
Robert J. Blakemore, COE Soil Ecology Group, Yokohama National University, Japan.

Email: robblakemore“at mark” bigpond.com  December, 2008

Abstract:
This updated revision lists ca. 82 valid earthworm taxa in seven families from Japan with approximately 80 further names (50% of the total) either in synonymy or retained as species incertae sedis. About 32 species are known exotics and another ten are possibly more widespread, thus the probable number of wholly endemic Japanese earthworms is around 40 species (ca. 50% of the total valid species). The genera Lumbricus and Polypheretima are now excluded from Japanese endemicity (cf. Easton, 1981), although Polypheretima elongata is an introduced taxon.

Changes from (Blakemore, 2003a,b) are new records for exotics Dendrobaena pygmaea (Savigny, 1826) from Yokohama, Eiseniella tetraedra (Savigny, 1826) from Toyama-ken, Eukerria saltensis (Beddard, 1895) from Kamakura/Machida and Biwako, and Pontoscolex corethrurus (Müller, 1857) from Okinawa (see Blakemore et al., 2007).

Revised taxa are: Amynthas agrestis (Goto & Hatai, 1899), A. micronarius (Goto & Hatai, 1898), A. carnosus (Goto & Hatai, 1899) (?syn. A. pingi), A. phaselus (Hatai, 1930), A. tappensis (Ohfuchi, 1935), A. tokioensis (Beddard, 1892), and A. koreanus (Kobayashi, 1934) to include Korean or Japanese names. Amynthas tokioensis has Metaphire levis as a new synonym, while M. soulensis (Kobayashi, 1938) and ?Metaphire koellikeri (Michaelsen, 1928) are restored.

Minor modifications are made throughout the text from Blakemore (2003). Additionally, Korean A. alveolatus Hong & James, 2001 is syn. nov. of A. kanrazanus incretus (Kobayashi, 1937); and A. yongshilensis Hong & James, 2001 is comparable to A. kanrazanus kanrazanus (Kobayashi, 1937), itself similar to A. tokioensis.

Keywords: M. hilgendorfi/A. tokioensis, A. corticis spp-complex, parthenogenetic polymorphism.
Introduction

Taxonomic background

Despite recent revisions (Easton, 1981; Ishizuka, 1999a, 2000c; 2001; Blakemore, 2003), the systematics and taxonomy of Japanese megadriles are chaotic and in urgent need of redefinition. Species names are confounded by homonymy and synonymy due to lack of basic research, non-compliance with the principles of the taxonomic code, the loss or lack of adequate type material, and frequent misidentifications. These difficulties are compounded by problems of language translation and the inaccessibility of obscure publications. Biologically, earthworms in Japan are also characterized by parthenogenetic polymorphism (pers. obs. also vide intra) so that many species names have been erected on variously degraded morphs. Reallocation of these names by association with their ancestral and biparental population, where these can be traced via their intermediate forms, may be possible using morphological and molecular techniques. However any answer to a specimen’s identity is entirely dependent on the reliability of the original description and its name is determined following the Principle of Priority under the taxonomic code (ICZN, 1999).

The first scientifically named species from Japan were *Megascolex sieboldi*, *Megascolex japonicus*, and *Megascolex schmardae*, all described by Horst (1883) from material in the collections (by P. Fr. B. von Siebold) of the Leiden Museum. Next, Michaelsen (1891) reported *Allolobophora japonica* and *A. fetida (= Eisenia)* from Japan, and Rosa (1891) described *Perichaeta ijimae*. In September, 1892, Michaelsen described *Moniligaster japonicus* and *P. hilgendorfi* and in December, 1892 Beddard described *P. rokugo*, *P. nipponica*, *P. masatake* and *P. tokioensis*. Shortly thereafter Goto & Hatai (1898; 1899) put names to ca. 27 species but their descriptions were inadequate and/or
confused so that most went directly into synonymy or incertae sedis in Michaelsen’s classical review (Michaelsen, 1900 “Das Tierreich”). Japanese studies continued steadily in a similar fashion to 1941 and were then interrupted for about 40 years until the systematics and distributions of Japanese earthworms were fully revised and reported by Easton (1981). Easton’s synopsis described 73 valid species (actually 74 but I exclude the un-named ‘Lumbricus sp.’), with a further 64 pheretimoid names placed in synonymy although 26 of these had question marks next to them. Tsai et al. (2000: 288) believed that these latter names should be retained until the specific status of each is verified, thereby possibly raising Easton’s total to 99 nominal taxa from Japan; however, I believe that the question mark serves to link possible related species and the "ressurection" of names should be proven by scholarly research. Ishizuka (1999a, 2000c, 2001) seems to have ignored Easton’s revisionary work while erecting approximately 60 new species names (excluding a few that were invalid or nomina nuda), several being homonyms, and most of which referred either to previously established taxa or to degraded morphs. Thus, including probable and possible synonymies, nearly 160 species names had been variously reported from Japan to 2002. These names are reviewed here as a prelude to the larger task of full systematic revision with inspection of types, re-survey for new specimens, and comparisons with the faunas in lands adjacent to Japan.

Oriental earthworm faunas tend to be dominated by megascolecid pheretimoid species, i.e., those formerly attributable to the genus Pheretima and characterized by racemose prostates, an oesophageal gizzard (after intersegment 7/8), perichaetine setae, and meric nephridia. Comprehensive reports of pheretimoid taxa have been presented by Michaelsen (1900) who listed all 167 species then known, by Sims & Easton (1972) who reviewed 746 nominal taxa although, according to Sims (1983: 468), about half of
these were synonyms. The revised system of classification of genera presented by Sims & Easton (1972) was further redefined in part by Easton (1979; 1982). More recently, Nakamura (1999b) claimed about 800 species but reversed most established synonymies and nomenclatural advances, and a checklist of 880 valid names was presented by Blakemore (2004). Those Japanese pheretimoids revisited in the paper by Nakamura (1999b, published December 20) were preceded and antedced with reviews by Ishizuka (1999a, published February 27; 2000c; 2001). Without much justification, both latter authors reverted to some earlier classification of *Pheretima* (cf. this genus’ definition in the current work), ignoring taxonomic progress and protocol, whereby several synonymies were inexplicably restored while other unlikely synonymies were invoked and some invalid replacement names were proposed. Such actions are retrograde and could best be ignored except where publication obliges conventional taxonomists to cite these works. However, it may also be argued that some of their nomenclatural acts do not satisfy all requirements for consistent application under the Principle of Binomial Nomenclature of ICZN (1999: Arts. 5.1; 11.4) because Japanese vernacular names are cited simultaneously and these soon assume precedence, e.g. Nakamura (1999b) provides several new Japanese names, and Ishizuka (2001: 50-52, tab. 3-46) entirely dispenses with scientific names in favour of the vernacular. Despite these challenges, a completely orthodox taxonomic revision of Japanese species was attempted by Blakemore (2003a,b).

Pheretimoids are partly distinguished by their caeca (singular, caecum) which are lateral pouches that, when present, occur on the intestine between segments 22 to 28 and possibly function for the maintenance of gut microfloral cultures and/or symbiotic protozoans (see references cited in Blakemore, 2002). In the process of computerized revision of genera into more manageable groups, Sims & Easton (1972) gave some
taxonomic importance to characters of the digestive system, even though it has long been
recognized that these may be more adaptive than are the reproductive organs - the “well
known dependence of the conformation of the alimentary tract on food and environment”
(Stephenson, 1930: 720). Nevertheless, caeca have been accorded taxonomic
significance: at the generic level by Sims & Easton (1972), whose redefinition of genera
was based partly on the absence or, where present, the segmental origin of the caeca (see
Table 1), and at the species level by Ishizuka (1999a). Sims & Easton (1972: Fig. 1, 174,
182-183) recognized three caecal characteristics:
1. Presence of intestinal caeca (absent; present in 22; present in [or near] 27).
2. State of caeca in segment 27 (single, or multiple [= multi-caecate]).
3. Modification of caeca in segment 27 (simple, or complex [= multi-lobed]).
These caecal states condence to three usual forms:
1. Simple, i.e., single with smooth margins.
2. Complex, i.e., single lobed but with several small processes and/or incised margins
   (= serrate).
3. Multiple, i.e., composed of several digiform diverticula (= manicate or “hand-like”).

Different types of caeca are shown in Fig. 0.1 (below) albeit types 1A-1D may merely be
age-related developments, and 1E-1F may be the same too. Interestingly, the genus
Planapheretima Michaelsen, 1934 allows species with caeca manicate, simple, or absent;
and Sims & Easton (1972: 222) allowed for P. (Parapheretima) to have either simple or
non-simple or multicaecate forms.
Ishizuka (1999a: 56), with a conviction that “the morphology of intestinal caeca as most important character”, attempted to differentiate four kinds of caeca (viz. simple, serrate, manicate, and multiple – this latter a supposedly more complex manicate form) while mostly ignoring nephridia, typhlosoles, vascular details, and important taxonomic differences of the male organs. Nakamura (1999b: 4, Fig. 1) only recognized two caecal forms and gave two examples for each but each time mistakenly cited species long established in synonymy and also confused ‘simple and serrate’ with ‘manicate’, and ‘manicate’ with Ishizuka’s ‘multiple’ (albeit these latter two are essentially the same).

The difficulty of reliance on caeca is that some early reports do not distinguish between forms, and may even overlook the caeca completely e.g. original descriptions of *Perichaeta iizukai* by Goto & Hatai, 1899 (*vide intra*) and in some synonyms of *Amynthas minimus* (see Sims & Easton, 1972: 224). Moreover, for lobate/serrate caeca,
Sims & Easton (1972: 264) for *P. darnleiensis* (Fletcher, 1887) remarked that these “cannot be regarded as taxonomic characters as they are more fully formed in the larger specimens and their development would appear to be correlated with growth” and for *P. (Parapheretima)* they (Sims & Easton, 1972: 222) allowed simple or multiple caeca. This may also be the case with *Metaphire musica* (Horst, 1882) which was described with either six secondary caeca or only the superior caecum being present (but this is probably misidentification of *Metaphire longa*); with the four former subspecies of *Amythas jampeanus* (Benham, 1896); with *A. digitatus* (Benham, 1897); with *Metaphire tschiliensis* (Michaelsen, 1928); and with *Amythas tuberculatus* (Gates, 1925) all of which have either simple, albeit incised, or multiple caeca (e.g. as found by Chen, 1936, figs. 18, 21). Chen (1933: 255, figs. 20, 21) in his re-description of *Metaphire yamadai* (Hatai, 1930) had two varieties with either serrate or manicate intestinal caeca (but obviously a misidentification of the former). As futher examples: Sims & Easton (1972: 258, fig. 3, tab. 14) describe in detail the various sub-species of *Amythas omeimontis* (Chen, 1931) that vary in this character (although these may in actuality be separate species according to Blakemore, 2004), and Qiu *et al.* (2002 poster paper at Cardiff conference) say that *Amythas palmosus* (Chen, 1946) appears to be a species-group with transition from simple to compound caeca. *Amythas manicatus* (Gates, 1931) from Myanmar and Thailand has perhaps the most developed intestinal caeca: they are manicate or complex in 27 with 4-11 secondary caeca and there are additional rudimentary manicate caeca in some or all of 28-30 (Gates, 1972: 201). Of note is that this latter species, that occasionally has male pores in segment 19 as with *M. megascolioidioides*, lacks a typhlosole - a possible analogous structure allowing culture of gut symbionts in the folds as well as increasing the surface area of the gut.
In the Megascolecidae, intestinal caeca are not confined to some pheretimoid genera as species with two pairs have recently been discovered for the first time in Australian natives placed in the genus *Caecadrilus* Blakemore, 2000 and the North American genus *Toutellus* Fender & McKey-Fender, 1990 has several pairs of intestinal caeca in series, and *Promegascolex mekonianus* Cognetti, 1922 also has simple intestinal caeca. In the Octochaetidae, some species of the Indian genus *Eutyphoeus* Michaelsen, 1900 (eg. *E. gigas*) also have intestinal caeca as in the pheretimoids.

**Pathenogenetic polymorphism**

Current field studies support literature reports of a high frequency of reproductive organ polymorphism in Japanese, Korean, southern Chinese and South-east Asian pheretimoids. Although sexual dimorphism is as yet unknown for hermaphroditic earthworms when compared to the sexually reproducing forms of marine Polychaeta in which the sexes may be separate, or simultaneous, or sequentially hermaphroditic. The three main kinds of morphological variability in earthworms, then, are a result either of different life stages (i.e., cocoon, hatchling, immature, juvenile, sub-adult, adult, regressed adult); or parthenogenetic degradation of reproductive organs; or due to other factors (e.g. aberrations from natural species variability, defective regeneration, and ecotypes - local ecophenotypes or genetic variants caused by geographic, climatic, elevational, or soil related factors). Gates (1972: 16-19) deduced parthenogenesis in lumbricid or megascolecid earthworms where members of a population, rather than aberrant individuals, have some or all of these conditions:

1. Testes and/or seminal vesicles retained in a juvenile state in adult specimens.
2. Absence of spermatozoal iridescence in male funnels and/or spermathecae.
3. Lack of spermatophores or, if present, absence therein of spermatozoa.

[Spermatophores have been found in a few pheretimoids by Michaelsen (1930)].

Male sterility in specimens with any of the above conditions may be further accompanied by loss or degradation, completely or partially, of other sexual structures, e.g. genital markings, spermathecae, male copulatory organs, prostates, and modified setae. Only the clitellum, ovaries, oviducts, and perhaps ovisacs, appear essential for reproduction.

Gates’s codes for the common forms of degraded morphs are:

A – for parthenogenetic athecal morphs (i.e., lacking spermathecae);

R – for parthenogenetic anarsenosomphic morphs (i.e., lacking male terminalia);

Z – for parthenogenetic morphs lacking testes (also testis sacs and/or seminal vesicles);

AR - athecal, anarsenosomphic, parthenogenetic morphs;

ARZ – athecal, anarsenosomphic, parthenogenetic morphs without testes;

I – for intermediate morphs with incomplete/asymmetrical deletion of the above organs;

Hp – for hermaphroditic parthenogenetic morphs in which the reproductive organs are present but remain in a juvenile state in adult specimens;

H – a hermaphroditic morph with biparental reproduction of a species also with parthenogenetic morphs. (Note: the H morph is not to be confused with the Holotype).

Intermediate morphs facilitate recognition of the ancestral amphimictic populations, in which case “the species is understood to include not only the interbreeding population, but also all recently evolved uniparental strains, clones, or morphs that clearly are affiliated with it” (Gates, 1972: 18). Where the original biparental population is unknown, or extinct, the intermediates may at least allow taxonomic synonymy of the variously degraded morphs that have been given species names.
precipitously. But this can be problematical when the spermathcae, usually reliable characters for separation of taxa, are variously deleted and degraded. Parthenogenetic morphs may yet copulate (e.g. pseudogamic reproduction with or without exchange of sperm), and polyploidy is not by itself evidential for parthenogenesis as some male sterile diploids are known (Gates, 1972: 16). The functional anatomy of the reproductive organs, especially the spermathecae and prostates, and their importance in earthworm systematics are discussed by Blakemore (2000; 2002).

Japanese studies on variability of genital structures, reproductive processes and breeding habits for parts of the *Metaphire hilgendorfi / Amynthas tokioensis* species-complex were by Oishi (1930), Kobayashi (1937), and Ohfuchi (1938a).

**Nomenclature and Systematics**

The formation of a species’ name by taxonomists is governed by rules and recommendations as codified by an international standard, the current version being ICZN (1999 - see http://www.iczn.org/iczn/index.jsp), which is also available in Japanese (see http://www.iczn.org/code.htm). Classification aims to be universal, hierarchical and phylogenetic. By convention, the species name is tied to and defined by the state of the unique type specimen (i.e., the holotype, lectotype, or neotype). Similarly at its least inclusive definition, the genus is characterized by its named type-species. All specimens that comply with these references, allowing for permissible variation, are attributed to the taxon at each level. Thus, only pheretimoid species with nephridia on the spermathecal ducts and male pores in copulatory pouches, as found in the type-species *Pheretima montana* Kinberg, 1867, belong in the genus *Pheretima* sensu stricto. Homonymy occurs where the same species name is applied to different organisms, although transfer to
separate genera may remove this (ICZN, 1999: Art. 52); synonymy is where the same organism has been given various names, so that only the earliest valid name is correct for that species (Art. 23.3); orthography is the correct spelling of the name (Art. 25) when published (Arts. 7-9, 21-22) by an author (Arts. 50-51). Junior primary homonyms are objectively and permanently invalid under the terms of ICZN (1999: Art. 57.2), but junior secondary homonyms are only treated as invalid whilst considered congeneric (Art. 59) and may be reinstated, with any replacement name proposed after 1960 entering their synonymy (Art. 59.4).

However, the naming process is a human activity that differs from speciation processes at work in Nature. Parthenogenetically degraded morphs that do not reproduce by normal meiosis and cross-fertilization to produce diploid offspring are outside the conventional species concept (e.g. Mayr, 1968; Gates, 1972; Reynolds, 1974). And, even though the availability of a taxonomic name is not affected even if "it is based on only part of an animal, or one sex, or one stage in the life cycle, or one of several dissimilar generations, or one morph or caste of a polymorphic species, or a parthenogenetic form, or a specimen which is an unusual example of the taxon" (ICZN, 1999: Art. 17.3), it is preferable that polymorphic forms should be distinguished only after considerable research has been conducted to determine the ancestral populations from whence they originate; moreover, Gates (1972: 95) said that provision of names for all intermediate morphs is "ridiculous". A major problem with Japanese systematics is that degraded morphs lacking male pores and spermathecae cannot easily be classified at genus nor species level by morphological methods alone, although not infrequently these events have been accorded scientific names.
Materials and Methods

The current taxonomic revision attempts, under ICZN (1999), to reallocate morphs that have been given names, or to associate them within informal species-complexes; alternatively they are listed as species incertae sedis until such a time as they can be linked with more definite descriptions of complete specimens from biparental populations that are not necessarily from Japan. The basis for this revision is a data survey from the literature complemented with species inspections where specimens were available. Examples of the most common cosmopolitan species obtained from various sources around the world have been previously redescribed (e.g. Blakemore, 1994; 1999; 2000; 2002). Due to operational constraints Japanese type specimens have yet to be thoroughly tracked, but there is no indication that these were inspected by Easton (1981), nor by Ishizuka (1999a; 2001). However, some specimens in institutional collections have been inspected and incidental collection by the author around Tokyo, Kanagawa, Nara and Kanazawa districts of Honshu and Shikoku Islands, Japan in 2001-2003 has allowed some redescription based on fresh material. While reallocating taxa as necessary, the classification system employed herein complies with recent precedent: nomenclature of pheretimoids follows Sims & Easton (1972) and Easton (1979; 1981), while lumbricid nomenclature mostly follows Sims (1983) and Easton (1983) that, surprisingly, are more in line with current concepts than the nomenclature presented by Sims & Gerard (1985) that is repeated in a new but unrevised edition in Sims & Gerard (1999). Brief diagnoses are given for the pheretimoids. Type locations and materials are derived from original descriptions, or from Michaelsen (1900), Gates (1972), and Reynolds & Cook (1976).

Some of the synonyms against which Easton (1981) had placed question marks are supported pending further investigation, but these names are also placed within braces.
in the species’ synonymies herein. Other braces surround the synonym concepts of previous authors following their citation, and these may or may not be wholly accepted currently. Where these authors expressed reservation, a question-mark precedes the specific name. Colons mark non-original citations (e.g. re- and mis-descriptions) and semi-colons separate repetitions. The synonymy format is therefore similar to that of Sims & Easton (1972: Appendix III). Other descriptive conventions are those usually employed for earthworm systematics (eg. Easton, 1981; Blakemore, 2000; 2002).
Systematics Results – Checklist of Japanese Earthworms

Summary Checklist of Taxa
* = exotic/introduced, - = native/endemic, # = uncertain origins/affinities; syn. = synonyms.
For common exotics not all synonyms are given as these may be readily found elsewhere eg. Blakemore (2002 and in prep.).

Family Moniligastridae

#1. *Drawida hattamimizu* Hatai, 1930.
*2. *Drawida japonica* (Michaelsen, 1892) (syn. *grahami*).

Family Criodrilidae


Family Lumbricidae

*Aporrectodea caliginosa* species-group sensu Blakemore (2002). Included species reported from Japan:


#15. *Dendrobaena octaedra* (Savigny, 1826).


*Dendrodrilus rubidus* species-complex sensu Blakemore (2002). Included subspecies reported from Japan:

*17. *Dendrodrilus rubidus rubidus* (Savigny, 1826).

*18. *Dendrodrilus rubidus tenuis* (Eisen, 1874).

*Eisenia fetida* species-complex sensu Blakemore (2002). Included species reported from Japan:


#21. *Eisenia japonica* (Michaelsen, 1891) (syn. *japonica gigantica; japonica minuta*).


[Note: a new *Helodrilus* sp. from Hachioji western Tokyo is by Blakemore (in prep.).]

Family Ocnerodrilidae


Family Acanthodrilidae


Family Octochaetidae (Subfamily Benhamiinae)

*26. *Dichogaster (Diplothecodrilus) bolai* (Michaelsen, 1891) (syn. ?*hatomaana*).

*27. *Dichogaster (Diplothecodrilus) saliens* (Beddard, 1893) (syn. ?*hatomaana*).

Family Megascolecidae sensu Blakemore (2000)

#28. *Pontodrilus litoralis* (Grube, 1855) [syn. *marionis; bermudensis, matsushimensis, albanyensis, cygni, indica, gracilis*; full synonymy in Blakemore (2002)].
*29. **Perionyx excavatus** Perrier, 1872 (syn. gruenewaldi; fulvus, ?koboensis, ?turaensis).

#30. **Amynthas carnosus** (Goto & Hatai, 1899) (syn. ?pingi Stephenson, 1925; kyamikia Kobayashi, 1934; ?youngtai Hong & James, 2001; sangyeoli Hong & James, 2001; ?A. nanshanensis Shen et al., 2003).

-31. **Amynthas conformis** (Ishizuka, 2000) [syn. monticola Ishizuka, 2000 - a permanently invalid primary homonym, non Beddard, 1912 (= Polytheretima monticola); an invalid manuscript name "montivaga" was sometimes supplanted over this name].

**Amynthas corticis** species-complex. Included species from Japan:

#32. **Amynthas corticis** (Kinberg, 1867) [syn. diffringens; ?sanctaehelenae; subquadrangula; indicus Horst, 1883 [non Perichaeta indica : Horst, 1885 (= Pheretima darnleiensis)]; peregrina; ?mirabilis; heterochaeta; ?ijimae; divergens; nipponica; ?molukaiensis; heteropoda; ?marenzelleri; divergens yunnanensis; ?sheni; oyamai; tajiroensis; ?homosetus; ?mori; torii; clerica; ?hatomajimensis; medicampestris Nakamura, 1999 [nom. nov. pro campestris Lee, 1952 non Goto & Hatai, 1898 (= A. robustus)]; imajimai; confusa; nipparensis; subrotunda; rufidula; silvestris Ishizuka, 1999 [a permanently invalid primary homonym, non Michaelsen, 1923]; semilunaris; fulva; subterranea; subalpina; mutabilis; nubicola; umbrosa ; invisA Ishizuka, 2000 [a permanently invalid primary homonym, non Cognetti, 1913]; nigella; ?setosa Ishizuka et al., 2000 (a permanently invalid primary homonym, non Cognetti, 1908)].

-33. **Amynthas distichus** (Ishizuka, 2000).

-34. **Amynthas ellipticus** (Ishizuka, 1999).

