with secretory diverticulum opening adjacent to prostate gland on non-superficial male pore with penial seta internally; intestinal caeca manicate from ca. 27.

Remarks. The genus has non-superficial male pores that define both *Metaphire* Sims and Easton, 1972 and *Pheretima* Kinberg, 1867 but it lacks the nephridia on the spermathecal duct required for membership of the latter genus. Differentiation is via acquisition of pronounced secretory diverticula, rather than mere stalked glands, opening along with pouched penes. The relationship of *Manus* to *Metaphire* is analogous to that of subgenus *Parapheretima* Cognetti, 1912 to *Pheretima* as exemplified by *Pheretima* (*Parapheretima*) *saba* Sims and Easton, 1972 when compared to *Pheretima* (*Ph.*) *darnleiensis* (Fletcher, 1886) in a detailed redescription in Blakemore *et al.* (2007, figs. 2–6). Secretory diverticula resemble tubular prostates as found in some more ‘primitive’ members of Megascolecidae sensu Blakemore, 2000 (cf. Gates, 1959) and in Acanthodrilidae but are presumed (by Stephenson 1930, and the current author) to not be homologous in these otherwise relatively “advanced” species.

Notwithstanding, Michaelsen (1928, p. 11) doubting homology of these structures between *Pheretima koellikeri* and *Parapheretima* because they were more muscular in examples of the latter he had experience of, he also said “Das Auftreten von Penialborsten im Zusammenhang mit diesen akzessorischen Prostaten der *Pheretima köllikeri*, würde, falls es sich bestätigen liesse, meine Deutung dieser Organe als acanthodriline Prostaten wesentlich stützen.” —[The occurrence of penial setae in connection with this accessory ‘prostate’ of *Pheretima köllikeri* would, if confirmed, support my interpretation of these organs as much like acanthodriline prostates]. However, as Stephenson (1930) remarked, normal glandular prostates with the usual relations are also present, thus duplicated or transitional functionality is unlikely. Unfortunately no complete specimens are available to allow re-examination of the accessory gland and its true rôle can only be speculative: obviously relating to mutual exchange of sperm when charging spermathecae, possibly it facilitates adhesion of con-copulants (especially since the spermathecal pores have flat areolae),

or it may serve in some way to prevent ingress of pathogens and/or parasites.

Other *Manus* candidates are unknown despite several *Metaphire* species having stalked glands, rather than definite diverticula, on their copulatory pouches (when present) adjacent to non-superficial male pores.

Etymology. *Manus*—meaning “hand” in Latin (masculine gender)—listed neither in Airey Neave’s Nomenclator Zoologicus (<http://uio.mbl.edu/NomenclatorZoologicus/>) nor in the Thompson Reuter ION facility of names (<http://www.organismnames.com/query.htm>). This name alludes to Röntgen’s famous X-ray picture of the hand of Alfred von Kölliker who also had a ‘hand’ in the determination of Gregarine parasites and of parthenogenesis in invertebrates, both pertinent to earthworm studies. The name also references the worm’s finger-like diverticular projections on the fist-like copulatory pouches, as well as its manicate caeca—these latter being a subordinate characteristic.

***Manus koellikeri* (Michaelsen, 1928), comb. nov.**

(Figs. 1–2)

Pheretima sp. (*Köllikeri* Mich. Ms.) (sic, nomen nudum), Michaelsen, 1903: 100.

Pheretima köllikeri Michaelsen, 1928: 8, figs. 1–2. [From “Japan” collected before 1903. Type specimens in the Zoological Museum Hamburg (V6074).]

Pheretima kollikeri: Stephenson, 1930: 000.

Pheretima (*Parapheretima*) *koellikeri*: Sims and Easton, 1972: 240, 266; Easton, 1981: 60 (same as *Pheretima* sp. Michaelsen, 1903, ?? *P. vesiculata*).

Metaphire vesiculata (part.): Blakemore, 2003: 1, 7, 31 [with ? *P. koellikeri* as a provisional junior synonym of prior *P. vesiculata* Goto and Hatai, 1899 (cf. Easton, 1981) along with ? *P. okutamaensis*, ? *P. biggiberosa*]; Blakemore, 2004: 156.