-35. **Amynthas flavescens** (Goto & Hatai, 1898) (syn. producta; houlleti bidenryoana; leucocirca : Ohfuchi, 1956 [?non Chen, 1933]; noharuzakiensis ).
36. *Amynthas fuscatus* (Goto & Hatai, 1898) (syn. *grosa; iizukai; ?shimaensis; montana*

Ishizuka, 1999 [a permanently invalid primary homonym, non Kinberg, 1867];

*atrorubens; alpestris; dura; turgida; argentea; ?flavida; ?lactea; ?mitakensis*).

#37. *Amynthas glabrus* (Gates, 1932) (syn. *tenellula; vieta; papilio* : Ohfuchi, 1956

[?misidentification, non Gates, 1930]).

*38. *Amynthas gracilis* (Kinberg, 1867) [syn. *hawayana; bermudensis; mandhorensis; ?mauritiana; ?kamakurensis; ?parvula* Goto & Hatai, 1898 non Ohfuchi, 1956 (= *Metaphire parvula* nec Ishizuka et al., 2000 (= 'P' palarva Blakemore, 2003); ?*decimpapillata; ?kagoshimensis; autumnalis*].


*40. *Amynthas hupeiensis* (Michaelsen, 1895).


43. *Amynthas micronarius* (Goto & Hatai, 1898) (syn.?*yamizoyamensis ; obtusa ; hinoharensis; ?hypogaea; ?edoensis*).

*44. *Amynthas minimus* (Horst, 1893) (syn. *pusilla* Ude, 1893 [non Ohfuchi, 1956];

*enchytraeoides ; zoysiae ;?fungina; ?muta; ishikawai; humilis*).


46. *Amynthas obscurus* (Goto & Hatai, 1898) [non Spencer, 1893 (= *Diporochaeta obscura*)].

*47. *Amynthas papulosus* (Rosa, 1896) (syn. *papulosa sauteri; composita; rockefelleri; hsinpuensis* Kuo, 1985).


*50. *Amynthas robustus* (Perrier, 1872) [syn. *masatakae; campestris* Goto & Hatai, 1898 (non Lee, 1952); *?zavattarii; ornata; ?sheni; ?lauta (siemsseni, fokiensis); corrugata*].

-51. *Amynthas scholasticus* (Goto & Hatai, 1898).


*54. *Metaphire californica* (Kinberg, 1867) (syn. *modesta; molesta; sakaguchii; sonaiensis*).

*Metaphire hilgendorfi / Amynthas tokioensis* species-complex [*Amynthas hilgendorfi* species-complex sensu Easton (1981)]. Included species recorded from Japan:

-55. *Amynthas agrestis* (Goto & Hatai, 1899) (syn. *striata*).

-56. *Amynthas ambiguus* (Cognetti, 1906) [Non *Pheretima barbara ambiguа Cognetti, 1913: 302 from New Guinea (= *Pheretima barbiguа Blakemore, 2004 nom. nov)*].


-59. *Amynthas parvicystis* (Goto & Hatai, 1899) [syn. *?verticosa; cf. tokioensis*].

-60. *Amynthas purpuratus* (Ishizuka, 1999b).

odaesanensis Hong & James, 2001, righii Hong & James, 2001, fasciiformis Hong & James, 2001 - synoynym as per Blakemore, 2003: 43, addenda; sanchongensis Hong & James, 2001).


-63. Amynthas vittatus (Goto & Hatai, 1898).

-64. Amynthas? yunoshimensis (Hatai, 1930).


#67. Metaphire hilgendorfi (Michaelsen, 1892) [syn. rokugo; ?irregularis Goto & Hatai, 1899 [non Spencer, 1895 (= Perionychella irregularis)]; ?yunoshimensis, glandularis].

-68. Metaphire servina (Hatai & Ohfuchi, 1937).

#69. Metaphire soulensis (Kobayashi, 1938) (syn. Pheretima shinkeiensis

#70. *Metaphire vesiculata* (Goto & Hatai, 1899)

(syn. *?okutamaensis* ; *?biggiberosa*).


[End of *M. hilgendorfi / A. tokioensis* species-complex].

#72. *Metaphire megascolidioides* (Goto & Hatai, 1899).


*74. *Metaphire peguana* (Rosa, 1890) (syn. *saigonensis*).


*76a. *Metaphire* (now *Duplodidodrilus*) *schmardae schmardae* (Horst, 1883) [non *Megascolex schmardae* Michaelsen, 1897], (syn. *triphyla*; *kikuchii*).

*76b. *Metaphire* (now *Duplododrilus*) *schmardae macrochaeta* (Michaelsen, 1899).


-78. *Metaphire tosaensis* (Ohfuchi, 1938).

#79. *?Metaphire koellikeri* (Michaelsen, 1928) (?introduction).


*Polypheretima elongata* species-complex [ *Metaphretima elongata* species-complex]
sensu Sims & Easton (1972); Easton (1976). Included species from Ryuku Islands:

*81. Polypheretima elongata (Perrier, 1872) [non Pheretima elongata: Ohfuchi, 1956 (= Amynthas morrisi)], (syn. biserialis, acystis, monocystis, aelongata).

Family Glossoscolecidae

*82. Pontoscolex corethrurus (Müller, 1857) (syns. - see Blakemore (2002). New record from Okinawa, Japan (although Nakamura (1994) reports it from Ogasawara/Bonin Isls.).

# Species incertae sedis [i.e., “of uncertain taxonomic position” ICZN (1999: Glossary)].

Amynthas hibernus (Ishizuka, 1999).

Amynthas illotus (Gates, 1932) species-group sensu Sims & Easton (1972). Included names recorded from Japan:

Amynthas assacceus (Chen, 1938) [syn. medipusillus Nakamura, 1999 nom. nov. pro Pheretima pusilla Ohfuchi, 1956 (non Ude, 1893); ?Amynthas proasacceus (sic) Tsai et al., 2001].


Amynthas imperfectus (Ishizuka, 1999).


[End of A. illotus species-group].

Amynthas octo (Ishizuka, 2000).

Amynthas stipatus (Ishizuka, 1999).

Amynthas tamaensis (Ishizuka, 1999).

‘Pheretima’ palarva Blakemore, 2003 [nom. nov. pro P. parvula Ishizuka et al., 2000 non Perichaeta parvula Goto & Hatai, 1889 (?= A. gracilis), nec Pheretima parvula Ohfuchi, 1956 (= Metaphire parvula); perhaps better as Amynthas? palarvus].

(* = exotic/introduced, - = native/endemic, # = uncertain affinities, syn. = synonyms).
Details of Revisions with Taxonomic Diagnoses (Families after Blakemore, 2000)

Family Moniligasteridae

Genus *Drawida* Michaelsen, 1900

Remarks: The distribution of *Drawida* was stated by Easton (1981: 34) to include Korea, 'Manchuria' and eastern Siberia as well as most of the Oriental Region, especially India, although he noted that the family Moniligasteridae possibly invaded Asia after the collision of the Indian and Asian plates during the Tertiary period. Gates (1972: 238) considered *Drawida* to have a self-acquired range greater than that of the ‘*Pheretima* domain’, with the total of species expected to rival the number of pheretimoids. Several species are cosmopolitan and their distribution has been extended by human activities (see Gates, 1972; Easton, 1982; Blakemore, 1999; 2002). Easton (1981) remarked that the genus is poorly known in Japan, and that five new *Drawida* species names listed by Oishi (1932: 18), e.g. “*Drawida hatai*”, were not supported by descriptions and are therefore *nomina nuda* outside of nomenclature.

*Drawida hattamimizu* Hatai, 1930


Distribution: Japan (Hokkaido, Kanazawa, Hatta village and Lake Biwa region).

Remarks: Large species with wide but restricted distribution in Japan that suggests it was possibly imported, although it is not yet known elsewhere. Identification confirmed on new material from type locality collected by current author in 2002.

*Drawida japonica* (Michaelsen, 1892)

*Moniligaster japonicus* Michaelsen, 1892: 232. From Japan. (Syn-)types in Hamburg
Museum: 403 (Reynolds & Cook, 1976), but stated by Michaelsen as in Zoological Museum, Berlin: 2122 (and this syntype is also listed by Hartwich & Kilias, 1989: 268 and, now, confirmed by Reynolds & Cook, 1992: 25).


*Drawida japonica typica*: Michaelsen, 1910:49.


Distribution: *Drawida japonica* is probably not endemic to Japan as Tsai et al. (2000: 290) list and cite references for its distribution in southern China, Taiwan, the Ryukyu Islands, Japan, Korea, and south-east Asia. Also reported from Indian Himalayas (Stephenson, 1917, 1923).

Remarks: Michaelsen (1910: 48-52; 1931b: 7; 1931: 523) established subspecies for this taxon, *Drawida japonica siemsseni* (Michaelsen, 1910) from Fuchow, China, and *Drawida japonica bahamensis* (Beddard, 1893) that was subsequently placed, at least by Easton (1984), in synonymy of *Drawida barwelli* (Beddard, 1886). Kobayashi (1940) had proposed a dispersal of *D. japonica* from China to Japan, possibly via Taiwan and questioned the identification of some earlier records from outside the Japan/Korea area. Nevertheless, Gates (1972: 244) was of the opinion that this species came originally from the Indian Himalayas, where it was first recorded by Stephenson (1917), from Yunnan and Szechuan. Easton (1981: 37) included only Japanese and Korean records in his distribution range for this taxon. Michaelsen (1892) described a pair of markings on 10 in front of male tubercules in 10/11. Easton and Stephenson only say markings are in 7-9, and sometimes 12 and 13; overlookin those stated to be in 10. Identification to be confirmed and augmented from inspection of new material by current author (ms in...
preparation).

**Drawida keikiensis** Kobayashi, 1938

*Drawida keikiensis* Kobayashi, 1938: 107. Types?
Distribution: Japan and Korea.

**Drawida koreana** Kobayashi, 1938

*Drawida koreana* Kobayashi, 1938: 102. Types?
Distribution: Korea and Japan.

**Drawida moriokaensis** Ohfuchi, 1938

*Drawida moriokaensis* Ohfuchi, 1938b: 44. Types?
Distribution: Japan.

**Drawida nemora** Kobayashi, 1936

*Drawida nemora* Kobayashi, 1936c: 141. Types?
Distribution: Korea and Japan.

**Drawida ofunatoensis** Ohfuchi, 1938

*Drawida ofunatoensis* Ohfuchi, 1938c: 33. Types?
Distribution: Japan.

**Drawida tairaensis** Ohfuchi, 1938

*Drawida tairaensis* Ohfuchi, 1938b: 39. Types?
Distribution: Japan.

Family Criodrilidae Vejdosky, 1884

[including Biwadrilidae as the separation, e.g. by Sims (1980: 106), on the basis of lateral lines appears erroneous, pers. obs.].

_Biwadrilus bathybates_ (Stephenson, 1917)

Fig. 1. _Biwadrilus bathybates_ (original figure).

_Criodrilus bathybates_ Stephenson, 1917: 96. From Biwa-ko (60m deep). Types are four immatures in Calcutta Museum. [Often misspelt "bathybathes"]


_Biwadrilus bathybates_: Easton, 1981: 40 (syn. _miyashitai_).

Distribution: Mainly known from the Lake Biwa region of central Honshu, Japan, also reported from NW coastal Yamagata-ken and SW coast Hyogo-ken.

Remarks: The previous family Biwadrilidae was monotypic although Sims (1980: 115; 1982: 285) seems to suggest that the family may be recombined with Criodrilidae as it differs only in details of its vascular system, in particular the presence of a supra-oesophageal vessel (and possible lack of a sub-neural vessel) and presence of "prostate glands" in 13. The stated presence of "a paired lateral line", eg. by Sims (1980: 106, 115), appears to be mistaken as the only visible lateral lines are due to blood vessels clearly visible through the body wall in the anterior segments in live specimens (pers. obs.).
Family Lumbricidae

Only partial synopses are given here, full synonymies of the species, diagnoses and distributions may be found elsewhere (e.g. Gates, 1972; 1974; Easton, 1983; Sims & Gerard, 1985; 1999; Blakemore, 2002 and a checklist of all species in Blakemore, 2005).

Distribution: Endemic to Holarctic, from Vancouver Island to Japan; several species cosmopolitan by introduction.

*Bimastos parvus* (Eisen, 1874)


*Allolobophora parva udei* Ribaucourt, 1896: 80. Locality Heustrich, Switzerland. Types?

*Allolobophora constricta var. germinata* Friend, 1897: 1. Co. Antrim, Ireland. Types?


*Allolobophora parva*: Easton, 1983: 475 (syn. *beddardi*, *parva udei*, *constricta germinata*). Distribution: Cosmopolitan species indigenous to Palaearctic (NE USA); fairly common in Japan. Current specimens from Okutama (collected 26th May, 2003 by R.J.B. under plant pots in carpark of hotel in Okutama) and Kuzuharagaoka Shrine, Kamakura, Japan (specimen collected from drain 13.vi.2004 by RJB, Amanda Reid and Yuko Hiramoto).

Remarks: Easton (1983) appears to ignore the synonymy by Gates (1972) in *Bimastos*
parvus of Bimastos longicinctus Smith & Gittings, 1915 that he instead retains provisionally in Eisenia. According to Easton (1983), Allolobophora parva Eisen, 1874 replaces Eisenia parva or Bimastos parvus, but current workers still use either of these names, and more recently this taxon was briefly transferred to the genus Allolobophoridella Mršić, 1990 before its return to Bimastos by Csuzdi & Zicsi (2003: 69).

Aporrectodea rosea (Savigny, 1826)

Enterion roseum Savigny, 1826: 182.

Eisenia rosea: Easton, 1981: 44.


Distribution: Cosmopolitan species, indigenous to Palaearctic; reported from Hokkaido.

Remarks: This species is widely distributed around the world mainly by introduction and has very numerous synonymies, including several from Kobayashi (1940), (e.g., see Gates, 1972, 1974; Sims & Gerard, 1985; 1999; Blakemore, 2002; 2004; 2005). The Japanese records, however, were thought dubious by Stop-Bowitz (1969: 190).

Aporrectodea caliginosa species-group sensu Blakemore (2002).

Included species reported from Japan:

Aporrectodea caliginosa (Savigny, 1826)

Aporrectodea trapezoides (Dugès, 1828)

Aporrectodea tuberculata (Eisen, 1874)

Distribution: Cosmopolitan species, indigenous to Palaearctic; several reports from Japan.

Remarks: All three of the above species have been reported as introductions to Japan: the first two, A. caliginosa and A. trapezoides, are cited by Easton (1981) and the third, A.
tuberculata, is tentatively derived from Kobayashi’s studies (published in 1940; 1941a, 1941b, 1941c) that listed A. caliginosa typica from Manchuria, Korea, and Japan although he may actually have been referring to A. tuberculata according to assessments by Gates (1972: 81) and by Shih et al. (1999: 439).

**Dendrobaena octaedra** (Savigny, 1826)

*Enterion octaedrum* Savigny, 1826: 183.

Distribution: Cosmopolitan, indigenous to Holarctic; recoded from Sapporo and Hidaka, Hokkaido (endemic?) by Easton (1981), and Fujikawa Shizuoka-ken by Nakamura et al. (1989).

Remarks: Parthenogenetic polymorphs are common (Sims & Gerard, 1985; 1999: 72).

**Dendrobaena pygmaea** (Savigny, 1826)

*Enterion pygmaeum* Savigny, 1826: 183.

Distribution: Indigenous to western Europe. This is the first record from Asia: from Yohohama National University campus (Coll. & Det.: R.J. Blakemore, 9-10th May, 2003).

Remarks: This taxon along with *D. attenuata* (Michaelsen, 1902) and *D. octaedra* (Savigny, 1826: 183) may form a parthenogenetic species-complex, possibly also involving the biparental *Satchellius mammalis* (Savigny, 1826: 181) in which case this latter species name would take overall priority (see Blakemore, 2002; 2003a,b).

**Dendrodrilus rubidus** species-complex sensu Blakemore (2002).

Included subspecies reported from Japan:

**Dendrodrilus rubidus rubidus** (Savigny, 1826)
**Dendrodrilus rubidus tenuis** (Eisen, 1874)

Distribution: Cosmopolitan species-complex, probably indigenous to Holarctic as fossil cocoons were found in postglacial deposits in Ontario (Schwert, 1979). In Japan, found mainly in Hokkaido and northern Honshu with new records from current study at Okutama and Yamanashi-ken in central Honshu.

Remarks: Full synonymies of subspecies and morphs may be found elsewhere (e.g. Blakemore, 2002).

**Eisenia fetida** species-complex sensu Blakemore (2002)

Included species reported from Japan:

*Eisenia andrei* Bouché, 1972 (nom. nov. pro *fetida* var. *unicolor* Andre, 1963)

*Eisenia fetida* (Savigny, 1826)

Distribution: Cosmopolitan species, indigenous to Palaearctic.

Remarks: *Eisenia andrei* is a molecular species that currently can be differentiated from *E. fetida* only by electrophoresis, indeed Easton (1983) considered it a junior synonym of *E. fetida*, and both taxa have morphs and/or ecotypes that overlap morphologically (Sims & Gerard, 1985; 1999). Moreover, it is possible that *Eisenia nordenskioeldi* (Eisen, 1874) is also implicated, either in synonymy or within the species-complex (see Gates, 1972: 103; Blakemore, 2002: 317). The *Eisenia fetida* species-complex is employed in vermicultural, laboratory and ecotoxicological studies around the world, including Japan (pers. obs.), although the names *fetida* and *andrei* are interchanged rather indiscriminately and the invalid “foetida” spelling persists in some reports. The first Japanese report was by Michaelsen (1892: 230).
**Eisenia japonica** (Michaelsen, 1891)

*Allolobophora japonica* Michaelsen, 1891: 6; 1892: 230. Type locality Japan (Enoshima, Hakodate, and Fuji-san). Types in Hamburg: 119-122, other material was stated by Michaelsen (1892) to be in Zoological Museum, Berlin: listed by Hartwich & Kilias (1989: 268) as 2115 from Hakodate (a syntype lost after loan to Turin Museum in 1893), and 2117 from Enoshima (8 syntypes).

*Helodrilus (Allolobophora) japonicus*: Michaelsen, 1900: 481.


*Eisenia japonica*: Easton, 1981:43; Easton, 1983: 480 (syn. *japonica gigantica, japonica minuta*).

Diagnosis: Lumbricine setae closely paired. Setae ab on 22 and 25 in tumid pads (Michaelsen). Spermathecal pores in 9/10/11 in c or cd lines. Clitellum 23,24-31. Tubercula pubertatis as low elongate markings on 25,26,27-29 and usually as raised papillae on 27 and 29. Specimens collected from Lake Biwa (by RJB 1st Feb, 2007) had some variation in genital papillae one having paired papillae on one side and a single papilla on 27 on the other.

Distribution: considered endemic to Japan (Hokkaido to Kyushu), Korea and possibly China (e.g. from Sansei by Ohfuchi, 1951: 62), despite a report from Europe (Germany, Graff, 1954); also listed in a Red Data Book of the Russian Federation (Anon, 1997) since its recording on south Sakahlin Island (Perel, 1979: 78) so it may yet be an introduction, possibly from eastern Siberia, or have a wide natural range.

Remarks: Easton (1981: 43) mistakenly cites the publication as “Michaelsen, 1892: 230”, but this is corrected in Easton (1983). The three “varieties” of this species were listed by
Easton (1981: 43) and, even though ICZN (1999, Art. 45.6.4) allows such names published before 1961 to assume sub-specific rank, they were later combined under *E. japonica* by Easton (1983:480). Gates (1975) provides a detailed account of this species. A congener also known from the region is *Eisenia koreana* (Zicsi, 1972), that is sometimes returned to its original genus of *Eiseniella*, which has these characters (Cs. Csuzdi pers. comm.): clitellum 25-31, TP 27-28, male pores on 15 in glandular region that extends into adjacent segments, length 30-35 mm, and a dark brown colour.

**Eiseniella tetraedra tetraedra** (Savigny, 1826)

**Taxonomic Notes:** Easton (1983) has these subspecies: *Ei. tetraedra intermedia* Cernovitov, 1934 [non Jackson, 1931] - the junior homonym now *Ei. tetraedra cerni* Blakemore, 2004 (replacement name); *Ei. t. neapolitana* (Örley, 1885) syn. ?ninnii Rosa, 1886; *tetraedra sewelli* Stephenson, 1924 (from Italy, California, Middle East) and recently elevated to species level by Csuzdi & Pavliček, 2005; and *Ei. t. pupa* (Eisen, 1874) syn. *hercynius* Michaelsen, 1890; *tetraedra quadripora* Cernovitov, 1942. The latter subspecies, *Ei. t. pupa*, is recorded from Niagara; Germany; Portugal; USA (California and Illinois); England (Tring, Hertfordshire; Ashby-de-la-Zouche, Leicestershire); and Fifeshire, Scotland; - it has male pores on 12 or 15 as do morphs of some other sub-species. According to Csuzdi & Zicsi (2003: 153-157) either *Ei. t. pupa* (which they have as junior synonym of "*Eis. t. hercynia*"") and *Ei. t. cerni* are in synonymy of *Ei. tetraedra*, or they are separate subspecies, or merely morphs; however, the only differences of several *tetraedra* taxa are the locations of the male pores they could be varieties rather than subspecies. Variations are usually thus:

*Ei. t. cerni* Blakemore, 2004 male pores on 14.
**Ei. t. tetraedra** (Savigny, 1826) male pores on 13.

**Ei. t. pupa** (Eisen, 1874) male pores on 12 or 15.

Distribution: Western Palaeartic (possibly endemic in north Balkans – Gerard), Scandinavia to Pri-urals; Adriatic and Mediterranean, many locations, eg. a spring at Mt Meon, Galilee, Israel (Csuzdi & Pavlicek, 2005) etc.; now introduced into mainly temperate regions including northern Nearctic (eg. Canada, Pennsylvania, California), also the Levant; southern South America [eg. Chile - Navarino Island where in 1830 Captain Fitzroy commanding the "Beagle", landed and took 4 young Fuegian hostages in retribution for a stolen boat, returning them on the "Beagle's" 2nd trip with Charles Darwin in January, 1833, and revisiting again in March, 1834] south of Tierra del Fuego, Chile - (Anderson & Hendrix, 2003), and remote Juan Fernández Islands (now renamed by the Chilean government as “Robinson Crusoe Islands” to commemorate the story of the same name based on Alexander Selkirk’s sojourn there); Azores; Canary Islands; Cape Verde; St Helena; Tristan de Cunha; Mexico; Colombia at 3,000m (Feijoo *et al.*, 2004); South Africa; Morocco; Libya; Iran, Afghanistan, Tajikistan; etc. India; New Zealand and Australia: infrequently reported from south-western WA [*Eiseniella intermedius* (sic) Jackson, 1931 synonomised by Michaelsen, 1935a: 40; Easton, 1983], NSW (Michaelsen, 1907a; Barley & Kleinig, 1964), Brownhill Creek in SA (J. Buckerfield, pers. com.), Macquarie Island and New Zealand, (Lee, 1959: 364), but not recorded from Qld. Current specimens were found in Vict. and Tasmania (new records); Taiwan and Toyama-ken, Japan (new records). Species details and description in Blakemore (2002).

**Genus Lumbricus**

Remarks: Easton (1981: 44) lists “*Lumbricus* sp. Ohfuchi, 1941: 255” from Honshu, but
these specimens did not have tanylobous prostomia (excluding them from *Lumbricus*), they appear highly variable and, because they were un-named, are not part of a species checklist. Nakamura (1999a: vii, 108) shows a photograph of *Lumbricus terrestris* Linnaeus, 1758 from his specimen collection, and he further records *Lumbricus rubellus* Hoffmeister, 1842/3 as being imported into Japan for vermiculture. Neither of these species is confirmed because there is no statement that *L. terrestris* is actually from Japanese material, and *L. rubellus*, although often claimed, has never been confirmed in vermiculture and is most often a misidentification of *Eisenia fetida* (see Blakemore, 1999).

Family Ocnerodrilidae

_Eukerria saltensis_ (Beddard, 1895)


_Acanthodrilus sydneyensis_ Sweet, 1900: 124 (from Fletcher’s ‘Museum Name’ according to Michaelsen, 1907a) Types?


_Kerria nichollsi_ Jackson, 1931:121, Pl. XVI, figs. 5,8,9,11. Types?


Taxonomic note: Often misdated as "Beddard, 1892" when other *Eukerria* species were described by this author. Full details and description in Blakemore (2002).

Distribution: South America and spread worldwide by human and other agencies; in Asia
only known from Myanmar and, now, from Kamakura/Machida and Biwako, Japan - New records Japan.

Economic note: in Australian rice paddies where they were abundant and thought to be rather problematic as they attracted wading birds such as Ibis spp. which muddied the water (M. Stevens pers. comm. see www.ricecrc.org/reader/rice-crc/Oligochaeta_sludge.htm www.ricecrc.org/reader/rice-crc/Oligochaeta_coccoons2.htm and Stevens & Warren, 2000). Japanese specimens were collected from a road-side drainage channel at Kuzuharagaoka Shrine, Kamakura, and a river in Machida, Tokyo (details in Blakemore et al., 2007). Further new records are from Fudogawa, Ojiyamakoen, Biwako (collected 31.i.2007 and 1.ii.2007 by R.J.B.); similar specimens collected from Kochi, Shikoku Island in 2002 were too damaged to reliably identify. It is not known if their spread into Japanese rice fields, where the rice is generally transplanted unlike in Australia, is likely to be problematic or not.

**Ocnerodrilus occidentalis** Eisen, 1878


Distribution: Cosmopolitan species (indigenous to Neotropics), widespread in Japan and on Okinawa.


Family Acanthodrilidae
Genus *Microscolex* Rosa, 1887

*Microscolex phosphoreus* (Dugès, 1837)

*Lumbricus phosphoreus* Dugès, 1837: 17. Type locality in greenhouses of Jardin des Plantes, Montpellier, France. Types: none known.


Distribution: Cosmopolitan species (indigenous to South America), widespread in Japan.

Remarks: Small and often overlooked with only a few reports from Japan (Easton, 1981).

Family Octochaetidae

Genus *Dichogaster* Beddard, 1888

*Dichogaster* (*Diplothecodrilus*) *bolaui* (Michaelsen, 1891)

*Benhamia bolaui* Michaelsen, 1891: 9 (corr. *bolaui*). Type locality Bergedorf near Hamburg. Types in Hamburg: 285, and Berlin: ZMB 7334 (fragments from 2 desiccated syntypes); also others listed in Reynolds & Cook (1976: 80).


Distribution: Cosmopolitan species (indigenous to Africa); a Japanese report from Okinawa by Kobayashi (1941), and possibly Hatoma-jima if synonymy of *hatomaana* is correct (cf. *D. saliens*).

Remarks: Small species often overlooked.
Dichogaster (Diplothecodrilus) saliens (Beddard, 1893)


Dichogaster (Diplothecodrilus) saliens: Csuzdi (1995).

Distribution: Cosmopolitan species (?indigenous to Africa), possibly reported once from Ryukyus: some specimens collected from Hatoma-jima, near Iriomote, on April 1st, 1936.

Remarks: Small and often under-reported (see Blakemore, 2002). Synonymy by Csuzdi (1995) of Dichogaster hatomaana Ohfuchi, 1957 in D. boluai rather than D. saliens as determined by Easton (1981) would, if so, remove this species from the Japanese list. The description by Ohfuchi (1957) is ambiguous as he first says female pore single, then that the "oviducts opening separately, each one on a papilla occupying the whole width of the segment [14]" - this also shown in his fig. 25. On balance, and because only one pair of prostates were reported, I believe the species concerned is probably D. saliens rather than D. boluai. It is highly unlikely that the confused account reports a new taxon.

Family Megascolecidae

Diagnosis (after Blakemore, 2000; 2002): male pores united with prostatic pores, paired or occasionally unpaired, commonly on 18 (rarely on 19 or 20). Prostates tubular to racemose. Nephridia holoic or meroic. Setae lumbricine to perichaetine. Dorsal pores present or absent. Oesophageal gizzard(s) usually present; calciferous glands present or absent; intestinal gizzard(s) and caeca sometimes present. Spermathecae single, paired, or multiple; diverticulate (or rarely with intramural sperm chambers).
Distribution: Australasian region (Australia, New Zealand); India; Asia and Oceania; North and Central America; many species peregrine, particularly some of the 400+ Oriental pheretimoids. Pheretimoid species are readily identified by the presence of an oesophageal gizzard after 7/8 (except for the monotypic genus Pleionogaster from the Philippines that has intestinal gizzards), combined with the apomorphic character states of racemose prostates, perichaetine setae, and meroic nephridia.

Remarks: Much misunderstanding and controversy has concerned the varied definitions and scope of the family Megascolecidae. The most current revision above is from Blakemore (2000) where this family is separated from Acanthodrilidae, Octochaetidae and the newly defined Exxidae Blakemore, 2000. These latter three families have an acanthodriline arrangement of male pores and nephridia that are either holoic, in Acanthodrilidae, or meroic in Octochaetidae and Exxidae, with Exxidae distinguished by its non-tubular prostates.

Many classical species names were transferred to Pheretima from the genus Perichaeta Schmarda, 1861 (type species P. leucocyla Schmarda, 1861; Synonyms Perichoeta: Vaillant, 1867; Pericheta: Perrier, 1874) which has long been combined as a junior synonym of the Sri Lankan genus Megascolex Templeton, 1844, for reasons explained by Horst (1883:182) and Sims & Easton (1972: 175). Two other pheretimoid genera: Nitocris Kinberg, 1867 and Rhodopis Kinberg, 1867 were preoccupied (see Sims & Easton, 1972: 178).

In view of the apparent confusion and dissenting opinions regarding the current classification of Japanese pheretimoids, each genus is summarized below from the works of Sims & Easton (1972), and Easton (1979; 1981; 1982; 1984), followed by Japanese species lists. The first two genera, Pontodrilus and Perionyx, are relatively primitive in
having plesiomorphic holoic nephridia and are not pheretimoids.

Genus *Pontodrilus* Perrier, 1874

Type species and locality: *Lumbricus litoralis* Grube, 1855, (syn. *Pontodrilus marionis* Perrier, 1874), originally described from shoreline of Mediterranean at Villafranca, Nizza, and Marseilles, in southern France.

Diagnosis (from Blakemore, 2000): Megascolecid with tubular prostates, lumbricine setae and holoic nephridia that are characteristically absent from anterior segments. Dorsal pores, calciferous glands, intestinal caeca, and intestinal gizzards absent.

Distribution: *Pontodrilus litoralis* is circummundane – on shorelines in the tropics and warmer parts of continents and islands in the Atlantic, Pacific and Indian Oceans, from the Mediterranean, South China Sea, and Red Sea; one species is lacustrine in New Zealand; two species are terrestrial, one in Sri Lanka and one in China. A fifth species, the newly described littoral *Pontodrilus primoris* Blakemore, 2000, is from north-eastern Tasmania. Having a second littoral species from Tasmania puts Australia, with its large and often tropical coastline, in contention for the provenance of the genus.

Remarks: *Pontodrilus* is ascribed to the family Megascoleidae sensu Blakemore (2000) rather than Acanthodrilidae where it had been placed by some earlier authors.

**Pontodrilus litoralis** (Grube, 1855)

Veneta brachyptera Karaman, 1929: 319 (syn. perrieri). Types unknown.


Veneta dubia Karaman, 1929: 319. Types unknown.


Veneta hirta Karaman, 1929: 319. Types unknown.


Veneta lata Karaman, 1929: 319. Types unknown.


Veneta posticata Karaman, 1929: 319. Types unknown.


Veneta tetrapuncta Karaman, 1929: 319. Types unknown.


Veneta wallacei Karaman, 1929: 319. Types unknown.

Veneta xiphum Karaman, 1929: 319. Types unknown.


Veneta (Vestigillum) venatica Karaman, 1929: 319. Types unknown.

Veneta (Vestigillum) zvinita Karaman, 1929: 319. Types unknown.


Distribution: Cosmopolitan species (indigenous to Himalayan region).

Remarks: A reference by Nakamura & Zicsi (1999) reporting Perionyx excavatus from Tokyo is not unexpected as this species is often used in vermicomposting operations around the world and since it is also recorded from Korea (http://earthworm.chonbuk.ac.kr/db_list/list_eng.asp). For full descriptions see Gates (1972), Blakemore (1994; 1999; 2002).

Genus Amynthas Kinberg, 1867

Type species and locality: Amyntas aeruginosus Kinberg, 1867 from Guam.

Taxonomic note: Kinberg (1867) spelt the genus name Amynthas (p. 97) and Amyntas (p. 101), the former spelling has priority, the latter was preoccupied. Moreover, Amynthas has priority as "page or position precedence" (ICZN, 1999: 69A.10) over Pheretima Kinberg, 1867: 102 (see also Sims & Easton, 1972: 176). Amynthas aeruginosus Kinberg, 1867 is particularly similar to A. taitensis (Grube, 1866) and, if they eventually prove to be synonymous, the latter name has priority as discussed by Blakemore (2002).

Diagnosis (from Sims & Easton, 1972): Pheretimoids with an oesophageal gizzard in 8-9 and intestinal caeca usually originating near 27 (if originating in 25 then holandric species only, cf. metandric Begemius); intestinal gizzard absent. Setae perichaetine. Male pores
superficial, never within copulatory pouches. Nephridia meroic, usually absent from the spermathecal ducts.

Distribution: Oriental region; of about 400 nominal species, at least ten are peregrines.

Remarks: The dominant genus in Asia, including Japan. A premise in the revision by Sims & Easton (1972: 214; 268) was that species were assumed to belong to *Amynthas* rather than *Metaphire* or *Pheretima* unless re-examination of types shows them to have copulatory pouches; thus they attributed specimens lacking male pores to *Amynthas* by default.

Concerning *Amynthas/Metaphire*, the division is straightforward when we have clear differences such as in *M. schmardae* (that has copulatory pouches with huge eversible "air-bags" with glands and penes as are found in *M. bipora*, *M. virgo* and possibly *M. malayana*), but naturally there are sometimes borderline cases that are difficult to classify. An answer is to simply ask "are the male pores superficial (= *Amynthas*), or are they non-superficial (= not *Amynthas*)" and in support I quote Gates (1975: 7) concerning this question:

"Presence or absence of copulatory chambers is too vague. The really important character is whether the male pores are superficial or invaginate. In the latter case, whether in slight transverse slits of much deeper spaces still confined to the parietes or whether thick-walled copulatory chambers deeply penetrating into coelomic cavity (cf Gates, 1972: 150)".

Complicating factors are that parthenogenetic morphs may lack male pores completely or, as stated by Easton (1982: 725), the techniques used to preserve specimens may cause copulatory pouches to evaginate making the male pores appear superficial, and in immatures the copulatory pouches may be undeveloped.

*Pheretima* species erected by Ishizuka (1999-2001) (see Table 2 below) are
mostly transferred to either one or other of these genera.

*Amynthas carnosus* (Goto & Hatai, 1899)

**Fig. 2** *Amynthas carnosus* (Goto & Hatai, 1899): top Goto & Hatai’s original Fig. 4; bottom *Ph. kyamikia* Kobayashi, 1934.

*Perichaeta carnosa* Goto & Hatai, 1899: 15, fig. 4. From Tokyo (the exact locality unknown; however, the authors worked at the First High School, Tokyo which is in Shibuya). Types none.

*Pheretima carnosa* : Michaelsen, 1900: 260; Kobayashi, 1936b (syn. *pingi, kyamikia*); Chen, 1936: 274 (when describing *P. pingi chungkingensis*, that now probably merits elevation to species level, remarked that *pingi* was probably a synonym of *carnosa*); Ohfuchi, 1937b: 56, fig. 9; Kobayashi, 1938: 161; Chen ?1959: 9, fig. 9 (syn. *pingi*); Ishizuka, 2001: 75, fig. 32; Nakamura, 1994: 27 (name misspelt “canosa”).

*?Pheretima pingi* Stephenson, 1925: 891, text fig. 1 (of testis sac), plate II fig. 7 (of a possibly parasitised spermatheca); Michaelsen, 1931: 11; Stephenson, 1931: 55; Chen, 1933: 228, fig. 15; Gates, 1943: 103; Ishizuka, 2001: 82, fig. 46 – looks exactly the same as *P. carnosa* in fig. 9 of Chen (?1959).

*Pheretima kyamikia* Kobayashi, 1934: 1, figs. 1-3. From Korea. [Kobayashi’s fig. 1 is almost exactly the same as Chen (?1959: fig. 9 variations). The name is from its Korean name “kyamiki” meaning “dog bait” or “useless as fishbait”].

(syn. kyamikia, sangyeoli) – their fig. 1 is reminiscent of both Chen (1933; fig. 15) of *P. pingi* and Shen *et al.* (2003 fig. 3) of *A. nanshanensis*.

*Amynthas youngtai* Hong & James, 2001: 269, fig. 1A-C [segments miscounted]. From Korea.

*Amynthas sangyeoli* Hong & James, 2001: 271, fig. 3A-C. From Korea.

*Amynthas nanshanensis* Shen *et al.*, 2003: 483.fig. 3, tab. 2. From Taiwan.

*Amynthas monsoonus* James *et al.* 2005: 1012. From Taiwan.

Diagnosis: Usually four pairs of obvious spermathecal pores in 5/6/7/8/9 [or occasionally three pairs in 6/7/8/9 as noted by Chen (1933: 233) or questionably in just 5/6/7/8]. Genital markings closely paired anteriorly in some of 7,8-9 and sometimes also in 18 and 19 often with another pair posteriorly on 18 just median to the line of the male pores. [Chen (1933: 231) for *P. pingi* allows papillae rarely absent, one to three pairs (occasionally up to five pairs) usually placed around male pores: two pairs on segment 18 in front and behind the setae and one pair on 19 in front of setae, the post-setal pair on segment 18 often close to male pores while the ante-setal pair on both segments either laterally or medially. Often paired on 8 and 9, those on 8 placed either ante- or post-setally if only one pair present, or on both sides of the setal line if two pairs present; one or occasionally two pairs on 9 generally placed ante-setally (seldom present post-setally on 9 and ante-setally on 10) – these papillae paired either latero-ventrally or medio-ventrally]. Intestinal caeca simple. Spermathecae usually four pairs, anterior pair often smaller; diverticulum clavate.

Distribution: Japan (Goto & Hatai, 1899; Ohfuchi, 1937; Easton, 1981), Korea and Quelpart Island (Kobayashi, 1934; 1936; 1938); and, in addition to these locations: from China - Jiangsu, Zhejiang, Anhui, Shandong, Hong Kong, Sichuan, and Beijing (citation
Vietnam as *P. pingi*. Recently claimed from Taiwan by Shen et al. (2005), while the Taiwanese taxon *A. nanshanensis* Shen et al., 2003 is also similar (perhaps differing only in earlier dorsal pores commencement from 5/6 rather than 11/12 or 12/13) as is their *A. penpuensis* that however lacks Genital Markingis (cf. *A. corticis*) [see http://www.sinica.edu.tw/zool/zoolstud/42.4/479.pdf; http://wwwdb.tesri.gov.tw/protect/UpLoadPic/051105232/05110523295/05110523295_pdf.pdf]. Possibly endemic to Japan and Korea, and introduced to China and Taiwan, unless, as Chen (1936: 275) first suggested when describing *A. pingi chungkingensis*, that *A. pingi* is a synonym of *A. carnosus*, in which case this taxon may be more prevalent in China and its centre of origin more obscure. Gates (1943) describes a single specimen of *Pheretima pingi* from 3,000-5,000 ft at Kuatun, Fukien China and makes no mention of the supposedly distinctive tubercules on the spermathecae. The genital markings of this specimen were about coincident with the spermathecal and male pores plus another two pairs just median to the male pores, one presetal and one postsetal, the latter in contact with but distinct from the male porophore.

Remarks: A problem with the original description was that the spermathecal pores were described in 5/6/7/8 but spermathecae were stated to be in 7,8,9 suggesting they exited in 6/7/8/9 or possibly one set was missed and they were actually in 5/6/7/8/9. While Gates (1972: 149) implied this taxon and *P. kyamikia* Kobayashi, 1934 might be the same as *Megascolex diffringens* Baird, 1869 [= *Amythas corticis* (Kinberg)] that has four pairs of spermathecal pores, Easton (1981: 50) tentatively included *P. carnosa* in synonymy of *Amythas gracilis*, apparently accepting three pairs of spermathecae in 5/6/7/8 as per the original description and as restated by Michaelsen (1900: 260). Nevertheless, Ohfuchi (1937b: 56-62, fig. 9) in a more detailed description, shows it with four pairs of
spermathecae in 5/6/7/8/9 and with variations in markings that encompass Kobayashi's *P. kyamikia*, thus it appears different from both *A. gracilis* and *A. corticis* by its markings described as more closely paired, almost mid-ventral, in 7,8-9 and 18, 19. Ishizuka (2001: 75) also figures *carnosa* with four pairs of spermathecae in 5/6/7/8/9 and with markings paired in 8 (two sets), 9, and 18 (two sets); while Ishizuka (2001: 82) figures "*Pheretima pingi* Chen, 1936" that looks exactly the same as Chen's fig. 9 of *Pheretima carnosus*. It is restored from Easton’s synonymy in the present account. [The Chinese distributions above are from Chinese Agricultural Academy of Science website http://www.agrionline.net.cn/zhuanti/index.htm whence *Pheretima carnosus* is described with either three or four pairs of spermathecae in 5/6/7/8/9]. Ishizuka’s *Amynthas distichus* is similar to the octothecal forms.

Hong & James' (2001b) *A. sangyeoli* does not differ from Ohfuchi's (1937b) redescription of *A. carnosus* where the spermathecae are located in 5/6/7/8/9, and their *Amynthas youngtai* (that has its figured segments miscounted) is also sufficiently similar to be included in synonymy of *carnosus*. The former of these synonyms was also independently determined by Shen et al. (2003b: 484, Tab. 2).

*Amynthas monsoonus* James et al. 2005: 1012 from Taiwan is also possibly in synonymy of *A. carnosus* as it has the same classical markings in 7-9 and spermathecae in 6/7/8/9.

*Amynthas conformis* (Ishizuka, 2000).

*Pheretima conformis* Ishizuka, 2000e: 182.

*Pheretima monticola* Ishizuka, 2000e: 191-193, figs. 60-66, tab. 1. [This junior primary homonym of *Pheretima monticola* Beddard, 1912 (= *Polypheretima monticola*) is
permanently invalid under ICZN (1999: Art. 57.2, 60) but is not replaced as a senior synonym exists].

Diagnosis: Spermathecal pores in 5/6/7/8/9. Male pores superficial. Genital marking large, paired on 10 and 17, at least. Intestinal caeca simple; [note: in the current study, a specimen from Yamanashi was identified with this taxon, but it differed by having incised caeca].

Distribution: Japan.

Remarks: Approximately 50 Amynthas species have spermathecae in 5/6/7/8/9 including members of the Amynthas corticis species-complex, for which this species may well qualify for inclusion (as with Ishizuka’s almost identical specimens given the invalid name of P. monticola), although Ishizuka (2000e: 185) compares his species only to Amynthas brevicingulus (Chen, 1938) that has spermathecae in 5/6/7/8 and belongs to the Amynthas hawayanus (= gracilis) group of Sims & Easton (1972). Ishizuka (2000e) makes no comparison with his subsequent P. monticola [non Beddard, 1912] despite the obvious similarities that suggest these specimens belong with the name conformis, wherever it eventually resides. Recently Dr M.T. Ito (pers. comm. 9/12/04) suggested the possibility that it belongs in synonymy with A. yamizoyamensis (Ohfuchi, 1957).

Amynthas corticis species-complex

Included species from Japan.

Amynthas corticis (Kinberg, 1867)


?Megascolex (Perichaeta) sanctaeelenae Baird, 1873: 272. Type locality St Helena.
Perichaeta subquadrangula Grube, 1877: 553 [due to its poor description, Sims & Easton (1972: 224) had this species name (with incorrect date as 1868: 36) as incertae sedis, but Easton (1979: 119; 1984: 118) placed it in synonymy of corticis]. Type locality Rewa River, Viti Leva, Fiji. Holotype in Zoological Museum, Berlin: 705.


Perichaeta indica : Michaelsen, 1892: 241. Specimen from Japan.

Pheretima indica : Michaelsen, 1900: 275 [syn. californica (part.) [laps.], ?corticis [laps.], heterochaeta, nipponica].

Perichaeta peregrina Fletcher, 1887: 969. Type locality Sydney believed introduced from Mauritius. Types in Australian Museum. [Name misspelt “pereginus” by Nakemura (1994: 27)].

Pheretima peregrina : Michaelsen, 1900: 293 (syn. ?molokaiensis Beddard, 1896); Lee, 1959: 327 (syn. campestris Lee, 1952 [non Goto & Hatai, 1898]).

?Perichaeta mirabilis Bourne, 1887: 668 (669?). Locality Naduvatam, East Indies. Types?

Perichaeta heterochaeta Michaelsen, 1891: 6 (non Megascolex heterochaetus Michaelsen, 1918: 25). Types missing.

(Perichaeta ijimae Rosa, 1891: 402)? From Japan - advericulate spermathecae in 5/6/7/8. [Under the taxon name ijimae were united kamakuresis, parvula and decimpapillata, all offerings from Goto & Hatai (1898), by Beddard (1900: 636)].

Male pores inconspicuous; prostates absent; spermathecae, sometimes ad diverticulate opening in 5/6/7/8/9; GM paired anteriorly in 7, 8 and 9 just medial to the line of the spermathecal pores (cf. *heteropoda*). From Japan. Holytype in Zoological Museum, Berlin: 2116 (lost).

*Perichaeta nipponica* Beddard, 1892b: 760. From Japan. Type BMNH 1904.10.5.993.

*?Perichaeta molokaiensis* Beddard, 1896: 201. Types?

*Perichaeta heteropoda* Goto & Hatai, 1898: 69. From Tokyo, Tokorosawa and Kamakura. Types? Spermathecae diverticulate in 5/6/7/8/9, prostates aborted but male pores present; GM paired anteriorly in 6-9 in same line as spermathecal pores.

(*Pheretima marenzelleri* Cognetti, 1906: 780, figs. 5-6; Kobayashi, 1938: 407)? From Yokohama. Types in Vienna?


*Pheretima divergens yunnanensis* Stephenson, 1912.

*?Pheretima pingi* Stephenson, 1925b: 891 [cf. *Amynthas carnosus* and *A. fuscatus*].

*Perichaeta mirabilis*: Gates, 1934: 50 [?non Bourne, 1887:669].

*?Pheretima sheni* Chen, 1935: 38 [athecal morphs, cf. *Amynthas robustus*, *A. illotus*]. From Hong Kong; eight specimens three of them aclitellate and all lacking spermathecae. Type described in the Museum of Fan Institute of Biology, Peiping but also claimed in US National Museum: 20181.


Pheretima torii Ohfuchi, 1941: 244, figs. 1-2.

Pheretima clerica Benham 1947. Types unknown.

Pheretima campestris Lee, 1952: 39 [placed in synonymy of Perichaeta peregrina Fletcher, 1887 (= Amynthas corticis) by Lee (1959: 327) as confirmed by Sims & Easton (1972: 234), nevertheless Nakamura (1999b: 2) proposed the unnecessary substitute name Pheretima medicampestris for Lee’s species which he took as a homonym of Perichaeta campestris Goto & Hatai, 1898 (= Amynthas robustus). Under ICZN (1999: Art. 60) this secondary junior homonymy replacement name is unnecessary since available and valid synonyms exist for this taxon].