? *Metaphire koellikeri*: Blakemore, 2007: 1, 20, 112, 125–6, fig. 6 (as provisional comb. nov. restoration separate from *Perichaeta vesiculata* Goto and Hatai, 1899); Blakemore *et al.*, 2007: 36–37; Blakemore, 2010: 7.

Planapheretima koellikeri (sic, lapsus): Texas A & M University website 2010 (<http://insects.tamu.edu/research/collection/hallan/test/Annelida/Family/Megascolecidae.txt> accessed 7. IX. 2010).

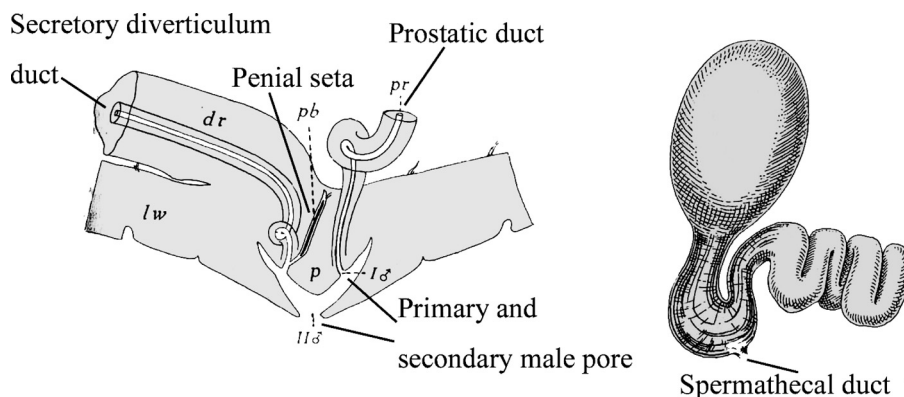


Fig. 1. Male organs (section of male pore) and a rhs spermatheca of *Pheretima koellikeri* after Michaelsen (1928, figs. 1–2).

Material examined. The type series (syn-types?) of ZMH V6074 with modern label stating: “*Pheretima Köllikeri* Type material”, comprising two specimens: one a posterior amputee mature, previously dissected with most of internal organs removed such as gizzard, both lhs spermathecae, and primary male organs except for part of 18lhs prostate gland; thus, this is the only known type, though it is not designated as the lectotype. The second, longer, specimen was previously undissected but is immature, it was dissected by the current author (RJB) for the first time to confirm its identity since the primary type was so damaged. This latter specimen is a probable syntype and thus eligible as a paralectotype. No other material is known to exist.

Origin of the type specimens. Although Michaelsen attributed collection to “A. v. Kölliker (Mus. München)” and wrote that the types belonged in the Zoological Museum Hamburg, they were transferred there from Munich (A. Schmidt-Rhaesa pers. comm. IX. 2010). It may be reasonably surmised that their provision is attributable to Rudolf Albert (or sometimes Albrecht) von Kölliker (1817–1905), the contemporary Würzburg scientist and co-editor, along with members of the family von Siebold who had strong connections with Japan, of the journal *Zeitschrift für Wissenschaftliche Zoologie* in which Michaelsen often published. I can find no report of A. von Kölliker visiting Japan, but he

may have been sent specimens via contacts with von Siebold’s family. In which case, the type locality, as for some earlier von Siebold specimens, may well be in Kyushu.

Distribution. “Japan.” Sims and Easton (1972, p. 221) mistakenly thought it an introduced *Parapheretima* and Easton’s (1981: 60) distribution included Kyushu (from Kobayashi, 1941, p. 513), but his other records were for his erroneous (priority) synonym (? *vesiculata* Goto and Hatai, 1899, p. 21). Kobayashi (1941) has an unconfirmed report from Korea. Yasuaki Sugi (pers. comm. 2. IX. 2010) did have records thought to be *P. koellikeri* from Kyushu, although he says these are *P. vesiculata*, rather than *P. koellikeri* proper.

Conservation status. This species appears to have been recorded only once by Kobayashi (1941) since its original description in 1903. Thus its status may be classed as rare or uncertain in both Japan and Korea.