(Pheretima hatomajimensis Ohfuchi, 1957: 245, fig. 20)? From Hatoma-jima, Iriomote, Ryukus. [Name misspelt “hatomajiensis” by Nakamura (1994: 27)].


Pheretima nipparensis Ishizuka, 1999c: 119-121, figs. 75-84, tables 5,6 [misspelt “Pheretima nipparaensis” in Ishizuka (2001: 91)].


Pheretima rufidula Ishizuka, 2000b: 15-16, figs. 8-14, tab. 1 [misspelt “P. rufidura” in Ishizuka (2001: 14, 30)].

Pheretima silvestris Ishizuka, 2000b: 18, figs. 23-29, tab. 1 [non Pheretima silvestris Michaelsen, 1923 (= Amythas silvestris) nec Pheretima silvestrii Cognetti, 1909, now also in Amythas. Under ICZN (1999: Arts. 57.2, 60) this junior primary homonym is permanently invalid but is not replaced as synonyms exist].

Pheretima semilunaris Ishizuka, 2000b: 18-21, figs. 30-36, tab. 1. [misspelt “Pheretima qasemilunaris” or “P. semilnaris” in Ishizuka (2001: 16, 30, 32)]. For advericulate specimens that otherwise appear to comply with A. corticis.


Pheretima umbrosa Ishizuka, 2000e: 187-189, figs. 43-51 (on page 190), tab. 1; Ishizuka,
2001: 84, fig. 49 [despite a really confused description, the figured genital markings, spermathecae and prostates agree exactly with those figured more than 60 years earlier by Ohfuchi (1937b: 73, 106) in his detailed redescription of *P. divergens* that has, just like *P. umbrosa*, a pair of simple caeca thus invalidating any justification].

*Pheretima invisa* Ishizuka, 2000e: 189-191, figs. 52-59, tab. 1 [this junior primary homonym of *Pheretima invisa* Cognetti, 1913 (= *Metapheretima invisa*) is permanently invalid under ICZN (1999: Arts. 57.2, 60) but is not replaced as synonyms exist for it].

*Pheretima nigella* Ishizuka *et al.*, 2000b: 185 [name variously spelt and dated as cited in Ishizuka (2001: 12, 13, 90, 102) with the same Japanese vernacular name as “*P. nigella* Ishizuka, 1999” or “*Pheretima negera* Ishizuka, 2000”, for a single specimen with adverticulate spermathecae that otherwise complies with *A. corticis*].

*Pheretima setosa* Ishizuka *et al.*, 2000b: 188. [non *Pheretima setosa* Cognetti, 1908 (= *Metaphire sieboldi* (Horst, 1883))]. [This junior primary homonym is permanently invalid under ICZN (1999: Arts. 57.2; 60) but is not replaced as synonyms exist]. For a single adverticulate specimen that otherwise appears to comply with *A. corticis*.

**Taxonomic notes**: Michaelsen (1900: 275) included the prior *Pheretima corticis* (Kinberg, 1867) in possible synonymy under *Pheretima indica* (Horst, 1883) *sensu stricto*, and now it is not certain whether all or any of the *indica* subspecies follow it into synonymy of *corticis* or whether they assume separate specific status. These subspecies are listed by Sims & Easton (1972: 235) as: *Amynthas indicus cameroni* (Stephenson, 1932) from the Malay Peninsula; *Amynthas indicus ceylonicus* (Michaelsen, 1897) from Sri Lanka; and *Amynthas perkinsi* (Beddard, 1896) from Halemanua and Kauai, Hawaii which was included by Michaelsen (1900: 276) as a ‘variety’ of *indica*. Certainly the latter two taxa are not
endemic to their localities.

Often *A. corticis* has been reported under the names of its junior synonyms as *Pheretima diffringens* or *P. peregrina* or, in earlier papers, as *P. heterochaeta*, and sometimes the name is misspelled as “corticus”. Sims & Easton (1972: 237) listed *heteropoda* Goto & Hatai, 1898 in *Metaphire* as part of a *bianensis bianensis* (Stephenson, 1931) species-group, but this is almost certainly a mistake as they too will have lacked any type material for reference. Ishizuka *et al.* (2000b: 192) have a species they name "*P. diffriage" that is possibly a reference to *P. diffringens*.

Diagnosis: *Amynthas* with four pairs of spermathecal pores ca. 0.3 body circumference apart in furrows 5/6/7/8/9 (the last pair sometimes missing?). Genital markings small paired or variable near spermathecal and male pores, or absent. Intestinal caeca simple with smooth or incised margins, originating near segment 27. Parthenogenetic morphs common (e.g., prostates and/or spermathecal diverticula aborted). Size range given as 45-270 mm (Sims & Gerard, 1985: 128; 1999: 128); cf. 45-170 mm (Gates, 1972: 178), (cf. *Amynthas fuscatus* given as 100-450 mm).

Distribution: According to Beddard (1893), its occurrence is "everywhere, including Europe". This species is the most widely distributed of the allochthonous species of the pheretimoid group, having been recorded from temperate and tropical regions throughout the world. Tropical records are more rare and usually from higher altitudes. The indigenous range of the species is believed to be in east and south-east Asia: Nepal, northern Pakistan and India, Myanmar, and southern China and it is also found in Taiwan, Korea, and Japan.

Remarks: Parthenogenesis is implied by the often reduced, parasitised or incomplete male reproductive and spermathecal organs. Gates (1972: 177-180) mentioned the various parthenogenetic morphs that have been recorded, and although he noted that total loss of
spermathecae and male pores is rare, he reported two specimens in a sample of 60 that lacked the posterior pair of spermathecae, and Gates (1972: 217) further suggested that *Pheretima sheni* Chen, 1935 may be athecal morphs of either *A. robustus* or *A. diffringens* (= *A. corticis*), most likely the latter.

The definition of *Amynthas corticis*, via its synonymous species such as *Pheretima divergens*, now accepts ‘serrate’ intestinal caeca (this character is often not differentiated from the simple kind in earlier descriptions and is perhaps also difficult to differentiate from grades of simple caeca). Small genital markings, where present, sometimes on 17 as well as near, or after, the male pores are also permitted.

While overlooking *Amynthas corticis*, and without obvious justification, Ishizuka (1999a: 58-59) retained *Pheretima divergens* (Michaelsen, 1892) and claimed several “syn. nov.”s, i.e., *decempapillata* (sic), *flavescens*, *kamakurensis*, *parvula* (Goto & Hatai), *producta*, and *scholastica*. However, of these, only *Amynthas scholasticus* (Goto & Hatai, 1898) has four pairs of spermathecae (but in 4/5/6/7/8), all the others have three pairs of spermathecae, and most (except for *A. flavescens* and its synonym *P. producta*) were already accepted in *Amynthas gracilis* synonymy. Ishizuka (2001: 101, 103) again listed *Pheretima divergens* (Michaelsen, 1892) but this time had its “syn. nov.”s as: *P. decempapillata* (sic), *P. flavescens*, *P. fuscata*, *P. obscura*, *P. producta*, *P. scholastica*, and *P. kamakurensis*, apparently adding *Amynthas fuscatus* (Goto & Hatai, 1898) and *Amynthas obscurus* (Goto & Hatai, 1898) but restoring *Pheretima parvula* (Goto & Hatai, 1898) as a separate species, even though it too has been long considered a synonym of *Amynthas gracilis*. This second listing is as inconsistent as the first and can best be ignored.

Ishizuka (1999c: 119) stated that his *Pheretima confusa* differed substantively from *Pheretima heterochaeta* Michaelsen, 1909 [sic, lapsus for “(Michaelsen, 1891)”]
only by its serrate intestinal caeca, and Ishizuka (1999c: tab. 6) further shows *P. confusa* sharing with *Pheretima divergens* (= *A. corticis*) both serrate intestinal caeca and presetal markings on 17 but with an extra pair on 18 (and rarely on 19 also). As both prior species have long been synonymised with *Amyntas corticis*, for example *Pheretima heterochaeta* by Gates (1972), and *P. divergens* by Easton (1981; 1982), then *P. confusa* may also belong in synonymy of *Amyntas corticis*. Next, Ishizuka’s *Pheretima imajimae* and *Pheretima nipparensis* (which are not to be confused with the prior names *P. ijimae* and *P. nipponica*) do not differ significantly from his *Pheretima confusa* and are therefore similarly synonymised, along with *P. confusa*, in *A. corticis*. All three species are close to Ishizuka’s (2000e) *Pheretima umbrosa*, when the errors and legends of the descriptions are corrected, and to his *Pheretima invisa*. Both these degraded morphs, stated to resemble *Pheretima divergens* (Michaelsen, 1892) and *P. heteropoda* (Goto & Hatai, 1898), respectively, therefore join them in synonymy of *A. corticis*.

Ishizuka (2000b; 2000e) has several almost identical and progressively synonymous species, some stated to be similar to *Pheretima divergens* and/or *P. heteropoda*, others that are degraded morphs lacking extensive genital markings, spermathecal diverticula or prostate glands, but all of which most probably belong in synonymy of *Amyntas corticis* (cf. Ishizuka’s *Amyntas conformis* and *A. distichus*, and *Pheretima octo* listed below as incertae sedis). Those listed here in synonymy are inadequately separated from *A. corticis* and its synonyms, but full resolution requires further research when it may be possible to determine the true affinities of the degraded morphs of this *Amyntas corticis* species-complex.

A brave attempt at resolution was by Ohfuchi (1937b) who detailed variations of *P. heteropoda*, *P. oyamai*, *P. divergens*, and *P. nipponica* but failed neither to clearly separate
nor to merge them. Ishizuka (2001: 103), in defiance of convention, listed the prior
*Pheretima nipponica* (Beddard, 1892) as “syn. n.” of *P. heteropoda* (Goto & Hatai, 1898).
This action can be ignored; moreover, both species have already long been established in the
synonymy of *Amynthas corticis*.

*Amynthas distichus* (Ishizuka, 2000).


Distribution: Japan.

Diagnosis: Spermathecal pores in 5/6/7/8/9. Male pores superficial. Genital marking
closely paired presetal almost mid-ventral in 8-9 and 17-20, at least. Intestinal caeca simple.

Remarks: Approximately 50 *Amynthas* species have spermathecae in 5/6/7/8/9 including
the various members of the *Amynthas corticis* species-complex and possibly also
*Amynthas carnosus*, yet for some reason Ishizuka compares his species only to *Amynthas
hexitus* (Chen, 1946) that has spermathecal pores in 7/8/9.

*Amynthas ellipticus* (Ishizuka, 1999).


Distribution: Japan.

Intestinal caeca simple.

Remarks: Approximately 50 *Amynthas* species have spermathecae in 6/7/8/9, including
*A. flavescens* from Japan; *Amynthas asiaticus* (Michaelsen, 1900) is particularly similar,
except for its serrate intestinal caeca.
*Amynthas flavescens* (Goto & Hatai, 1898)

*Perichaeta flavescens* Goto & Hatai, 1898: 72. From Tokyo. Types?

(*Perichaeta producta* Goto & Hatai, 1898: 73)? From Tokyo. Types? Genital markings paired anteriorly on 8, 18 and posteriorly on 7, 8 and 18 all in line with the male pores plus a pair posteriorly on 18 median to the male pores. Prostates aborted; spermathecae adiverticulate, i.e. parthenogenetically degraded morph.

(*Pheretima houlleti bidenryoana* Ohfuchi, 1956: 169, fig. 15)? [Names sometimes misspelt as “houletti” and “bidenryoana” or “bidenryoana”].


(*Pheretima noharuzakiensis* Ohfuchi, 1956: 175, fig. 18)? [Name sometimes misspelt as “noharuzakensis”].

*Amyntas* (sic) *flavescens* : Beddard 1900a: 628 (syn. *producta*).


Distribution: Japan (including Okinawa).

Diagnosis: Spermathecal pores in 6/7/8/9. Male pores superficial. Genital marking serial, in line with spermathecal pores on 7-9 and in clusters near male pores. Intestinal caeca simple. Spermathecal diverticula and/or prostates sometimes absent (i.e., parthenogenetic morphs).

Remarks: Michaelsen (1900: 264, 314, 317) thought that *Pheretima flavescens* and *P. producta* were possibly junior synonyms (but lacking the anterior spermathecal pores) of his *P. divergens* (= *A. corticis*). Easton (1981) tentatively placed *Pheretima houlleti bidenryoanus* (Ohfuchi, 1956) in synonymy of *A. flavescens*. However, Gates (1972: 192) and Sims & Easton (1972: 237, 243) had earlier recognized its specific status separate from
Metaphire houlleti (Perrier, 1872), thus it was assigned as Amynthas bidenryoanus. It is provisionally retained in synonymy of A. flavescens despite Ishizuka (1999a: 60) inexplicably and erroneously listing the prior Metaphire houlleti in synonymy of Amynthas bidenryoanus, both of which he reverted to Pheretima - actions that can be ignored.

Amynthas fuscatus (Goto & Hatai, 1898)


Perichaeta grossa Goto & Hatai, 1898: 75. Type locality Kawaguchi, Yamanashi-ken.


Pheretima iizukai : Ishizuka, 2001: 90, figs. 1-8 (fig. 2 shows caeca).

?Perichaeta shimaensis Goto & Hatai, 1899: 15)? From Shima, Kai Peninsula, Kansai (H. Sakai pers. comm.). [Possibly a valid taxon with GMs paired on 19 posteriorly; cf. Easton (1981) who mistakes location as "Gumma-ken" and placed it in synonymy of micronarius]. Types? New material complying with type description found by current author from Mt Fuji, about central within the range of A. fuscatus.


[Under ICZN (1999: Art. 57.2) Pheretima montana Ishizuka, 1999 is an objectively and permanently invalid junior primary homonym of Pheretima
montana Kinberg, 1867, the type species of the genus Pheretima. A substitute name is not provided for Ishizuka’s taxon as it is considered a synonym (see ICZN, 1999: Art. 60). In some, but not all, distributed reprints of Ishizuka (1999c) the name “montana” is crossed out and another name written in in pen. This does not constitute a published nomenclatural act and is not valid under the code (ICZN, 1999: Arts. 8, 9). In a subsequent paper (Ishizuka, 2001: 12, 14, 92) the name “Pheretima montivaga Ishizuka, 1999” appears as a nomen nudum (under ICZN, 1999: Arts. 13, 16) for this taxon (cf. Ishizuka, 2001: 12, 102 where “P. montana Ishizuka, 1999” reappears). Transfer to Amynthas in synonymy with Amynthas fuscatus further removes this primary homonym from use (see ICZN, 1999: Arts. 23.3.5; 53.3; 60 and the Glossary definition of synonym).

Pheretima atrorubens Ishizuka, 1999c: 105.


Pheretima dura Ishizuka, 1999c: 105.

Pheretima turgida Ishizuka, 1999c: 110.


Distribution: widespread in Japan.

Diagnosis: Large species (c. 100-450 mm). Spermathecal pores in 5/6/7/8/9. Male pores superficial but may be invaginated on preservation to give spurious appearance of small copulatory pouches (debatably intermediate from superficial in some morphs). Genital marking variable: absent, or sometimes median to spermathecal pores post-setally on 5-8,
and usually serial and in line with male pores centred post-setally in some or all of 17 and/or 19-26. Spermathecae with convoluted diverticula (at least in larger specimens), or adiverticulate (in parthenogenetic morphs). Intestinal caeca relatively small, simple with incised margin (at least in larger specimens).

Remarks: The basis of this revision is inspection of newly collected material from the Hachioji/Mt Takao and Mt Fuji regions and a review of the literature by the current author. Although type material is missing, I defer designation of a neotype until fresh material is obtained from vicinity of the Kamakura type-locality. Almost certainly *Perichaeta iizukai* was misdescribed regarding an absence of intestinal caeca, which is why it was erroneously placed in *Polypheretima* (e.g. by Easton, 1981); the demonstrated presence of serrate caeca in specimens that otherwise comply places it in the synonymy of *Perichaeta fuscata* and removes *Polypheretima* from Japanese indigeny. The only salient difference of Goto & Hatai’s *P. iizukai* from their earlier *P. grossa* was the supposed lack of intestinal caeca, but it has recently come to my attention that Ohfuchi (1937: 41) had already determined that both *grossa* and *iizukai* had intestinal caeca:- “The intestinal coecum is single in both species”.

Indeed, Ishizuka (2001: 90) shows caeca in “*Pheretima*’ iizukai” (but he overlooks the prior *P. grossa*).

Difference in distribution of genital markings for the other synonymous species listed above are within permissible limits for normal intraspecific variability. Ishizuka (1999c) described several specimens as new species, inadequately comparing them with *Pheretima grossa* (Goto & Hatai, 1898), which had already been placed in synonymy of *Metaphire fuscata* (Goto & Hatai, 1898) by Easton (1981). However, on an assumption of differences in male pores, Sims & Easton (1972: 242) had placed *P. fuscata* in an *Amynthas diffringens* (= *A. corticis*) species group and *P. grossa* in a *Metaphire malayana*
species-group, both groups with spermathecae in 5/6/7/8/9 and, on recent review, they may actually be closely allied.

Ishizuka’s invalid taxon *Pheretima montana* (non Kinberg, 1867) lacks genital markings (parthenogenetic morph?) but otherwise complies with *A. fuscatus*. Ishizuka (2000b) described further sympatric species that lacked the obvious incised caeca; however, Sims & Easton (1972: 264) remarked that these “cannot be regarded as taxonomic characters as they are more fully formed in the larger specimens and their development would appear to be correlated with growth”. Thus it is possible that smooth caeca may become more markedly incised in older specimens and that *Pheretima flavida* Ishizuka, 2000 is synonymous with his *Pheretima montana* Ishizuka, 1999, joining it in synonymy of *A. fuscatus*. Similarly, *Pheretima lactea* Ishizuka, 2000 may be a parthenogenetic morph (lacking prostate glands), and *Pheretima mitakensis* Ishizuka, 2000 its more complete form, thus both are either parthenogenetic and/or underdeveloped specimens synonymous with Ishizuka’s *Ph. flavida*.

Parthenogenetic morphs that lack spermathecal diverticula and genital markings, yet otherwise comply with the definition of *A. fuscatus*, have also been identified by the current author, supporting these synonymies. Moreover, large species such as *Amynthas fuscatus* probably survive for several seasons, thus it is not unreasonable to expect that older specimens will have increased development of structures such as genital markings and caeca compared to mature yet younger specimens. As noted in the diagnosis above, the male pores of some specimens may appear invaginated on preservation (and Ishizuka’s descriptions only report superficial male pores), but it is here proposed to accept that the normal state has superficial male pores, i.e., attributable to *Amynthas* rather than *Metaphire*.

Notwithstanding this interpretation of the taxa, the slight possibility remains that *A.*
fuscatus is part of the A. corticis species-complex as described herein, in which case A. pingi (Stephenson, 1923) may also be implicated as discussed by Blakemore (2002: 183) but cf. A. carnosus.

*Amynthas glabrus* (Gates, 1932)


*Pheretima tenellula* Gates, 1932: 398. From Kwang Yeh, Yunnan and Myanmar. No types. [Misspelt as "tennellulus" in Sims & Easton (1972: 246) who also (1972: 213, 237) have these taxa in an "Amynthas youngi-group" erroneously as *A. youngi* (Gates) actually has two pairs of spermathecae dorsally in segment 6 and in 6/7].


(*Pheretima papilio*: Ohfuchi, 1956: 140 [?non Gates, 1930: 316 - misidentification].


Diagnosis: Size 30-110 mm. Spermathecal pores small, paired and postsetal on 6 (or absent in some morphs). Male pores superficial on 18 within longitudinal seminal grooves in 17-18 or extending further. Genital markings absent. Intestinal caeca, small, simple.

Distribution: Yunnan (China) and Myanmar (Gates, 1972: 188), Japan: Kyushu and Ryukyus (Easton, 1981: 50) also reported from Sichuan and Guizhou Provinces of China (by Zhong et al., 1987).

Remarks: Gates (1972: 187-188) described this species as parthenogenetic with several known morphs. Gates (1972: 205) rejects the identification by Ohfuchi (1956: 140) of Ryukyu specimens with his *Pheretima papilio papilio* Gates, 1930 subspecies, and Easton
(1981) places these misidentified specimens in possible synonymy with *A. glabrus* pending further investigation. Ishizuka (1999a, 2001) appears to have overlooked *A. glabrus* and, for some reason, Ishizuka (1999a: 63, 66) still lists *P. papilio* Gates, 1930 and *P. vieta* Gates, 1936 as valid names with Japanese records.

*Amynthas gracilis* (Kinberg, 1867)


*Perichaeta mandhorensis* Michaelsen, 1892: 241, figs. 18-19. From Mandhor, Borneo (and Java). Holotype in Zoological Museum, Berlin: 484. [Note: Gates (1972: 217) remarks that the British Museum specimen 1904:10.5.1401 labeled *P. mandhorensis* from West Indies is a misidentification and mislabeling of *Amynthas robustus*].

(?*Perichaeta mauritiana* Beddard, 1892a: 170, Pl X, figs. 5-6.


(*Perichaeta decimpapillata* Goto & Hatai, 1898: 71)? [Name sometimes misspelt as “decempapillata” perhaps following Michaelsen’s different subsequent spelling that is incorrect and unjustified under ICZN (1999: Art. 33)]. From Tokyo. Types?
(Pheretima kagoshimensis Takahashi, 1932: 343)? [Sometimes misspelt cagoshimensis].


Pheretima autumnalis Ishizuka, 1999c: 101-103, figs 1-10, Tables 1, 6 [misspelt “P. autamunalis” in Ishizuka (2001: 11, 13, 87, 101)].

Taxonomic Note: Amynthas gracilis is sometimes still reported under the name of its junior synonym A. hawayanus (Rosa, 1891).

Diagnosis: Amynthas with three pairs of spermathecal pores, ca. 0.25-0.3 of the body circumference apart in furrows 5/6/7/8. Genital markings near male (and spermathecal) pores. Intestinal caeca simple, (always?) with incised margins. Prostates always present?

Size range 56 – 156 mm (cf. A. papulosus 45-78 mm).

Distribution: Tropical and warm temperate localities on most continents. Original homeland possibly in China.

Remarks: Stephenson (1923) included quadrithecal morphs in Rosa’s Pheretima hawayana with which he further included the possible synonyms of Perichaeta barbadensis Beddard, 1892 (?part - specimen “b”), and Perichaeta pallida Michaelsen, 1892 (?part or cf. synonymy of A. morrisi), but these may actually be referrable to the Amynthas morrisi group of Sims and Easton (1972). Sims & Easton (1972: 224, 244) have Perichaeta parvula Goto & Hatai, 1898 a species incertae sedis as it was described as lacking male pores, but Easton (1981: 50) tentatively placed it, along with Pheretima carnos (Goto & Hatai, 1899),
in synonymy of *Amynthas gracilis*. However, it is unlikely that *Perichaeta parvula* is synonymous with *A. gracilis* as Goto & Hatai described it as small, only 32 mm long, therefore it is possibly closer to *A. papulosus*, or else it belongs *incertae sedis* along with the *A. illotus* species-group (cf. *A. assaceus*)

In the current account, *P. carnosa* is removed from synonymy due to its closely paired genital markings, and is restored as *Amynthas carnosus*.

**Amynthas habereri** (Cognetti, 1906)

*Pheretima habereri* Cognetti, 1906: 777, figs. 1-4. From Yokohama. Types not known (in Vienna?).

*Amynthas habereri*: Sims & Easton, 1972: 234; Easton, 1981: 51

Diagnosis: Length ca. 170 mm. Spermathecal pores closely paired in 5/6/7/8/9. Male pores superficial on large porophores on 18. Genital markings small, paired pre- and post-setal on 19 and 20 (united in common longitudinal fields) in line with male pores. Intestinal caeca manicate, each with about 10 diverticula.

Distribution: Japan (Yokohama), recently rediscovered at Hakone (H. Sakai, pers. comm.).