External characters. Colour grey with clitellum buff in alcohol (based on type specimens). Body has much secondary annulation. Length 148–164+ mm by 8–9 mm with ~100 segments (Michaelsen, 1903) [the first specimen explained in “Material examined” (current candidate for ‘lectotype’) 150+ with 80+ segments and the second specimen (immature, candidate for ‘paralectotype’) 170 mm with 140 segments, i.e., agreeing tolerably]. Setae 37–57. First dorsal

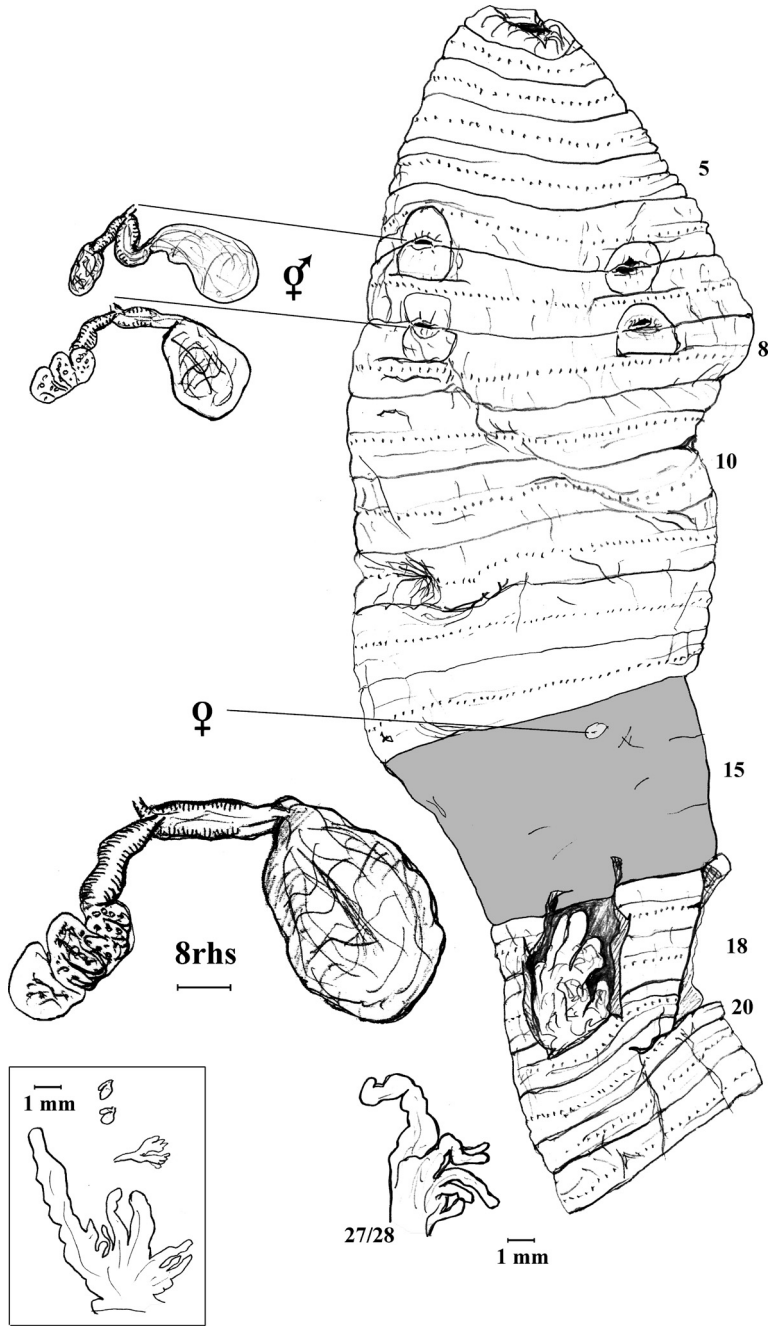


Fig. 2. The first specimen of type series of *Manus koellikeri* (Michaelsen, 1928), comb. nov. (Zoological Museum Hamburg V6074) with enlargement of 8 rhs spermatheca; boxed sketch: lhs spermathecae, 18 rhs prostate and manicate caecum of the immature second type specimen of V6074.

pore 12/13 (with that in 11/12 minute and poked by Michaelsen in 'lectotype'). Male pore ca. 0.3 circumference apart on penes invaginated within gaping transverse slots on large "ill-defined" porophores on 18 that extend across intersegmental furrows into 17 and 19; a dozen setae intervene (Michaelsen). Female pore single, ventromedian on 14. Spermathecal pores in 6/7/8 ca. 0.4 C apart. Genital markings absent except for pads around spermathecal pores noted for the first time (pers. obs. and current Fig. 2).