Remarks: Ishizuka (1999b, 2001) appears to have overlooked this species.

**Amynthas hupeiensis** (Michaelsen, 1895)

*Perichaeta hupeiensis* Michaelsen, 1895: 35. From Shi-hui-yao near Wuchang in Hupei (= Fuchow) province, China. Types missing.


*Pheretima hupeiensis*: Michaelsen, 1900: 273; Chen, 1933: 251, fig. 19; Kobayashi, 1936; 1938: 152; Gates, 1958: 17-20 (he thought American worms in greenhouses, turf
farms, and golf courses may have been introduced from Japan); Gates, 1972: 213.


**Diagnosis:** Spermathecal pores paired in 6/7/8/9. Spermathecae originally described with diverticula twice as long as ampullae but they may be longer when fully formed. Male pores superficial on small porophores on 18. Genital markings large paired near line of male pores in 17/18 and 18/19. Intestinal caeca simple. Septa 8/9/10/11 retained. Coils, but is placid, when touched. Emits an odour.

**Distribution:** China, Japan, Taiwan, Korea; further introduced into North America and, possibly, New Zealand and Christmas Island (Australia). A species widely distributed by transportation from Asia, occurs in Japan from Hokkaido to Okinawa (Easton, 1981).

**Remarks:** *Amynthas hupeiensis* is distinguished from the similar *Metaphire bahli* and *M. peguana* by its superficial male pores. Gates (1972: 213) says that the Chinese species, *Amynthas hupeiensis* has been mistaken for *Metaphire posthuma* in the past; thus the report by Easton (1981: 53) of *A. hupeiensis* from New Zealand may be questionable.

Previously two Ishizuka taxa: *hypogaea* and *edoensis* were considered possible synonyms, it now seems that they are in the ambit of *Amynthas obscura* (Goto & Hatai, 1898: 70) or, more likely, *A. micronarius* (Goto & Hatai, 1898: 74). Despite the previous rationale for synonymy of these Japanese names, characteristics of *A. hupeiensis* include its characteristic colour, behaviour and odour (as described above and in Blakemore, 2000) and the extended spermathecal diverticula, however these may naturally start from shorter rudiments.

*Amynthas japonicus* (Horst, 1883)

Perichaeta japonica: Beddard, 1895:426.

Pheretima japonica: Michaelsen, 1900: 279.


Diagnosis: Length 220mm. First dorsal pore 11/12. Spermathecal pores in 6/7/8. Setae 66 per segment. Male pores superficial on segment 18 in J-shaped seminal grooves that extend into 17. Genital markings absent (or not noted). Intestinal caeca not described (possibly simple as no remark comparing to other manicate species described by Horst, 1883: 194).

Distribution: “Japan” (Horst, 1883) collected by von Siebold but possibly from southern region as with other taxa.

Remarks: It appears that Ishizuka (2001) overlooked this species. Not subsequently found although seminal grooves are reported for other Ryukyu species - e.g. Amynthas glabrus that is known to have athecal morphs (Gates, 1972: 188), and decathecal M. riukiuensis.

Several Korean species have seminal grooves eg. A. deogyusanensis Hong & James, 2001 and A. pagueiensis Hong, 2001, and A. mujuensis Hong & Kim, 2004 and their intestinal caeca are simple but they appear to differ in other characters.


Pheretima kunigamiensis Ishizuka et al., 2000a: 92, figs. 12-25, tab. 2.


Distribution: Japan (Okinawa).

Remarks: The position and number of spermathecal pores (and genital markings) is highly confused and somewhat contradictory in the account, figures, and table in Ishizuka et al. (2000a), but if we assume they are in 6/7/8/9 then the current specimens are very closely similar to *Amynthas asiaticus* (Michaelsen, 1900), as well as *A. robustus* as discussed below. Approximately 50 other *Amynthas* species have spermathecae in 6/7/8/9 including *Amynthas bidenryoanus* (= *Amynthas flavescens*) also known from Okinawa (cf. *A. yambaruensis*).

*Amynthas micronarius* (Goto & Hatai, 1898)

*Fig. 3 Amynthas micronarius* (Goto & Hatai, 1898). Sketch of Watarase Tochigi prefecture specimen collected by Takafumi Kamitani April, 2003 from his Control site "R". Kamakura specimens collected by R.J.B., Y.H. and A.R., 12.iv.2004 from Kuzuharagaoka Shrine (built 1300's) along with seven other spp. Ibaraki specimens collected from farms at Ami in 2006.

*Perichaeta micronaria* Goto & Hatai, 1898: 74. From Tokyo. Types?

*Pheretima micronaria* : Michaelsen, 1900: 316 (“perhaps belonging in *P. divergens*”);

Ohfuchi, 1937b: 50, fig. 8; Ishizuka, 2001: 79 (segments miscounted).

(*Pheretima yamizoyamensis* Ohfuchi, 1935: 413)? [Name sometimes misspelt “yamijoyamensis” e.g. Reynolds & Cook (1976: 191), and “yamizoyamaensis” by Nakamura (1994: 27)]. From Yamizo-san, on the border of Fukushima, Ibaraki and Tochigi-ken. Types?

*Pheretima obtusa* Ohfuchi, 1957: 244, fig. 19. From Sonai, Sakishima. Types?


*Pheretima hypogaea* Ishizuka, 1999d: 234; Ishizuka, 2001: 70 [misspelt “hypogae” in

?Pheretima edoensis Ishizuka et al., 2000b: 181; Ishizuka, 2001: 76 [variously cited and dated as “Ishizuka, 1999” or “Ishizuka, 2000” in Ishizuka (2001: 11, 54, 76, 101) for a figured specimen that, although misplaced in a section of species having four pairs of spermathecae, has only three pairs and appears to comply with either A. micronarius or A. obscurus, most likely the former]. Syn. nov.


Diagnosis: Length ca. 66-180 mm. Spermathecae four pairs (or three pairs if anterior pair reduced or absent), sometimes advericulate, with pores in 5/6/7/8/9 (?or 6/7/8/9). Male pores superficial on segment 18. Genital markings paired almost intersegmental and just median to the lines of the male pores in 17/18 and/or 18/19. Intestinal caeca simple.

Distribution: Japan, from Hokkaido to Ryukus.

Remarks: Michaelsen (1900: 316) thought that this taxon, along with eleven other of Goto & Hatai’s names, may be closely related to P. divergens (= Amynthas corticis) whereas Easton (1981) maintained it. However, it is possible that this taxon is closely related to Goto & Hatai’s prior Amynthas obscurus, despite the extra pair of spermathecae. Ishizuka’s P. hinoharaensis is synonymous (previously I had it in A. corticis) and, moreover, Ishizuka’s Pheretima hypogaea and Pheretima edoensis (that I previously placed provisionally in A. hupeiensis) with three pairs of spermathecae, and P. tamaensis with two (advericulate) pairs, may also be parthenogenetically degraded morphs belonging to such a group. On the other hand, Pheretima shimaensis - considered a possible synonym by Easton (1981: 54), from its description and new material, is apparently separate or closer to Amynthas fuscatus.
Nothing in Ohfuchi's description of *obtusa* differs from *micronarius*, apart from "the presence of the diverticulum".

Ibaraki specimens agree with the above description, lacking the extra pair of spermathecae in 5/6 and with spermathecae adverticulate or just with stalks.

Although a specimen from Watarase or Kamakura could be made a neotype, it would be better to get toptotypic samples from "Tokyo", possibly from near the site of the "First High School" in Shibuya where Goto & Hatai were based (cf. Ishizuka's samples).

*Amynthas minimus* (Horst, 1893)

*Perichaeta minima* Horst, 1893: 66, fig. 27. Type locality Tjibodas, Java. Type in Leiden: 1836.

*Perichaeta pusilla* Ude, 1893: 63 [non *Pheretima pusilla* Ohfuchi, 1956 (= *Amynthas assacceus*)]. [Taxonomic Note: Easton (1979: 119) states that *minimus* (Horst, 1893) has priority over *pusilla* Ude, 1893].


*Pheretima zoysiae* Chen, 1933: 288, fig. 27. Type locality Chekiang. Types in Nanking (Ann. 570) or reported in Smithsonian.


?*Pheretima muta* Chen, 1938: 391.

*Pheretima ishikawai* Ohfuchi, 1941: 248.

*Pheretima humilis* Gates, 1942: 120. Type locality, “Earth in large flower pots on west veranda of faculty house”, Judson College, Rangoon, Myanmar. “The type locality and types destroyed during World War II”.


Diagnosis: Spermathecal pores in 5/6 only, or absent. Male pores superficial on segment 18. Genital markings small on pre- and postclitellar segments, or absent. Intestinal caeca simple. Size 16-60 mm.

Distribution: Widespread species by introduction around the world, originally from Asia.

Remarks: A detailed description may be found in Blakemore (2002). Gates (1972: 202) presumed that parthenogenesis occurs in morphs referred to this taxon, and it is probable that *Pheretima oyuensis* (*species incertae sedis*) is an AR or ARZ morph. Ishizuka (1999a; 2001) appears to have overlooked *A. minimus* and has ignored the nomenclatural conflicts in some its synonyms which he seems to still maintain.

Amynthas morrisi (Beddard, 1892)

*Perichaeta morrisi* Beddard, 1892a: 166. Type locality Kew Gardens in soil from Penang and/or Hong Kong. Types in British Museum according to Gates (1972) but not listed in Reynolds & Cook (1976).

*Perichaeta barbadensis* Beddard, 1892a (July): 167 (?parts “a” and “c” cf. *A. gracilis*).


1898: 445). [It is not certain that all of these synonyms follow \textit{barbadensis} into synonymy of \textit{morrisi} – see remarks below].


\textit{Amynthas morrisi} : Sims & Easton, 1972: 236, figs. 1A, 1H; Easton, 1981: 55 (syn. \textit{exiloides} : Ohfuchi, 1956, \textit{elongata} : Ohfuchi, 1956); Easton, 1982: 729, fig. 4c; Sims & Gerard, 1985: 132, fig. 47a (syn. \textit{barbadensis}, \textit{mauritiana}).


Distribution: Widespread around the world by introduction. In Japan, known from Kanagawa (O-shima) to Okinawa.

Remarks: Gates (1972: 203) presumed this species to be biparental (i.e., not parthenogenetic). Sims & Gerard (1985; 1999) include both Beddard’s \textit{barbadensis} and \textit{mauritiana} in \textit{A. morrisi}. Beddard’s \textit{barbadensis} comprised more than one species (and it is probable that his specimen “b” with three pairs of spermathecae is acutally \textit{A. gracilis}), but his specimens “a” (the primary type?) and especially “c” are closer to the current species. According to Michaelsen (1900: 254), \textit{A. barbadensis} defined with spermathecae in 5/6/7 or seldom in 5/6/7/8 has several junior synonyms (listed under this entry in the synonymy above), but the possibly that some of these are synonyms of \textit{A. gracilis} requires further research. It is more likely that \textit{A. mauritiana} is a variation of \textit{A. gracilis}, lacking the anterior
pair of spermathecae, as was suggested by Michaelsen (1900: 316), Gates (1972: 217), and Blakemore (2002: 177). Ohfuchi (1956) misidentified *P. morrisi* as both *Pheretima exiloides* and as *Pheretima elongata*, according to Gates (1972: 182) and Easton (1981: 55). Through inadequate survey of the literature and lack of understanding of taxonomic principles, Ishizuka (1999a: 63; 2001: 101) proposed the invalid and incorrect synonymy of the prior *Pheretima elongata* (Perrier, 1872) in *Pheretima morrisi* (Beddard, 1892). This action can be ignored (see *Polypheretima elongata* below).

*Amynthas obscurus* (Goto & Hatai, 1898)

*Perichaeta obscura* Goto & Hatai, 1898: 70 [non *Perichaeta obscura* Spencer, 1893: 3 (= *Diporochaeta obscura*). Note: according to ICZN (1999: Art. 23.9.5) the junior primary homonymy by Goto & Hatai (1898) of *Perichaeta obscura* Spencer, 1893, as noted in Reynolds & Cook (1969: 146) and Blakemore (2003), is not replaced and prevailing usage is maintained as the two taxa were “not considered congeneric after 1899”, e.g. Michaelsen (1900: 202, 316) at least had them in separate genera]. From Kamakura. Types?


Diagnosis: Spermathecal pores postsetal on 6, 7, and 8 (or more likely as originally described just in front of 6/7/8/9). Male pores superficial on segment 18. Genital markings anterior on 18 and posterior on 18 and 19, median to the line of the male pores. Intestinal caeca simple. Spermathecae with straight, digitiform diverticula.

Distribution: Japan, known only from Kamakura, but see *A. micronarius*.
Remarks: Michaelsen (1900) thought this species was possibly synonymous with *P. divergens* (= *Amynthas corticis*) despite its having only three pairs of spermathecae. Sims & Easton (1972: 237) placed *A. obscurus* in an *A. sieboldi* species-group that has spermathecal pores in 6/7/8/9, whereas Easton (1981) accepted the pores were on 6, 7 and 8. As noted under *A. micronarius* above, this species may have several parthenogenetically degraded morphs. Possibly it is a morph of *A. micronarius* with one fewer pairs of spermathecae.

Goto & Hatai’s descriptions were notoriously inaccurate and it is just as possible that this *A. obscurus* is the same as their later *P. decimpapillata* or *P. flavescens*, or that all actually have non-superficial male pores and thus qualify for *Metaphire*.

*Amynthas papulosus* (Rosa, 1896)


*Amynthas papulosus* : Easton, 1981: 56 (syn. *papulosa sauteri, rockefelleri*).

*Pheretima hsinpuensis* Kuo, 1995. From Taiwan. [Name originally misspelt "hsinpuesis"; corrected and synonymized with *A. rockefelleri* (Chen, 1933) by Shen, et al. (2003a) and independently by Blakemore (2003, addenda)].
Diagnosis: Spermathecal pores in 5/6/7/8. Male pores superficial on segment 18. Genital markings small pre- and postsetal discs in transverse rows on 6,7-9 and 17-19. Intestinal caeca simple. Size range 45-78 mm (rockefelleri 85-130 mm).

Distribution: China, Taiwan, and south-east Asia; recorded from Kyushu and the adjacent Yaku-Shima (Kobayashi, 1941), but reports from the Riukyus by Ohfuchi (1956) are most likely mistakes according to Gates (1972: 207) (cf. Easton, 1981: 56).

Remarks: This species may be easily confused with A. gracilis, differing only in its genital markings, and possibly its slightly smaller size. Gates (1972: 207) dismisses Ohfuchi’s (1956: 164) report from the Ryukyu Islands of P. papulosa var. “sauteria” [sic]. Inexplicably, Ishizuka (1999a: 64, 65) resurrected both “Pheretima papulosa (ROSA, 1896) var. sauteria OHFUCHI, 1956” (sic, lapsus for Pheretima papulosa sauteri Michaelsen, 1922) and “Pheretima rokefelleri CHEN, 1933” (sic, misspelling of rockefelleri), although Gates’s synonymies of both taxa in A. papulosus were accepted by Easton (1981), Shih et al. (1999: 436), and Tsai et al. (2000: 286). The sauteri variety was originally distinguished by location of caeca from 29 extending forward to 26 in a single specimen that may have been abnormal (Gates, 1972: 207). Gates (1972: 207) also thought that the parthenogenetic rockefelleri morph (lacking prostates and sometimes with defective spermathecae) was only distinguished by quantitative differences. More recently Shen et al. (2003a) disputed their earlier inclusion of A. rockefelleri in A. papulosus and retained both taxa but added A. hsingpuensis to synonymy of the former (as per synonomy by Blakemore, 2003 addenda).

Amythas phaselus (Hatai, 1930)
*Pheretima phaselus* [sic] Hatai, 1930b: 659, fig. 7. From Sendai, Aomori, Hokkaido, Shikoku. Types? (Described as "nearly white all over" and as "slugish, does not make typical jump but instead secretes a mucous juice copiously" - possibly due to parasitism).

(*Pheretima maculosus* [sic] Hatai, 1930b: 661)? [Non *Pheretima maculosa* Gates, 1933 (= *Amyntas malacus* (Gates, 1936) nom. nov. pro *Pheretima maculosa* Gates, 1933 as confirmed by Sims & Easton (1972: 237) and Gates (1972: 199), cf. Nakamura (1999b: 2) who proposed the unnecessary replacement name “*Pheretima medinaculosa*” for Gates’s *P. maculosa*). [Note: Sims & Easton (1972: 237) mistakenly cite *Planapheretima maculata* (Ude, 1925) as a further homonym, cf. Sims & Easton (1972: 243) where this specific name is correctly cited]. From Sendai, Kominato, Yokohama village, Moura, Sapporo and Yunoshima Island, Aomori-ken. Types? (Described as "uniform light grayish" or with "transparent body wall" but also "spotted appearance").

(*Pheretima kamitai* Kobayashi, 1934: 5, figs. 4-6)? From Keijo, Korea. Two specimens.

*Pheretima serrata* Kobayashi, 1936: 165. From Koryo, 30 km from Kijo, Korea. About 21 specimens. (Placed in synonymy of *kamitai* by Kobayashi, 1938: 146, fig. 11).

*Amynthas serratus*; Sims & Easton, 1972: 245.

*Pheretima phaselus typica* (sic); Kobayashi, 1938: 410. From Hakodate.

(*Pheretima phaselus tamurai* Kobayashi, 1938: 411)? Said to differ only by its male pore aspects that, despite being in L-shaped grooves, are stated to be "without any porophore-like elevation". From Hakodate. Types?

Diagnosis: Spermathecal pores in 5/6/7/8. Male pores superficial within bean-shaped
pads bearing small, shallow longitudinal slit (or "L" shaped grooves in *tamurai*) that possibly function as seminal grooves. Genital markings absent. Intestinal caeca simple with incised margins. Spermathecae with long diverticula. Originally described as nearly white all over the body except for a dark clitellum; it is sluggish and does not jump like most other worms. Male pores were said to be in large kidney bean shaped patches with longitudinal slits in centres.

Distribution: Japan, Korea.

Remarks: Easton (1981: 48) tentatively put *Amynthas phaselus* (Hatai, 1930), *Metaphire maculosa* (Hatai, 1930) [genus designation from Sims & Easton (1972: 239) probably wrong and should be in *Amynthas*], *Amynthas kamitai* (Kobayashi, 1934) and *Amynthas phaselus tamurai* (Kobayashi, 1938) in synonymy of "*Amynthas acinctus*" that is now presumed to actually be in *Metaphire*. In addition, *Amynthas serratus* (Kobayashi, 1936) was included because Kobayashi (1938: 146) had placed it in synonymy of his *A. kamitai* (Kobayashi, 1934). Ishizuka (1999a: 56, 64) restored some of these subspecies as (illegitimate) infrasubspecific varieties under “*Pheretima phaselus* HATAI, 1930” [sic] while also placing *Metaphire yezoensis* (Kobayashi, 1938) from Hokkaido in synonymy of ‘*Pheretima acincta*’ as was suggested by Yamaguchi (1962) and Kamihira (1973), although Easton (1981) had maintained it separately as *Metaphire yezoensis*.

Ishizuka 2001:12,102) with superficial male pores qualifying for inclusion, as here, in *Amynthas* (however his figure has the segments miscounted and it is also possible that the specimen is the same as *A. stipatus* or some other species such as *Amynthas gracilis*). Hong *et al.* (2001: 264) describe a superficially and morphologically similar Korean species, *Amynthas minjae* Hong, 2001 that they compare with *A. phaselus* and *A. kamitai*. Moreover, *A. assacceus* as described under species incertae sedis herein is also similar to these taxa.

*Amynthas quintanus* (Ishizuka, 1999).

*Pheretima quintana* Ishizuka, 1999d: 239.


Distribution: Japan.

Remarks: Approximately 14 *Amynthas* species have spermathecae in 4/5/6/7/8/9, possibly including *Amynthas scholasticus* from Japan, and the two similar *A. albobrunneus* and *A. orientalis*, these latter both by Beddard (1912). It is not clear why Ishizuka chose only to differentiate this species from *A. micronarius* that has spermathecal pores in 5/6/7/8/9 and genital markings that are larger and closer to intersegments 17/18 and 18/19, and which itself may be a synonym of *A. obscurus*.

*Amynthas robustus* (Perrier, 1872)

*Perichaeta cingulata* (part) : Vaillant, 1867:234 (err. non Schmarda, 1861).

*Perichaeta masatakae* Beddard, 1892b: 761. [Note: Sims & Easton (1972: 181; 244), Reynolds & Cook (1976: 134), and Easton (1981: 56) misspell Beddard’s species “mastakaе”, while Michaelsen (1900: 282) has it correctly, as here, as *P. masatakae* named after donator Mr Masataka Rokugo]. Spermathecal pores and genital markings (two on each side with glands internally) on 8 and 9; spermathecae "very small"; the "usual pair of caeca are in 27". From “Japan”. 


*Pheretima masatakae*. - Michaelsen, 1900: 282; Kobayashi, 1937: 337, fig. 2; Ohfuchi, 1938c: 62, figs 6-7.

*Megascolex robustus*. - Vaillant, 1889: 76 [this name miscited by Reynolds & Cook (1976: 164) as a separate species].


?Pheretima sheni Chen, 1935: 38 [cf. A. corticis, A. illotus]. From Hong Kong. Types in U.S. National Museum: 20181 (or Fan Biological Institute, China?).

Pheretima robusta: Michaelsen, 1900: 299; Chen, 1936: 271 (syn. siemssen (part), fokiensis, lauta, loehri, corrugata; non P. corrugata kulingiana nec P. aspergillum); Ljungström, 1971: 27 (syn. campestris, corrugata, lauta, masatakae); Gates, 1972: 216 [syn. ornata, ?zavatarii (sic lapsus pro zavattarii), ??sheni].


Diagnosis: Spermathecal pores 0.5 body circumference apart in (6/)7/8/9. Male pores superficial on segment 18. Genital markings small, paired on 7, 8, 9 and (larger on) 18, at least; spermathecal and male pores on small circular discs. Intestinal caeca simple but incised. Size 33-180 by 2-9 mm, but usually >85 mm (Gates, 1972).

Distribution: Widespread species by introduction, found in China (homeland?), Taiwan, Korea (including Quelpart Island), Japan, Okinawa, India, (Philippines, West Indies, Madagascar, Mauritius?).

Remarks: Easton (1981) considered P. campestris Goto & Hatai in synonymy but this must be questioned as the spermathecal pores are less than 0.5 body circumference apart - ca. 0.3 according to the original description - and the markings on (7, 8 and 17-19) are all postsetal. Conversely, P. obscura Goto & Hatai, 1898: 70 may be in synonymy as it differs only in an extra pair of spermathecal pores in 6/7. Easton (1981) had Amynthas lautus (Ude, 1905) as a synonym of A. robustus, but this requires confirmation as Tsai et al. (2000: 286) disagree, based on inspection of (all?) Taiwanese specimens. On the other
hand, Chen (1933: 282) thought \textit{Ph. (Ph.) semsseni} Michaelsen 1931:17 and \textit{Ph. (Ph.) fokiensis} Michaelsen, 1931: 19 were synonymous with \textit{P. lauta} Ude; and later Chen (1946: 136) thought his \textit{P. corrugata} was synonymous with \textit{P. robusta}, but he specifically excluded his \textit{P. corrugata kulingensis} Chen, 1933: 278 subspecies.

Ljungström (1971) revised this taxon and placed \textit{P. masatakei} in synonymy. This latter was redescribed and figured by Kobayashi (1937: 337, fig. 2) who, like Beddard, found Quelpart Island specimens that lacked prostatic glands (i.e., parthenogenetic morphs); he also noted its closeness to \textit{P. ultoria} Chen, 1935 from Hong Kong. \textit{P. masatakei} was also redescribed by Ohfuchi (1938c: 62, figs 6-7). Recently, \textit{A masatakei} was again claimed from Taiwan by Chuang & Chen (2002).

Gates (1972: 216-218) said \textit{A. robustus} was a parthenogenetic species complex that possibly involved athecal \textit{Amynthas sheni} (Chen, 1935) and morphs with various spermathecal deformities; and he thought it especially similar to, and possibly a junior synonym of, \textit{Amynthas aspergillum} (Perrier, 1872:118) which is known from China (Fuchow, Amoy, and Kowloon) as well as Taiwan (Taipei). However, probably \textit{A. aspergillum} is separate as, although it has spermathecae in 7/8/9, it tends to a larger size of 115-375 mm, and its junior synonym is the Taiwanese \textit{Perichaeta takatorii} Goto & Hatai, 1898:76 according to Michaelsen (1900: 318) and Shih \textit{et al.} (1999: 436).

In the current studies a Japanese specimen was identified that, apart from its spermathecae in 6/7/8/9 (cf. \textit{P. obscura} Goto & Hatai, 1898: 70), was identical with sympatric specimens attributable to \textit{A. robustus} (pers. obs.), which is why this option is given in the above diagnosis. We know that parthenogenetic complexes often vary in spermathecal details. Moreover, two taxa albeit with spermathecae in 6/7/8/9 recently described from Okinawa are similar on most points to \textit{Amynthas robustus} from which
they were inadequately differentiated (see *A. kunigamiensis* and *A. yambaruensis* both from Ishizuka *et al.*, 2000a).

*Amynthas scholasticus* (Goto & Hatai, 1898)

*Perichaeta scholastica* Goto & Hatai, 1889: 70. From Tokyo. Types?

*Pheretima scholastica*: Michaelsen, 1900: 317 ['syn. *divergens (= A. corticis)*].


Distribution: Japan (Tokyo).

Remarks: Michaelsen (1900) and Easton (1981) have this species with four pairs of spermathecae in 4/5/6/7/8 as originally described, but Sims & Easton (1972: 236; 268) mistakenly place it in an *Amynthas hexathecus*-group with five pairs while noting that *A. hexathecatus* (Benham, 1896) actually possesses only five pairs of spermathecae [cf. Nakamura (1999b) who still claims six pairs]. Ishizuka (1999a: 59), perhaps following the suggestion of Michaelsen (1900), placed this species in synonymy of “*Pheretima divergens*” which is now in synonymy of *Amynthas corticis* that more often has four pairs of spermathecae in 5/6/7/8/9. Lack of genital markings, spermathecal diverticula and prostatic ducts mark this entity as a pathogenetically degraded morph and it is yet possible that other taxa, such as Ishizuka’s *A. quintana* (albeit with a greater compliment of spermathecae), are in its synonymy.

*Amynthas yambaruensis* (Ishizuka & Azama in Ishizuka, Azama and Sasaki, 2000).
Pheretima yambaruensis Ishizuka et al., 2000a: 90.


Distribution: Japan (Okinawa).

Remarks: Approximately 50 Amynthas species have spermathecae in 6/7/8/9 [including Amynthas bidenryoanus (= Amynthas flavescens) that is also known from Okinawa]. The current specimens have not been adequately differentiated from, and thus may well be synonymous to, Amynthas robustus.

Genus Duplodicodrilus Blakemore, 2007

Type-species Megascolex schmardae Horst, 1883: 194 from “Japan”. [Non Megascolex schmardae Michaelsen, 1897: 208 from “foot of Adams Peak”, Sri Lanka for which replacement is not automatically required and prevailing usage is maintained (under ICZN, 1999: Art. 23.9.5) since these taxa have not been considered congeneric after 1899, e.g. Michaelsen (1900) held them in separate genera].

Diagnosis: Male pores within copulatory pouches on segment 18, eversible as large inflatable and doubled intromittant organs or pseudo-penes (Fig. 6). Genital markings lacking. Intestinal caeca manicate or complex, paired in segment 27 (Fig. 7). Holandric. Spermathecal pores paired in 7/8/9.

Included species Duplodicodrilus schmardae schmardae (Horst, 1883) (type)
[syns. ?Perichaeta sumatrana: Beddard, 1892a:155, Pl IX, fig. 4, (non Megascoleex sumatranus Horst, 1883); Perichaeta trityphla Beddard, 1896: 205 from Barbados, types BMNH:1904.10.5.169; Pheretima kikuchii Hatai & Ohfuchi, 1936: 767 from Japan]; D. schmardae macrochaeta (Michaelsen, 1899: 235 is listed as a subspecies by Sims & Easton (1972: 239) which, as described by Michaelsen (1900: 302), is from Japan and “Tiensin, China” but it is not certain that its variations are outside of normal intraspecific variability and therefore this name may warrant merger with the nominal subspecies.

Etymology for the doubled, eversible copulatory organs resembling “air-bags” in this worm (gender masculine).

Distribution Oriental (Japan, China), the nominal type widespread by transportation.

Remarks Male organs of Duplodicodrilus schmardae differentiate it from other comparable pheretimoid genera: male pores are superficial in Amynthas Kinberg, 1867: 97 (Fig. 1) or non-superficial in Pheretima Kinberg, 1867: 102 (Fig. 2) and Metaphire Sims & Easton, 1972 (Figs. 3-5). The newly proposed genus is most derived in its complex eversible male organs (Fig. 6), combined with its complex intestinal caeca (Fig. 7) that is perhaps less taxonomically important. The elaborate eversible male organs of Duplodicodrilus, used for mutual charging of spermathecae, differ from those found in Metaphire and, moreover, lack of spermathecal nephridia differentiate both from Pheretima s. stricto.

Several other taxa described with large and eversible male pores, possibly also forming doubled intromittent organs or pseudo-penes, that may qualify them for inclusion with D. schmardae in Duplodicodrilus. Likely candidates species are:

- Metaphire bipora (Beddard, 1900: 908) plus its synonyms from “Malay Peninsula” (including Singapore), Myanmar, and Thailand that has one or two
pairs of genital markings (in 19 or 19 and 20) themselves resembling copulatory pouches, four pairs of spermathecae in 5/6/7/8/9 and simple intestinal caeca;

- and *M. virgo* (Beddard, 1900: 895) from Thailand, Malaysia and Myanmar with spermathecae in 6/7/8/9 that also has simple intestinal caeca.

Inclusion of these taxa would require expanding the generic definition to include their characteristics (e.g. simple caeca, extra spermathecal pores and genital markings) as well as genus distribution.

Less likely candidates also described with large eversible intromittent organs are:

- *M. kentungensis* (Gates, 1931) from Myanmar and Laos with spermathecae in 7/8/9 that has glands within its copulatory pouches “*perhaps somewhat as in P. schmardae*”;
- *M. quadrigemina* (Gates, 1932) from Myanmar with spermathecae in 6/7/8/9;
- *M. brevipes* (Qiu & Wen, 1988) from Guizhou, China with spermathecal pores in 7/8/9 and simple caeca;
- and, questionably, *M. quelparta* (Kobayashi, 1937) from Cheju Island, South Korea with spermathecae in 6/7/8/9 plus its possible synonym *M. sanseiana* (Ohfuchi, 1951) from China.

Another possible member of this group would be Gates’ (1972: 199) rather contradictory concept of *Metaphire malayana* (Beddard, 1900) [cf. *M. bipora* and *Pheretima (Pheretima) darnleiensis* as redescribed by Blakemore (2002; 2006; 2007)].

Determination of membership in *Duplodicodrilus* requires inspection of all the taxa listed above (plus their synonyms) probably including DNA ‘fingerprinting’,
preferably of (neo)types, and their comparison with the type, but this work is beyond the
resources of the current study and is deferred.

**Duplodicodrilus schmardae schmardae** (Horst, 1883)

*Fig 4.1* *Duplodicodrilus schmardae*, eversible male pores and intromittent organs (after
Hatai & Ohfuchi, 1936, figs. 4, and 8 for their *P. kikuchii* synonym).

*Fig 4.2* *D. schmardae*, manicate (or multiple) intestinal caeca (after Hatai & Ohfuchi, 1936,
fig. 9 for their *P. kikuchii* synonym).

*Megascolex schmardae* Horst, 1883: 194. [Non *Megascolex schmardae* Michaelsen, 1897:
208 from “foot of Adams Peak”, Sri Lanka. Since these taxa have not been
considered congeneric after 1899, e.g. Michaelsen (1900) had them in separate
genera, a replacement name is not automatically required and prevailing usage is
maintained (ICZN, 1999: Art. 23.9.5)]. From “Japan”. Syntypes in Leiden: 1818
(inspected by Sims & Easton, 1972: 181) and (erroneously?) reported as in Vienna:
3970 by Reynolds & Cook (1976).

?*Perichaeta sumatrana*: Beddard, 1892a:155, Pl IX, fig. 4, (non *Megascolex sumatranus*
Horst, 1883).

[Name misspelt “trityphla” e.g. Sims & Easton, 1972: 246].

*Amyntas schmardae* [sic]: Michaelsen, 1899: 13; Beddard 1900a: 619 (syn. *trityphla*
*vesiculata*).

*Pheretima schmardae*: Michaelsen, 1900: 302 (syn. *trityphla*).

*Pheretima kikuchii* Hatai & Ohfuchi, 1936: 767.

*Metaphire schmardae*: Easton, 1981: 58 (syn. *kikuchii*); Sims & Gerard, 1985: 132, fig. 47e (syn *sumatrana*: Beddard, non Horst, 1883) [as Beddard’s (1892) account of *sumatrana* from Kew Gardens did not mention that the intestinal caeca were manicate, therefore it is more likely that these specimens were of *Metaphire californica* or possibly *M. javanica* - especially since Sims & Easton (1972:239) placed it in the *javanica*-group with simple intestinal caeca].


**Note:** as remarked on above, Sri Lankan *Megascolex schmardae* Michaelsen, 1897 is not the same species as *Megascolex schmardae* Horst, 1883 (= *Metaphire schmardae*).

**Dignosis:** Spermathecal pores paired, c. 0.5 circumference apart in furrows 7/8/9. Male pores within copulatory pouches on segment 18. Genital markings lacking. Intestinal caeca manicate in segment 27.

**Distribution:** Japan (type locality); Hawaii; Antilles; Barbados; Sao Paulo, Brazil (Righi, 1980 plus other Brazilian reports); China; Taiwan; and Kew Gardens (but the report from Kew Gardens is a probable misidentification by Beddard of *M. californica*).

**Locality:** this description is extracted from the references given in the synonymy and from the author’s Japanese studies.

**Habitat:** ?

**Behaviour:** male pores evert like twin “air-bags” for copulation.

**Length:** 80-90.

**Width:** 2-3 mm.

**Segments:** 90-93.
Colour: golden grey.

Prostomium: epilobous.

First dorsal pore: 12/13.

Setae: numerous (ca. 50-60).

Nephropores: ?

Clitellum: annular 14-16.

Male pores: ca. 0.3 circumference apart in lateral slits of copulatory pouches on 18.

Female pore: on 14.

Spermathecal pores: two pairs in 7/8/9 ca. 0.5 circumference apart.

Genital markings: none.

Septa: 6/7-7/8 thick, 8/9-9/10 aborted.

Dorsal blood vessel: single.

Hearts: last pair in 13.

Gizzard: in 8.

Calciferous glands: absent.

Intestine origin (caeca, typhlosole): in 15; caeca manicate in 27-24; typhlosole present.

Nephridia: meroic.

Male organs: testes/funnels in 10 and 11 in sacs; seminal vesicles large in 11 and 12.

Ovaries: in 13.

Prostates: racemose with S-shaped ducts.

Spermathecae: 8 and 9 with short duct and ampulla and long bent diverticulum.

Gut contents: ?

Remarks: The manicate caeca have three or more ‘fingers’ and are distinctive for this species.
Other species with large and eversible male pores, possibly also with intromittent organs or pseudo-penes, are *M. bipora* (Beddard, 1900), *M. virgo* (Beddard, 1900), *M. kengtungensis* (Gates, 1931), and questionably *M. quelparta* (Kobayashi, 1937) plus its possible synonym *M. sanseiana* (Ohfuchi, 1951), *M. quadrigemina* (Gates, 1932), and *M. brevipenis* (Qiu & Wen, 1988). Another possible member of this grouping would be Gates’ (1972: 199) rather unreliable concept of *Metaphire malayana* (Beddard, 1900) [cf. *M. bipora* and *Pheretima (Pheretima) darnleiensis*].

Sims & Easton (1972: 239) list the subspecies *Metaphire schmardae macrochaeta* (Michaelsen, 1899) which, as described by Michaelsen (1900: 302), is from Japan and “Tiensin, China”, thus qualifying as peregrine in one or other place (or both places?), and it was differentiated on details of its anterior setae. It is briefly described below…

*Duplodicodrilus schmardae macrochaeta* (Michaelsen, 1899)

*Perichaeta schmardae* : Michaelsen, 1892: 235.


*Pheretima schmardae* var. *macrochaeta* : Michaelsen, 1900: 302.


**Diagnosis:** As *D. schmardae schmardae* but with 50 or less setae in the anterior and those on segments 4-6 enlarged and ornamented.

**Distribution:** Japan and China (Tiensin) by Michaelsen (1900: 302).
Remarks: It is not certain that these stated variations are outside of normal intraspecific variability and therefore this name may warrant merger with the nominal subspecies.

Genus *Metaphire* Sims & Easton, 1972

Type species and locality: *Rhodopis javanica* Kinberg, 1867 from Java. [Note: Blakemore (2002) questions the distinction of this taxon from the page prior *Pheretima californica* Kinberg, 1867, as also discussed under this taxon’s account below].

Diagnosis: Male pores in copulatory pouches; no nephridia on spermathecal ducts.

Distribution: mostly Oriental region, several species peregrine.

Remarks: Degraded morphs lacking spermathecae cannot easily be distinguished between the genera *Metaphire* and *Pheretima*. As information about the occurrence of nephridia on spermathecal ducts is frequently omitted from earlier descriptions, Sims & Easton (1972: 218) say some current members of *Metaphire* may yet prove to belong to *Pheretima*. Moreover, Sims & Easton (1972) caution that preservation may cause evagination of copulatory pouches and therefore a false resemblance to the superficial male pores of *Amynthas*. These authors (Sims & Easton, 1972: 199, 214) provided a provisional list of nominal species (and subspecies), they further assumed a taxon to belong in *Amynthas* unless copulatory pouches were proven, thereby several members of the *Metaphire hilgendorfi* species-complex were retained in *Amynthas*.

*Metaphire acincta* (Goto & Hatai, 1899)

*Perichaeta acincta* Goto & Hatai, 1899: 16, fig. 6. From Tokyo. Types?

*Pheretima acincta* : Michaelsen, 1900: 252.

Pheretima yezoensis Kobayashi, 1938: 412, fig. 4. From Hakodate from a "cultivated field".

Types?

Diagnosis: Spermathecal pores in 5/6/7/8. Male pores within copulatory pouches that extend just into 17 and 19. Genital markings absent. Intestinal caeca simple often with incised margins. Spermathecae with diverticula up to twice as long as ampullae.

Distribution: Japan, Tokyo to Hokkaido.

Remarks: Originally erected for two aclitellate specimens, hence the name, matures are naturally clitellate. Cf. A. phaselus. Although Sims & Easton (1972) have Metaphire yezoensis in a Metaphire merabahensis species-group, Ishizuka (1999a: 56), as was suggested by Yamaguchi (1962) and Kamihira (1973), placed it in synonymy of Amynthas acinctus whereas Easton (1981) maintained "Metaphire yezoensis" separately.

Metaphire californica (Kinberg, 1867)


(Pheretima sakaguchii Ohfuchi, 1938c: 53)?

(Pheretima sonaiensis Ohfuchi, 1956: 154)?


Remarks: Descriptions of *Metaphire californica* (Kinberg, 1867) are similar to those of *M. javanica* (Kinberg, 1867) and, if these taxa eventually prove to be synonymous, the former name has page priority (see Blakemore, 2002: 191).

[[Start of *Metaphire hilgendorfi / Amynthas tokioensis* species-complex]].

**Metaphire hilgendorfi / Amynthas tokioensis** species-complex


*Amynthas hilgendorfi* species-complex Easton, 1981: 35; 51 [“included species”: *hilgendorfi* (syn. *rokugo, irregularis, schizopora*); *tokioensis; sieboldi*: Beddard, 1892b; Goto & Hatai, 1898: 65 [non Horst, 1883 (= *Metaphire sieboldi*)]; *vittata; agrestis; glandularis; levis; communissima* (syn. *sieboldi*: Goto & Hatai, 1898); *sieboldi lenzi; ambigu; yunoshimensis; tappensis; gomejimensis*].

*Metaphire hilgendorfi / Amynthas tokioensis* species-complex Blakemore, 2003: 1, 7, 26; [currently INCLUDED SPECIES are given below including *A. parvicystis*].

**Composite diagnosis of *M. hilgendorfi / A. tokioensis* species-complex:** Spermathecal pores absent, single or paired in some of 5/6/7/8 or 6/7/8/9 (e.g. in parts of *A. yunoshimensis*) or 6/7/8 or 6/7 or 7/8 [cf. 7/8/9 in *D. schmardae*]. Male pores absent, aberrant, or when present superficial (*Amynthas*) or non-superficial and sometimes in copulatory pouches (*Metaphire*). Genital markings absent, or as clusters of one or more
papillated pores or as indistinct pigmented areas on pre- and post-clitellar segments (typically segmental, multiple mid-ventral in *M. hilgendorfi* or near intersegmental and paired in *A. tokioensis*). Intestinal caeca non-simple, variably incised or manicate originating in segment 26 or 27. Body may be laterally striped with paler intersegments although this was not described on earlier, original descriptions so is an uncertain characteristic for the group.

[Note: the spermathecal diverticular bulbs of specimens identified with both *A. tokioensis* and with *M. hilgendorfi* in the current study have been found to vary, sometimes within a single specimen from one side to the other, from elongate to spherical – and in the latter case not filled with the usual white coagulum. The diverticula may therefore be likened to balloons that expand and elongate only when inflated following copulation. It thus appears that the actual shape of the spermathecae, themselves usually important taxonomic characteristics, may vary considerably in these parthenogenetic morphs].

This diagnosis above is based on the original descriptions, information given by Michaelsen (1900) and Easton (1981), and personal observations. *A. koreanus* is a new addition to the complex cf. Blakemore (2003).

**Distribution of *M. hilgendorfi* / *A. tokioensis* species-complex:** Japan, Korea, China (eg. *M. yamadai*), Kunashir Island adjacent to Hokkaido in the Kuril group of Far East Russia (Perel, 1997: 263; Anon, 1997); three taxa, *agrestis, hilgendorfi* and *levis*, have been reported as introductions into North America (Edwards & Lofty, 1977: 63; Easton, 1981: 53) although these names may be synonyms according to some authors. Components of the *M. hilgendorfi* species-complex not recorded from Japan, from Easton (1981: 52), were: *gucheonensis* Song & Paik, 1970; *jiriensis* Song & Paik, 1971 (both in the *A. tokioensis*-species group); *koreana* Kobayashi, 1938; and *shinkeiensis* Kobayashi,
1938; to this list may be added nine taxa with manicate caeca recently proposed by Hong & James (2001a) that were mutually compared and differentiated, with scant consideration given to previous Japanese taxonomy, and the Korean *Amynthas paiki* Hong, 2001 that is possibly a synonym of *A. tokioensis*.

**Remarks on *M. hilgendorfi* / *A. tokioensis* species-complex:** Resolution of the *Metaphire hilgendorfi/Amynthas tokioensis* species-complex is one of the most pressing and seemingly intractable problems in Japanese (and Korean) earthworm systematics. The unsatisfactory diagnosis above is revised to accept male pores in copulatory pouches, and therefore *Metaphire* species, as several component taxa have this condition, including those samples of *M. hilgendorfi* that actually have male pores. Many species names have been created for parthenogenetic morphs and further synonymy is possible within this group (see *species incertae sedis* below). I concur with Easton (1981) who stated that insufficient data are yet available either to establish the validity of the component taxa or to recognize discrete subgroups. Contributions by Ishizuka (1999a; 1999b; 2000d, 2001) have not much clarified the situation. Several species recently described by Hong & James (2001a) possibly also belong within this species complex. It may be further remarked that comments by Easton (1979) on the developmental stages of copulatory pouches in *Metaphire* means the generic allocation of several taxa may be further complicated by sub-maturity as well as by parthenogenetic degradation of male pores.

More work is obviously required to sort the parthenogenetic morphs into their respective taxa, and also to separate *Amynthas* species from *Metaphire* species, assuming that these genera are tenable within such a species complex subject to male pore degradation. However, it is possible that *Amynthas tokioensis* (Beddard, 1892) if it
actually has manicate caeca, is representative of an Amynthas group that can be separated off from the Metaphire hilgendorfi species-group.

INCLUDED SPECIES RECORDED FROM JAPAN:

**Amynthas agrestis** (Goto & Hatai, 1899)

*Fig. 4.1 Amynthas agrestis* (Goto & Hatai, 1899). Sketches of two specimens from Ami, Ibaraki-ken (collected by author and others, August, 2006), plus original text-figure of a spermatheca.

*Fig. 4.2 Amynthas agrestis* compared with M. hilgendorfi from Hatai (1930; figs. 1-3).

*Perichaeta agrestis* Goto & Hatai, 1899: 17, fig. 7 (sketch of a spermatheca). From Takahashi (Okayama-ken), Tokorozawa (Saitama-ken) and Oarai (Ibaraki-ken). Types unknown.

**Pheretima agrestis** : Michaelsen, 1900: 313 (“possibly a variety of P. hilgendorfi”); Yamaguchi, 1930: 51, fig. 3; Kobayashi, 1938: 141; Gates, 1953: 5; 1958: 1-3 (?syn. hataii); Hatai, 1930: 651, figs. 1-3; Yamaguchi, 1962: 25, fig. 10; Ishizuka *et al.*, 2000b: 179 [highly confused description (even the synonymy is wrong and misses Hatai’s crucial 1930 paper cited above). Ishizuka *et al.* have “Three pairs of spermathecal pores in 6/7/8” repeated as ”Three pairs of spermathecae on segments VIII-IX” and ”Male pores simple, superficial on segment XVIII, but rarely found”, thus a possible misidentification]; Ishizuka, 2001: 67, 103 (syn. hataii).

**Amynthas agrestis** : Beddard, 1900: 637; Sims & Easton, 1972: 235; Easton, 1981: 51 (not explicitly assigned to a genus).

**Pheretima striata** Ishizuka, 1999b: 53, figs. 91-101. From Mt Mitake, Hino City; other material claimed from Institute for Nature Study, Itsukaichi City. Said to have large, stubby penes in 3% of specimens that extend from 17/18 to postsetal
region of 18; but in Ishizuka's (1999b: figs. 93, 99-101; 2001: 67, fig. 17.7a-7c) these are shown to be merely genital markings, probably indistinguishable from those shown on the same page by Ishizuka (2001: 67, figs. 16.7a-7c) for what he calls "Pheretima agrestis (Goto & Hatai, 1899)".


Distribution: From Japan and Korea (e.g. Hatai, 1930:653; Kobayashi, 1938: 141; Hong *et al.*, 2001: 265) and reported as introduced into North America e.g. by Edwards & Lofty (1977: 63), Gates (1958; 1982) who thought it introduced from Japan with imported materials, and by Callaham *et al.* (2004 see [http://www.srs.fs.usda.gov/pubs/ja/ja_callaham01.pdf](http://www.srs.fs.usda.gov/pubs/ja/ja_callaham01.pdf)).