Internal morphology. Only part of oesophagus in 13 with ovaries and last hearts plus an anterior pair of pseudovesicles remain in the 'lectotype' with prostates just a glandular part on 18rhs, thus account mostly from Michaelsen's original. Septa 7/8 weak, 8/9/10 absent (from both type specimens), 10/11 thin, 11/12–14/15 thickened, thereafter thin. Gizzard strong barrel-shaped. Holandric with testis sacs ventral in 10 and 11; seminal vesicles anteriorly in 11 and 12, the later pair with more distinct appendices. Pseudovesicles anteriorly in 13 noted for the first time. Prostates racemose in 17–22 each ducting to penis within copulatory pouch that is confined to body wall with accessory secretory diverticulum opening anterior to male pore and associated with a large penial seta (as shown in Michaelsen's fig. 1). These diverticula resemble flattened tubular prostates and extend to segments 16 or 17. Spermatheca with diverticulum shorter than ampulla and Michaelsen shows one with zig-zagging diverticular bulb; in contrast, the current 'lectotype' had flat, rather compact bulbs on short only slightly wavy stalks (Fig. 2). Both diverticula stalk and spermathecal duct are muscular and no nephridia are attached (pers. obs. and Michaelsen, fig. 2). Intestinal caeca manicate (confirmation) and gut contains yellow soil and coarse organic matter in type; typhlosole not found.

Remarks. The accessory secretory diverticula are characteristic. Each with this form (translated from Michaelsen's German): "A large, broad tongue-shaped gland extends from the penis apparatus towards the front as far as seg-

ment 17 or 16, with its ental part bent to the side and backwards. This gland is almost flat, superficially notched only weakly, but with a very delicately cracked network, having the appearance of the prostatic glands of some other species of *Pheretima*, but much more compact. The axial canal is lined with columnar epithelial cells, whereas small groups of gland cells form the bulk of the gland."

Michaelsen compares this accessory structure to that in Cognetti's *Parapheretima*, probably leading Sims and Easton (1972, p. 266) to liken their *Ph. (Paraph.) saba* with *Ph. (Paraph.) koellikeri* although lack of nephridia on its spermathecal ducts clearly disqualifies it from the genus *Pheretima s. stricto*.

Easton's improper synonymy of prior *Metaphire vesiculata* under *Pheretima koellikeri* presumably assumed this species had nephridia on its spermathecal ducts (although Michaelsen's fig. 2 shows none, and their lack is confirmed from type specimens), and that *M. vesiculata* had them too (plus secretory glands?). Goto and Hatai (1899, fig. 15) did not describe any such glands for their *P. vesiculata* and, moreover, a usual characteristic of *Metaphire* is having stalked glands, rather than secretory diverticula, on the copulatory pouches (Sims and Easton, 1972, pp. 215, 221; Blakemore, 2008a).

Sims and Easton (1972, p. 222) had only provisionally placed *koellikeri* in the subgenus *Pheretima (Parapheretima)* because Michaelsen (1928, p. 11) remarked on its similarity to other congeners. During provisional placement of *koellikeri* in *Metaphire* by Blakemore (2007, p. 126) it was noted that it might merit allocation to another, possibly new, genus on the basis of its secretory diverticula. This action is taken here.

Augmentation from Michaelsen's original description (and Easton's that included *M. vesiculata* in part) are that the current type has large flat pads around the spermathecal pores, possibly these have some corollary function to the diverticula and penial setae of the male pores. Moreover, the spermathecal diverticula differ slightly from Michaelsen's account as the muscular stalks

are not quite as short and the bulb not as zig-zagged as shown in his (or an artist's impression) figure.

Previously thought to resemble parts of the *M. hilgendorfi* species-group (Blakemore 2003, 2010), it is now clearly separated. Further study is needed to relocate *Manus koellikeri* in its place of origin—possibly in Kyushu—to determine its conservation status, and, if it still survives, to investigate its natural habitat and ecological associations.

Etymology. Emendation of latinized Swiss-German honourific paronym; sometimes misspelt “*kollikeri*.”

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