Diagnosis: Spermathecae paired in 5/6/7/8; markings as closely paired darker patches or puckered stripes on 7 and/or 8 and sometimes on 6 and 9, or "without the modified patches" (Goto & Hatai, 1899: 17); tumid circular genital markings with central invaginated area sometimes present paired presetally on 18 that lack glands internally; male pores when present mistakenly reported to be on penes (e.g. *striatus*) or if *P. hataii* was included in synonymy slightly invaginated (i.e., = *Metaphire*), however in newly inspected material (R.J.B. pers. obs.) from Ibaraki-ken the male pores were found to be small and superficial in setal arc below tumid genital markings (i.e. in *Amynthas*). Intestinal caeca appear to vary in specimens from deeply incised or hemi-pinnate to manicate or almost complex, perhaps this latter condition is found in older specimens. [A similar situation seems to occur in *M. yamadai* as Chen (1933: 259, fig. 21) shows variation from deeply incised to manicate caecae].

The original description of more than one hundred included a few specimens (from Oarai, Ibaraki) that had a pair of large papillae presetally in 18, and a few others
without the anterior genital patches and these would presumably be indistinguishable, apart perhaps from convoluted spermathecal diverticula, from Goto & Hatai’s subsequent *M. communissima* that is described separately below.

Hatai (1930: 653) states that most *agrestis* from Hokkaido possess male pores, and Gates (1958: 1-3) mentioned that Kobayashi (1938) found two from 246 Korean specimens had genital markings and male pores on 18 so that Gates believed specimens from around Sapporo would provide needed intermediate forms, although these would need to be compared to *M. hataii*. While Ishizuka (1999a: 57) listed a misnamed “*Pheretima HATAI & OHFUCHI, 1937, p. 13*” as “syn. n.” of *Pheretima agrestis* (Goto & Hatai, 1899), this was later corrected to *Pheretima hataii* Ohfuchi, 1937 by Ishizuka (2001: 103), although these two taxa were already combined by Gates (1938) or retained separately, as *Amynthas agrestis* and *Metaphire hataii*, by Sims & Easton (1972) and Easton (1981) on a probable basis of differences in the form of the male pores (where present).

For Ishizuka’s *P. striata*, one or maybe two specimens [stated to be 3% of 35 specimens (= 1.05 worms??) although possibly not the holotype despite the figure legends for Ishizuka’s (1999b: figs. 91-101) being confused] were said to have male pores: but the "penes stubby and large" are actually genital markings, and probably the actual male pores exiting superficially in the setal arc [from prostatic glands figured in Ishizuka (1999: fig. 8)] were overlooked, just as the setae were missed in Ishizuka's (1999: fig. 7a cf. 7b). Some examples of *P. agrestis* shown on the same page as *P. striata* in Ishizuka (2001: 67) had similarly large and irregularly paired presetal papillae on 18, as were described for a few of Goto & Hatai’s original specimens.

*Amynthas ambiguus* (Cognetti, 1906)
**Pheretima ambiguа** Cognetti, 1906: 782, fig. 7 [non *Pheretima barbara ambiguа* Cognetti, 1913: 302 (= *Pheretima (Parapheretima) barbiguа* Blakemore, 2004 replacement name under ICZN, 1999: Art. 57.2 Examples)]. From Yokohama.

Type in Vienna: 3979.

**Amynthas ambugiuа**: Sims & Easton, 1972: 236, 240 (*Amynthas illotus* species-group);


Remarks: Length ca. 95mm. Lacking spermathecae and prostate glands, but with manicate intestinal caeca. Gates (1958: 23) said “The type on which *P. ambiguа* Cognetti, 1906, was erected is of an AR morph indistinguishable from *irregularis*” that he therefore included under *Pheretima levis*. Compare with *A. tokioensis* and *Amynthas koreanus*.

**Amynthas gomejimensis** (Ohfuchi, 1937)

*Pheretima gomejimensis* Ohfuchi, 1937a: 18. From Oshima and Gomejima (Aomori-ken). Types?


Remarks: *Amynthas gomejimensis* was stated by Ohfuchi (1937: 19, 24) to resemble *Pheretima servinus* (= *Metaphire servina*) or his own *P. hataii* (cf. *Amynthas agrestis*) in all characters except for its lack of genital markings on 18; thus, because no fully mature specimens were found, the relationship is most likely with either of these two previous taxa.

**Amynthas koreanus** (Kobayashi, 1938)

*Pheretima koreana* Kobayashi, 1938: 115, fig. 5. Korea. About a dozen specimens.


Remarks: Variously described as either having paired or unilateral spermathecal pores in 6/7 or 5/6 with deformed spermathecae, or lacking them completely, and often lacking genital markings and male pores; size 90-140 mm. In neither of the above cases is the condition in the holotype explicitly stated, but irrespectively these names may be ‘grab bags’ of degraded morphs of more than one unresolved species with no particular biogeographic nor phylogenetic merit. Their manicate caeca probably place them in one or more parts of the Metaphire hilgendorfi species-complex: most likely associated with Pheretima irregularis, from which neither Kobayashi (1938) nor Ishizuka (1999b) managed to adequately differentiate them, or possibly to A. ambiguus (Cognetti, 1906). There is almost no difference in the degraded specimens that Ishizuka (2000) unnecessarily provided with a name from those described earlier by Kobayashi (1938), showing that little new has been learned during the last 60 years.

In these most recent revisions (August 2004; January, 2005) it seems to me that these taxa (koreana, conjugata) are the same as P. schizopora (Goto & Hatai, 1898:76), especially since the justification for their original name was for a pair of female pores and Ishizuka (1999b: fig. 8) appears to show separate pores for his P. conjugata (not that this is a reliable taxonomic character) and, moreover, that this latter taxon is probably synonymous with A. tokioensis (Beddard, 1892), into which all these names should be sunk.

Amynthas parvicystis (Goto & Hatai, 1899)

Perichaeta parvicystis Goto & Hatai, 1899: 18, figs. 8, 8a, 8b. From Uwajima (Ehime-ken,
Shikoku) and Oarai (Ibaraki-ken, Honshu). Types?

_Pheretima parvicystis_: Michaelsen, 1900: 316 (“perhaps a variety of _P. tokioensis_”).


Diagnosis: Spermathecal pores stated to be presetal on 7 and 8, (or more likely in 6/7/8?).

Male pores superficial on segment 18. Genital markings paired glandular pores near spermathecal pores (in 7 and 8) and usually with two pairs just median to male pores. Intestinal caeca simple incised (or more likely manicate?). Prostate glands aborted (always?).

Distribution: Japan.

Remarks: This species name, maintained separately by Easton (1981), was thought a possible variety of _Amynthas tokioensis_ (Beddard, 1892) by Michaelsen (1900) and, maybe because of this, was also held by Ishizuka (1999a: 66; 2001: 102) in synonymy of “_Pheretima tokioensis_” that is now returned as _Amynthas tokioensis_ after its previous inclusion in the _Metaphire hilgendorfi_ species-complex characterized by intestinal caeca that are manicate. _A. parvicystis_ was originally described by Goto & Hatai with a single pair of caeca with the “external margins frizzled” and stated to be similar to the condition found in _Amynthas digitatus_ (Benham, 1896) and _A. bonthainensis_ (Benham, 1896), and Sims & Easton (1972: 173, Fig. 11) show _A. digitatus_ with multiple (= manicate) intestinal caeca. However, Goto & Hatai (1899: 23) failed to include _A. parvicystis_ in their list of species with manicate caeca (although they also miss their own _agrestis_ and mistakenly include _divergens_ in this list), and they had earlier overlooked the caeca of their _P. iizukai_ and had misdescribed the multiple caeca of their _P. megasolidioides_. Yet Easton (1981) appears to have accepted that the caeca of _A. parvicystis_ were simple with incised margins. Almost certainly Goto & Hatai confused the position of the spermathecal pores with those
of the genital markings (as they did both for their *P. obscura* and *P. vittata*). Moreover, Sims & Easton (1972: 237) for unexplained reasons include *A. parvicystis* in their *tokioensis*-group characterized by spermathecal pores intersegmental in 6/7/8. Thus there is some ambiguity of the exact condition of caeca and spermathecal pores for this taxon.

Nothing matching the original description has been re-discovered thus far [except for a dubious report by Kobayashi (1941a)] and, if both their respective caeca are manicate, most likely it is merely a synonym of *A. tokioensis* [for which Ishizuka’s *P. verticosa* is also a synonym with his figures (Ishizuka, 1999b: 50, figs. 75-83) complying almost exactly with Goto & Hatai’s figures]. If, however, the spermathecal pores are actually in (6/)7/8/9 rather than 6/7/8, then this species would be similar to *A. robustus* that does have simple but incised caeca and a similar distribution of genital markings.

*Amynthas purpuratus* (Ishizuka, 1999b).

*Pheretima purpurata* Ishizuka, 1999b: 42 [misspelt “purpuratga” by Ishizuka (2001: 14)],

[non *Perichaeta purpurea* Benham, 1897 (= *Amynthas purpureus*)].

Remarks: The description is confused regarding the distribution of anterior genital markings, and it is probable that this species is similar to *Amynthas tappensis* (Ohfuchi, 1935) and therefore in synonymy of *A. vittatus*, but this needs confirmation from inspection of types.

*Amynthas tappensis* (Ohfuchi, 1935)

*Pheretima tappensis* Ohfuchi, 1935: 409, figs. 1-5. From Tappi, Higashi-Tsugaru district, Aomori northeast Honshu - the closest point to Hokkaido. Types unknown.

Pheretima bimaculata Ishizuka, 1999b: 42; 2001: 60.


?Pheretima surcata Ishizuka, 1999b: 48; 2001: 63. (cf. A. tokioensis); [Ishizuka (2001: 63) has miscounted segments and erroneously states spermathecal pores are in "5/6/7" although the original description, and all figures, show them in 6/7/8].

Amynthas odaesanensis Hong & James, 2001: 86, figs. 5F-H. From Korea.

Amynthas righii Hong & James, 2001: 87, figs. 5I-L. From Korea.

Amynthas fasciiformis Hong & James, 2001: 89, figs. 5M-O. From Korea.

?Amynthas sanchongensis Hong & James, 2001: 90, figs. 5P-T. From Korea.

Diagnosis: Size 40-208 mm, segments 54-115, setae 32-64. Brown dorsum. Male and spermathecal pores ca. 0.4-0.5 circumference apart with about 16-25 setae between male pores. Spermathecal pores in 6/7/8 (probably). Genital markings as one or more small papillae posterior-median to position of spermathecal pores in some or all of 7-8,9 (probably) and anterio-median to relative position of male pores in some or all of 17-19,20. Intestinal caeca manicate.

Distribution: More than sixty years ago, Kobayashi (1941c: 380) reported Ph. tappensis from Kinki, through Kanto to Tohokku regions of Honshu, i.e., much of central and northern Japan, well encompassing the range of all of Ishizuka's specimens. Korean records are more recent.

Remarks: Descriptions of all three of Ishizuka's species are highly confused regarding the location of spermathecal pores and distribution of genital markings, but all are mutually similar, allowing for natural variation, and they all also resemble Amynthas tappensis (Ohfuchi, 1935) thereby possibly qualifying for synonymy along with A. vittatus (Goto & Hatai, 1898) in A. tokioensis (Beddard, 1892) - see also A. purpuratus.
Examples of the confusions are that the Ishizuka's description of *bimaculata* has markings stated in 9-10 and spermathecae in 6/7/8. But his Fig. 38 shows markings in either 8-9 or 9-10, and his fig. 39 has them in 7-8 [this same figure is copied in Ishizuka (2001: 60, fig 3a) but now has them in 8-9 and spermathecae in 7/8/9]. Moreover, his description of *surcata* had spermathecal pores quite clearly stated to be in 6/7/8 (spermathecae in 7 and 8), while the markings were said to be in presetal in 7-8 and in 18. Yet his Fig. 65 possibly has the segments miscounted, and Fig. 66 show spermathecae in 5/6/7 and only one marking in 7 (or is the legend wrong?). Also the key in Ishizuka (1999b: 55), apart from having "markings absent", has "genital glands complex duct type" (even though they are stated in the description to be either simple or complex in both his *silvatica* and *surcata*) and in the next couplet he confuses *surcata* with *verticosa*, albeit they may indeed be identical species, both belonging in *A. tokioensis*. Unremarkably, these latter errors in the figures are perpetuated in Ishizuka (2001: 60, 63) and a research imperitive is to reinspect types and redescribe these taxa.

Ishizuka's *silvatica* which was based on either 9 or 10 specimens, may differ slightly in having first dorsal pores in 11/12 rather than 12/13 (normal variation?) and seminal vesicles given in the unlikely location of 10-11 rather than 11-12 (albeit the figure legend for these is also mis-scaled), and these may just as easily be miscounts.

Hong & James' *A. odaesanensis, A. righii, A. fasciiformis* and *A. sanchongensis* are all mutually compared, agree with each other, and fall within variation of Ishizuka's specimens and thus are also likely synonyms within the ambit of *A. tappensis*. The latter species, *Amynthas sanchongensis*, is even described with "eight of sixteen" specimens lacking genital markings near the spermathecal and male pores and therefore, presumably, almost impossible to distinguish between *A. tokioensis* and/or *A. tappensis* specimens that
also lacked markings. Hong & James (2001: 91) compared this latter species only with the sympatric *A. jiriensis* (Song & Paik, 1971) saying "it differs in the shape of male pore region and the genital markings..." and I take it that they meant to add ‘...when these are present...’. Moreover, if not synonymous, male pores in *sanchongensis* may be strictly non-superficial and thus it would presumably qualify for *Metaphire*.

The real question, despite all this diversion, is the relationship of *A. tappensis* to the prior *A. vittatus*, and to *A. tokioensis* as redescribed below.

*Amynthas tokioensis* (Beddard, 1892)

**Fig. 5.1** *Amynthas tokioensis* (Beddard, 1892). Sketch of previously dissected type specimen (BM:1904:10:5:166) showing spermathecae and glands in 7 and prostate ducting to rhs male pore *in situ* with a spermatheca found in a vial (from 8 rhs or lhs, other spermatheca missing from jar). Manicate intestinal caeca is from around segment 26 rhs. Enlargements are of spermathecal region (7 lhs) and male pore region (18 lhs). Clitellum is shown shaded.

**Fig. 5.2** *Amynthas tokioensis* (Beddard, 1892). Rough sketch of internal arrangement of spermathecal and male field of type specimen (not to scale). X - site of previously removed or cut out genital gland, spermathecae, and prostate gland.

**Fig. 5.3** *Amynthas tokioensis* (Beddard, 1892), *P. schizopora* and *P. irregularis* compared showing spermatheca with ampulla and genital marking glands.

**Synonymy:**

*Perichaeta tokioënsis* Beddard, 1892b: 762 [Published December, 1892 according to Michaelsen, 1900: 272]. From Japan (Tokyo, as in "tokioensis"?). Holotype in British Museum: 1904.10.5.166 (inspected by Sims & Easton, 1972: 181, 191 and re-inspected here at YNU in Dr M. Ito’s laboratory).

?*Perichaeta vittata* Goto & Hatai, 1898: 74. From Tokyo, Kamakura; no types. [Markings, 3 presetal and lateral pairs in 7 and 8; spermathecae absent or a single pair in 8 (or two pairs in 7/8/9?); prostates aborted; caeca manicate].
?Perichaeta schizopora Goto & Hatai, 1898: 76. From Tokyo. No types. [Spermathecal pores in 7/8, the spermathecae in 8 irregular: the one on the left side had "three diverticula" (they may have mistaken two copulatory glands for diverticula), the one the right a normal single diverticulum; prostates aborted; caeca manicate. Oviduct (female) pores were reported as "one pair", "entirely separate", but either this is an abnormal specimen or, since this single aclitallate specimen was not fully mature (hence no genital markings), the absence of a tumid clitellum may cause the pores to appear separately. Either way, the presence of paired rather than separate female pores is not a particularly 'good' character and in every other reported respect, this 'species' is probably the same as *P. vittata* and also resembles the current redescription of *A. tokioensis*].

?Perichaeta irregularis Goto & Hatai, 1899: 13 (not figured). [Non *Perichaeta irregularis* Spencer, 1895: 53 (= *Perionychella irregularis*), however, a replacement name for the permanently invalid junior primary homonym is not provided under ICZN (1999: Arts. 23.9.5, 57.2, 82) as the two names were “not considered congeneric after 1899”, eg. Michaelsen (1900: 206, 276) had them in separate genera. Cf. *M. hilgendorfi* synonymy below]. From Uwajima, western Shikoku, and Takahashi, that is adjacent to the north of Shikoku in Okayama-ken. No types. [Intestinal caeca manicate but spermathecae, genital markings, prostates and male pores absent, therefore a highly degraded parthenogenetic morph that could belong to any number of similar taxa; cf. *M. hilgendorfi*, *A. parvicystis*. Nakamura (1994: 29) lists it as a separate taxon “*Amynthas irregularis* (Goto et Hatai) Ohfuchi”).

*Perichaeta levis* Goto & Hatai, 1899: 20, fig. 12. [See also its separate description below].
From Takahashi Okayama-ken and Kumamoto (Kyushu). No types. [Spermathecae and copulatory glands exactly as in *tokioensis*, male pores and prostates absent, which is probably why Goto & Hatai found them “difficult to recognize with the naked eye”; cf. *M. hilgendorfi*].

*Pheretima levis*: Kobayashi, 1938: 129 fig. 7, from Korea; Gates, 1958: 21-24 (?syns. *irregularis, ambigua, vittata, schizopora*), from USA. Spermathecal pores in 6/7/8, genital markings paired in 8 and/or near spermathecal pores, male pores absent, caecae manicate - i.e., agreeing with current redescription of *A. tokioensis*.

*Amyntas (sic) tokioensis*: Beddard, 1900: 633 (syn. *candida* Goto & Hatai, 1998: 77; *parvicystis* Goto & Hatai, 1899: 18). [These synonyms were not universally accepted and, moreover, the type of *tokioensis* is now known to have manicate intestinal caseca whereas the intestinal caeca of these others names are still rather uncertain].

*Pheretima tokioensis*: Michaelsen, 1900: 309, 316 (?syn. *parvicystis*).


*Pheretima verticosa* Ishizuka, 1999b: 50, figs. 75-83; 2001: 64.

*?Pheretima irregularis*: Ishizuka, 2001: 19, 20, 53, 54, 61 - sometimes misspelt "irreguralis" and probable misidentifications, although it may yet be a synonym.

*[?Amyntas yongshilensis* Hong & James, 2001: 80, figs 4A-C. From Korea. Sympatric
on Quelpart Island with *Amynthas alveolatus* Hong & James, 2001 that is exactly the same as *A. kanrazanus incretus* (Kobayashi, 1937) and comparable to *A. kanrazanus kanrazanus* (Kobayashi, 1937) that is itself similar to *A. tokioensis*.

*Amynthas eastoni* Hong & James, 2001: 83, figs 4M-Q (on page 80). From Korea.

*Amynthas boletiformis* Hong & James, 2001: 84, figs 5A-E. From Korea.

? *Amynthas paiki* Hong in Hong, Lee & Kim, 2001: 266, fig. 4. From Korea. [See http://zoolstud.sinica.edu.tw/Journals/40.4/263.pdf where the taxon is compared only to *A. taebaekensis* Hong & James, 2001 that, however, has simple rather than manicate intestinal caeca, and spermathecal pores in 5/6/7 rather than 6/7/8].


**Diagnosis**: Spermathecal pores widely paired ca. 5 mm apart compared to body diameter of 6 mm in 6/7/8 (or one or more absent – pers. obs. including a single specimens with no spermathecae nor anterior markings but with markings near superficial male pores in 18); genital markings paired just in front of the setal arcs on 7 and/or 8 (originally said by Beddard to be in 8 and 9 but more likely in 7 and 8 due to the position of the internal glands here) just medial to the spermathecal pores, with two or three glandular pores near to and medial to the male pores (all markings with various glands internally, those near the spermathecae may "unite to open close to, if not in common with, the spermatotheca of segment VIII" - Beddard). [Or genital markings absent?]. Spermathecae “of exactly
the same form as in *Perichaeta rokugo* (= *M. hilgendorfi* i.e., with diverticula long and thin but widened proximally).

Intestinal caeca now known to be manicate (pers. obs.). Beddard (1892b: 763) originally stated that “there are only the usual two caeca in segment 26” and so Michaelsen (1900) quoted the intestinal caeca form as “usual”, but Sims & Easton (1972: 191), after inspection of the holotype, stated it is multiple (= manicate as confirmed here) thus Easton (1981) included it in his *Amynthas hilgendorfi* species-complex. Michaelsen and later Beddard (1900) also thought that *A. parvicystis* (Goto & Hatai, 1899: 18) was possibly a variety of *A. tokioensis* with which I am inclined to agree, allowing for errors in the original account such as the confusion of genital markings with spermathecal pores and *vice versa*. It is also possible that the various degraded morphs of *A. vittatus* and *A. tappensis* may also be synonymous, and therefore so too are all known synonyms of these two taxa.

Easton (1979: 119) added *gucheonensis* Song & Paik, 1970 and *jiriensis* Song & Paik, 1971 to the *A. tokioensis*-species group of Sims & Easton (1972) that raised it to 20 nominal taxa - with many of these synonyms. M.T. Ito (pers. comm. January, 2007) believes that *A. jiriensis* is also a synonym of *A. tokioensis*.

Ishizuka’s *P. verticosa* largely complies with what is known of *A. tokioensis* and also with some of the possibilities, as noted under its account, in the highly confused description of *P. parvicystis* by Goto & Hatai (1899: 18). Figures accompanying Ishizuka's (2001: 61) redescription of *"Phreretima irregularis"* (Goto & Hatai, 1899) correspond closely what is known of Beddard's (1892b) earlier taxon (having spermathecal pores in 6/7/8, glandular markings on 7, 8 and 18, and manicate intestinal caeca), and may thus prove to actually be of *A. tokioensis*. Originally, *P. irregularis* was based on
specimens with manicate caeca but that lacked spermathecae, genital papillae and male pores!

Following recent inspection of the type by Sims & Easton (1976) and per. obs., we can now accept that the intestinal caeca are indeed manicate, and male pores (when present) are superficial; thus *Amynthas tokioensis* becomes the representative taxon of an *Amynthas tokioensis* species-group currently combined, uncomfortably, within the *Metaphire hilgendorfi* species-complex, that would be redefined to accept spermathecal pores in 6/7/8, or just in 7/8, or absent.

Hong & James' (2001) *A. yongshilensis*, *A. eastoni* and *A. boletiformis* also agree, with each other, with *parvicystis* and, thus are likely synonyms of *A. tokioensis* or, at the very least, would belong in an *A. tokioensis* species-group (- synonymy as per Blakemore, 2003: 43, addenda). A further possible synonym is *Amynthas paiki* Hong in Hong, Lee & Kim, 2001- [http://zoolstud.sinica.edu.tw/Journals/40.4/263.pdf](http://zoolstud.sinica.edu.tw/Journals/40.4/263.pdf)

*[Amynthas vittatus* (Goto & Hatai, 1898) [cf. *A. tokioensis* account above].

*Perichaeta vittata* Goto & Hatai, 1898: 74 (crudely figured). From Tokyo, Kamakura [later as "Tokio and Yokohama" in Table 3 of Hatai (1929: 281)]. Types?

*Amyntas vitatus* : Beddard, 1900: 635.

*Pheretima vittata* : Michaelsen, 1900: 312; Cognetti, 1906: 783 (Yokohama), figs. 8-11; Hatai, 1929: 271, figs. 1-2; Ishizuka, 2001: 64.

*Amynthas vittatus* : Sims & Easton, 1972: 236 (*pomellus*-group with spermathecal pores in 7 & 8, but this obviously a mistake); Easton, 1981: 51.

Distribution : Japan and Korea; Hatai (1929) described it from Aomori, through Miyagi to Shikoku, and from Oshima and Kagoshima-ken. Also reported from northeastern
Connecticut, USA by Schneider & McDevit (2002).

Diagnosis: Spermathecae, at most, paired in 6/7/8; genital markings absent or in paired sets of one to six papillae linearly in 7 and 8 just in front of setal line (rarely in 5, 6 or 8 too), and similar markings sometimes near male pore(s), when present, on 18. Intestinal caeca manicate. Banded colouration due to pale setal lines. Size about 100-155 mm.

Remarks: Goto & Hatai’s original description confused the pre-setal genital marking glands in 7 and 8 with spermathecae and thus falsely claimed 6 pairs in these two segments (parroted by Cognetti, 1906). Subsequently, Hatai (1929) corrected his earlier flawed account and indicated that spermathecae may be present in some of 6/7/8. As noted under the account of Metaphire hilgendorfi / Amynthas tokioensis herein, it is possible that Goto & Hatai’s subsequent P. irregularis is merely a more degraded morph of A. vittatus - or some other taxon. Several variable specimens newly collected from Tokyo and/or Hokkaido and studied by the current author agree with A. vittatus and tend to have a similar banded colouration dorsally; they also merge characteristics with Goto & Hatai’s schizoporus and levis (in all cases male pores were absent or superficial, i.e., not qualifying for Metaphire). It is thus possible that all three taxa (irregularis, schizoporus, levis) are synonymous with A. vittatus, which in turn is synonymous with A. tokioensis.

What is known is that the markings (when present?) on segment 7 are just in front of the setal arc and are in lateral series of about three on each side. This may well be the most distinct characteristic, although when they are single, double, or missing, then this worm will presumable be similar to several other taxa, especially A. tokioensis.

Ishizuka (2001: 64) shows specimens claimed to be P. vittata one of the latter with the same markings as found on 7, also on 18 just median to what appear to be superficial male pores; this specimen has two pairs of diverticulate spermathecae with
openings in 6/7/8, perhaps indicative of a sexually reproducing specimen. (Ishizuka's (2001: 61) "Pheretima irregularis" is more likely a misidentification of *A. tokioensis*). It is thought that Ohfuchi’s *P. tappensis* is also in synonymy along with its various junior synonyms comprising several of Ishizuka’s proposed taxa (e.g. *bimaculata, purpurata, silvatica* and *surcata*). In addition, Hatai & Ohfuchi’s *M. servina* may also be closely related, if not synonymous, but with the male pores claimed to be in more defined pouches. Such possibilities require further investigation, but the over-riding consideration is the relationship of *A. vittatus* to *A. tappensis* and the relationship of both to the prior *A. tokioensis*, as discussed under that taxon’s account above.

*Amynthas? yunoshimensis* (Hatai, 1930)

*Pheretima yunoshimensis* Hatai, 1930b: 655, figs. 4 (of body), 5 (of defective spermathecae and internal capsulogenous glands); Ishizuka (1999a: 67) [name misspelt “yunoshimaensis”]; Ishizuka, 2001: 105 [name misspelt “yunishimaensis”]. From Sapporo, Hokkaido and Aomori, northern Honshu where Yunohima is a small island off Asamushi township. Types unknown.


Remarks: Genital markings as composite papillae in 8 and 18. Due to the original description allowing spermathecae in either 6/7/8 or 5/6/7/8, Sims & Easton (1972: 237) had this taxon partly in an *Amynthas tokioensis*-group with spermathecal pores in 6/7/8, and partly in an “*Amynthas sieboldi*-group” with spermathecal pores in 6/7/8/9; accordingly, this latter condition is added to the *hilgendorfi*-complex diagnosis above (cf. Easton, 1981). Spermathecae mostly appear defective. Male pores were present in specimens from Sapporo (Hatai, 1930: 656) but their form was not described and this
taxon is poorly differentiated from Metaphire hilgendorfi with which it shares patches of central genital markings in 8 and 18. In fact, Gates (1958: 13) had earlier said it was indistinguishable (accepting an extra spermatheca or two in 5/6 as mere variation) and thought it a junior synonym of hilgendorfi.

**Metaphire communissima** (Goto & Hatai, 1899)


*Perichaeta sieboldii*: Goto & Hatai, 1898: 65; Goto & Hatai, 1899: 23 [non Megascoleex sieboldi Horst, 1883 (= Metaphire sieboldi)].

*Perichaeta communissima* Goto & Hatai, 1899: 23. From Nakahama, Tokyo, Sendai, Tsugaru, Shizuoka, Ibaraki, Bichu. Type material unknown.


Remarks: In a footnote, Sims & Easton (1972: 235) state that: “Both communissimus and sieboldi lenzi were provided for Perichaeta sieboldi: Goto & Hatai, 1898 (non Horst, 1883); communissimus has priority”. This was already established by Michaelsen (1900: 262), but appears to have been ignored by Easton (1981:51) who listed sieboldi lenzi as a
separate “INCLUDED SPECIES” in his *hilgendorfi* species-complex rather than a synonym.

Characteristics of *Metaphire communissima* are spermathecal pores paired in 5/6/7/8; absence of genital markings; male pores apparently in small copulatory pouches; spermathecae with convoluted diverticula; and manicate intestinal caeca. Having male pores in copulatory pouches as shown in Ishizuka (1999b: figs. 84-85; 2001: 66), rather than “on top of papillae” as in the original description, would qualify this taxon for inclusion in *Metaphire*. Michaelsen (1900: 263) stated that the prostatic ducts were thickened at the end but did not have copulatory pouches, which is similar to the arrangements figured by Ishizuka (1999b: fig. 87; 2001: 66). The inadequate morphological characteristics used by Ishizuka to separate his *P. florea* from *M. communissima* (misspelt “commnissima”) were a smaller body length, stated to be 60-70 mm, although he has misquoted as “150-250 mm” the accepted range of *communissima* given by Michaelsen (1900: 262) as 90-250 mm; and spermathecal ampullae stated to be “shovel-shaped” in *florea* as opposed to “globular” in *communissima*, even though Michaelsen (1900: 262) had stated they were “flattened”. Ishizuka (2001: 66) redescribes *communissima* on the same page as his *florea* (misspelt “frolea”), here giving the respective lengths as 90-180 and 60-80 mm, and figuring other morphological criteria as being indistinguishable (apart perhaps from slight age-related differences). Both figured specimens appear to have male pores in copulatory pouches, supporting their inclusion in *Metaphire*, and are essentially indistinguishable, supporting their synonymy. Were there parthenogenetic specimens of *M. communissima* lacking male pores, these would presumably be similar (synonymous?) to either *A. agrestis* or *M. hataii* specimens lacking genital makings.
Ishizuka (1999b; 2001) implies that geographical or topographic locations of his *P. florea* specimens coming from a Yamanashi-ken mountain is unique, but he appears to ignore the distribution of *M. communissima* given as from around Osaka, through Shizuoka, Tokyo, Aomori and Ibaraki, to Sendai in the north (or as stated by Goto & Hatai: “that is to say all over the Main Island”), that puts Yamanishi-ken in about the middle of the known range.

Relationship of *M. communissima* to the prior *A. agrestis* and subsequent *M. hataii* require resolution as their characteristics overlap possibly indicating synonymy.

**Metaphire hataii** (Ohfuchi, 1937).

Fig. 7 *Metaphire hataii* (Ohfuchi, 1937). Based on original figures.

*Pheretima hataii* Ohfuchi, 1937a: 13, fig. 1. From Kyu-sakurayama near Morioka, Iwate-ken. Types unknown.


Notes: Newly restored from synonymy in *A. agrestis* by Blakemore (2005).

Distribution: From northern Japan.

Diagnosis: Spermathecae paired in 5/6/7/8; markings as closely paired dark patches on 7 and paired presetally median to male pores on 18 that lack glands internally

Remarks: Male pores in slight copulatory pouches as in tyes specimens of *Metaphire hataii*, and as described in 2 out of 248 specimens (of *P. agrestis*) by Kobayshi (1938: 142, 145) qualify this taxon for inclusion in *Metaphire* separate from *Amynthas*.

**Metaphire hilgendorfi** (Michaelsen, 1892).
*Perichaeta hilgendorfi* Michaelsen, 1892: 235, fig. 15. [Published in September, 1892] therefore has priority over Beddard's December, 1892 *P. rokugo* and *P. tokioensis*. From ‘Japan’ (Hakodate, Yokohama and possibly another locality). Types of five specimens of the original seven specimens (i.e., two missing?) in Zoological Museum, Berlin listed by Hartwich & Kilias (1989: 266) after Michaelsen (1892: 237) thus:

- 2114: Japan; HILGENDORF leg. (1 synytype).
- 2123: Japan, Hakodate; HILGENDORF leg. (3 syntypes).
- 2149: Japan, Yokohama; v. MARTENS leg. (1 syntype).

Michaelsen (1892) had five "varieties" thus:

α - (150 mm long) with spermathecae in 6/7/8, GM 8 (3 specimens from Hakodate);

β - spermathecae in 6/7/8, GM 8 and 9 (No. 2149, Marten's specimen from Yokohama);

γ - spermathecae 6/7/8, no GM (one specimen from Hakodate);

δ - spermathecae 5/6/7/8 (one specimen from Hakodate);

ε - spermatheca on lhs in 7/8 (No. 2114, one of Hilgendorf's from 'Japan').

*Perichaeta rokugo* Beddard, 1892b: 756, tab. 32, figs. 1-7 (published in December, 1892). Spermathecal pores in 6/7 and 7/8; genital markings central on 8; male pores and prostates absent. From "Japan". Types (of four examples?) in British Museum: 1904:10.5.144-145.

?*Perichaeta irregularis* Goto & Hatai, 1899: 13. [Non *Perichaeta irregularis* Spencer, 1895: 53 (= *Perionychella irregularis*) - note: under ICZN (1999: Art. 23.9.5) the junior primary homonym by Goto & Hatai (1899) is not replaced and prevailing
usage is maintained as the two taxa were “not considered congeneric after 1899”,
e.g. Michaelsen (1900: 206, 276) at least had them in separate genera - see also
A. tokioensis synonymy above.

Perichaeta glandularis Goto & Hatai, 1899: 18, figs. 9-11. From Takahashi. Types unknown. Spermathecae 6/7/8; genital marking patches mid-7 and mid-17/18.


[?Pheretima yunoshimensis Hatai, 1930b: 655. Cf. its description above].

Amynthas hilgendorfi: Sims & Easton, 1972: 237 [partly in tokioensis-group, youngi-group (that is mistaken as P. youngi - a junior synonym of A. glabrus, actually has two pairs of spermathecae not just one pair) and partly in their zebrus-group]; Easton, 1981: 51 (appearing to accept Beddard’s 1900 synonymy of rokugo, irregularis, schizopora rather than Michaelsen’s synonymies).

Diagnoses of the various forms of this taxon from Michaelsen (1892, 1900) are: with spermathecal pores in 6/7 and/or 7/8 or 5/6/7/8; genital markings as presetal, central patches with numerous papillae (correspnding with internal pore-glands) in 8 and/or 9, and often in 17 and/or 18; intestinal caeca manicate.

Perichaeta glandularis was described by Goto & Hatai (1899: 18) with
spermathecal pores 6/7/8, markings in 7 and 17/18 and figured with male pores in copulatory pouches, but in other regards complies with Michaelsen’s α morph.

The list of included species in the “Amynthas hilgendorfi species-complex” by Easton (1981) was fairly extensive and he appeared to accept the synonymies of A. hilgendorfi s. stricto by Beddard (1900) rather than those advocated by Michaelsen (1900). Studies by the current author have found specimens agreeing with M. hilgendorfi that have male pores (paired or single and sometimes displaced to segment 17 or 19) either in copulatory pouches or everted, and some other accounts (e.g. Ishizuka, 2000d; 2001) have morphs with male pores that appear in copulatory pouches and, if this is taken as the normal situation, then this taxon belongs in Metaphire rather than Amynthas.

Although Michaelsen (1900) had diagnosed this species with “Prostates usually aborted, if present, similar to those of P. sieboldi, i.e. exiting directly without copulatory pouches”, Metaphire sieboldi was subsequently categorized as having copulatory pouches. Inexplicably, Ishizuka (1999a: 60) has both “Perichaeta glandularis : GOTO & HATAI, 1899” and “Perichaeta rokugo : BEDDARD, 1892” as syn. n.’s of P. hilgendorfi (Michaelsen, 1892) despite their earlier placings; and Ishizuka (1999a: 61) has both “Perichaeta levis GOTO & HATAI, 1899” and the prior “Perichaeta schizopora GOTO & HATAI, 1898” as syn. n.’s of P. irregularis (Goto & Hatai, 1899: 13) which he variously dates as either “1898” or “1899”. In fact, Ohfuchi (1938a: 2; 1939: 81) had already combined P. levis (Goto & Hatai, 1899: 20) with P. irregularis (Goto & Hatai, 1899: 13) more than sixty years before. It is possible that the degraded morphs named P. conjugata by Ishizuka (1999b) are the same as irregularis as Ishizuka's figures of the deformed spermathecae are not much different to those shown in Ohfuchi (1938a: fig. 5) for his P. koreana. However, because Perichaeta schizopora and P. irregularis are such
degraded morphs, they could actually be attributed to several taxa with manicate intestinal caeca and, in my opinion, both are possibly in synonymy of \textit{A. vittatus} and/or \textit{A. tokioensis}.

[?\textit{Metaphire levis} (Goto & Hatai, 1899) cf \textit{A. tokioensis} above, this description in braces for clarity and comparison.


\textit{Pheretima levis} : Kobayashi, 1938: 129 fig. 7, from Korea; Gates, 1958: 21-24 (\textit{?syns. irregularis, ambigua, vittata, schizopora}), from USA. Spermathecal pores in 6/7/8, genital markings paired in 8 and/or near spermathecal pores, male pores absent, caecae manicate - i.e., agreeing with current redescription of \textit{A. tokioensis}.

\textit{Metaphire levis} : Sims & Easton, 1972: 238 (\textit{Metaphire glandularis} species-group).

Genus? \textit{levis} : Easton, 1981: 51 (genus not stated within his \textit{"Amynthas hilgendorfi} species-complex").

Diagnosis: Spermathecal pores in 6/7/8 surrounded by small papillae with glands internally; male pores and prostates typically aborted or vestigial - thus is is not known how Sims & Easton (1972) could reliably transfer this taxon to \textit{Metaphire}.

Distribution: Japan, Korea (Kobayashi, 1938), and reported as introduced into North America by Gates (1958) and Easton (1981: 53) and from the Carolinas and Tennessee (where it is erroneously cited as "\textit{Metaphire levis} (Horst, 1893)" - see \url{http://www.inhs.uiuc.edu/~mjwetzel/AOGSMNPPkChklst.html}) - possibly a
misidentification of a species that does have copulatory pouches. Recently reported from
Bac and Nui Provinces of Vietnam.

Remarks: Possibly this species name is in synonymy of *M. hilgendorfi* as was indicated
by Michaelsen (1900: 272) [cf. Easton (1981) who appears to have maintained them
separately], and is provisionally retained herein as *Metaphire levis* although it too may
actually belong in synonymy of *A. vittatus*, or as Ohfuchi (1938: 2) thought: a synonym of
the *irregularis* synonym. My current opinion is that, since there is no reliable evidence
that the male pores, when present, are invaginate, it is most likely yet another synonym of
*A. tokioensis* wherewithin it is here included.

*Metaphire servina* (Hatai & Ohfuchi, 1937)

*Pheretima servinus* Hatai & Ohfuchi, 1937: 1. From many localities in NE Honshu. Types?

*Metaphire servina*: Sims & Easton, 1972: 238 (*Metaphire glandularis* species-group);

  Easton, 1981: 59 (but he mistakes the spermathecae as in 6/7/8/9).

Genital markings small, with large glandular masses internally, paired median to male
pores equatorially on 18. Intestinal caeca manicate. Body usually less than 120 mm long.

Distribution: Japan, (mainly northern Honshu).

Remarks: Easton (1981) mistakenly has *Metaphire servina* with three pairs of spermathecae
in 6/7/8/9 while Sims & Easton (1972) place it in a group with only two pairs in 6/7/8 as in
the original description. Ohfuchi (1937: 19) stated that his proposed *Pheretima hataii*
resembled *Pheretima servinus* except for its three pairs of spermathecae as did his *P.
gomejimensis* except for its lack of genital markings on 18. It is thus possible that these taxa
are closely related and that *P. gomejimensis* is synonymous with *M. servina*. Two other taxa
that are possibly related are *A. tappensis* and *A. vittatus*, the latter having nomenclatural priority. This taxon is a new combination in the *M. hilgendorfi* group.

**Metaphire soulensis** (Kobayashi, 1938)


*?Amynthas dageletensis* Hong & Kim 2005: 129. From Korea. *?Syn. nov.*

Distribution: Korea and Japan.

Remarks: Parthenogenetically degraded morphs 50-125 mm long described with adiverticulate spermathecae in 6/7/8 (sometimes lacking?), and (always?) lacking prostate glands and male pores but with genital markings as clusters of two or more papillae on 18 that have corresponding glands internally in the usual position of the male pores. These papillae, when fully formed, are at least partly retractable into the body (hence = *Metaphire*). Intestinal caeca manicate. Specimens have also been found at Kuzuharagaoka Shrine, Kamakura, Japan (several specimens collected 13.vi.2004 by RJB, Amanda Reid and Yuko Hiramoto) that agree superficially although they lack male pores and markings, but have an extra pair of spermathecae in 5/6 (cf. the smaller *P. kamakurensis*).
Easton's (1981: 6) synonymy in *M. yamadai* (Hatai, 1930) of *M. souensis* (Kobayashi, 1938) is not accepted here due to differences in markings around the male pores.

Specimens with or without copulatory pouches are included because an almost continuous series may be thus found: from degraded morphs that only have a few superficial markings on 18 [for example, male sterile morphs such as *Amynthas shinkeiensis* (Kobayashi, 1938) sensu Sims & Easton (1972: 245)], to those with many markings on an invaginated disc on 18 [for example, male sterile morphs such as *Metaphire soulensis* (Kobayashi, 1938) sensu Sims & Easton (1972: 238)]. Kobayashi's (1938: fig. 8) of *P. soulensis* is essentially the same as Ishizuka's (2000e: figs. 9-16) of the holotype of *P. aokii*, and Kobayashi' (1938: fig 9) of *P. shikeiensis* is again similar to Ishizuka's (2000e: figs. 17-18) of a paratype of *P. aokii*. In Ishizuka et al. (2000b: 180) the distribution of *P. aokii* is claimed to include Korea, but this is without obvious justification although, by applying the principal of priority, if it were synonymous with *M. souensis* then the range of this latter taxon would now extend to Japan. In actuality, the biogeographic value of these parthenogenetic events is often open to discussion.

*Metaphire vesiculata* (Goto & Hatai, 1899)

*Perichaeta vesiculata* Goto & Hatai, 1899: 21, figs. 13-15. From Takahashi (Okayama-ken) and Oarai (Ibaraki-ken). Types?

*Pheretima vesiculata* : Michaelsen, 1900: 312.


[?*Pheretima köllikeri* Michaelsen, 1928 : 8, figs. 1, 2 (et *P. koellikeri*). From “Japan”.


Distribution: Japan (and Korea?).

Remarks: Easton (1981: 60) tentatively included *Pheretima vesiculata* Goto & Hatai, 1899 in synonymy of *Pheretima (Parapheretima) koellikeri* (Michaelsen, 1928), but *P. vesiculata* has priority. Sims & Easton (1972: 238) have *Metaphire vesiculata* in a *Metaphire glandularis* species-group [other stated members were *glandularis* (Goto & Hatai, 1899), *levis* (Goto & Hatai, 1899), *servinus* (sic) (Hatai & Ohfuchi, 1937), and *soulensis* (Kobayashi, 1938)]. In this current revision, *Pheretima koellikeri* is removed from synonymy and returned to its probable genus *Metaphire*.

Ishizuka (1999a: 65) has *P. vesiculata* (with spermathecae in 6/7/8) as "syn. n." of *Duplodidodrilus schmardae* (with spermathecae in 7/8/9) although this was already claimed by Beddard (1900a: 619), and Ishizuka (1999b) described *Pheretima okutamaensis* and its synonym *P. biggiberosa* with spermathecae in 6/7/8 and male pores in copulatory pouches (everted during preservation in *biggiberosa*) with secretory diverticula internally. However, no mention of nephridia on the spermathecal ducts was made nor were any shown in figures, therefore these two names are provisionally placed under *Metaphire vesiculata* pending further resolution. Affinities may be with the *M. hilgendorfi* species complex into which this taxon is newly accommodated herein, or possibly with *Metaphire soulensis.*
Metaphire yamadai (Hatai, 1930)

Pheretima yamadai Hatai, 1930b: 664, fig. 8. From Tottori, Okayama, Wakayama, Kobe and Hatta (Ishikawa-ken). Types unknown.


Metaphire yamardai: (sic lapsus pro yamadai) Easton, 1981: 60 (syn. soulensis - but this not accepted here, see M. soulensis below); Blakemore, 2003: 43, addenda.

Diagnosis: Length up to 127 mm (cf. 210 mm pectinifera). Spermathecal pores in 6/7/8/9. Male pores within copulatory pouches occupying 17/18-18/19. Genital markings small, median to spermathecal pores on 7 and 8 and within copulatory pouches (pectenifera has additional markings in several longitudinal ranks median to level of spermathecal pores in 7-9). Intestinal caeca manicate (or the exact quote: "in XXVIII the finger shaped coeca [sic] with five projections are found in pairs"); [Chen (1933:255-261, fig. 21) has "caeca lobulated in 27-24 or 23(22), with parallel lobes or vertically tooth-shaped diverticula" but this was a misdescription according to Gates (1948: 13)].

Distribution: Japan, China, ?Korea (Easton, 1981: 60 states "Japan, China, Korea", but Korea is probably just for his soulensis synonym; whereas Kobayashi (1939) just claims yamadai in Japan and China).

Remarks: Some accounts (erroneously?) have spermathecal pores in 5/6/7/8 despite them being described as in 6/7/8/9. This taxon is a new combination in the M. hilgendorfi species complex. M. yamadai (Hatai, 1930) is almost exactly similar superficially to M. aggera (Kobayashi, 1934) that differs in its simple but incised intestinal caeca (?unless
these were misdiagnosed in *M. yamadai*), and Kobayashi (1938a: 155, 157) says that his *P. aggera* is close to, and may be synonymous with, *Amynthas tschiliensis* (Michaelsen, 1928), its synonym *Metaphire kiangsuensis* (Chen, 1930) from Chen (1933: 250), and with his own *Metaphire quelparta* (Kobayashi, 1937). *M. quelparta* is almost exactly the same in each described character except for its large saccuar bodies associated with the spermathecal pores, but it may belong in synonymy nevertheless. For Chinese *M. yamadai*, Chen (1933: 259, fig. 21) shows variations with the caeca either deeply incised or manicate, but this was a misdescription by Chen of a composite of both Michaelsen's *P. pectenifera* and *P. tschiliensis*.

If *M. yamadai* is misinterpreted and in acutality has incised caeca, then its synonymy may include *M. quelparta* (Kobayashi, 1937), *M. sanseiana* (Hatai, 1951: 56) and the probable syn. nov. of the latter species, *M. indigo* (Hatai, 1951: 58).

Easton's inclusion of *Metaphire soulensis* in synonymy of *M. yamadai* is not supported, as there are notable differences in morphology, especially of the markings around the male pores. Thus, *M. soulensis* is maintained separately and described below with *shinkeiensis* Kobayashi, 1938 and Ishizuka's *P. aokii* included as junior synonyms.

[[End of *Metaphire hilgendorfi / Amynthas tokioensis* species-complex]].

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*Metaphire megascolidioides* (Goto & Hatai, 1899)

*Perichaeta megascolidioides* Goto & Hatai, 1899: 21, fig. 16. From within the compound of the then Central Metereological Observatory (= Metereological Agency), Akasaka,
Tokyo. Types?

*Pheretima megascolidioides* : Michaelsen, 1900: 283; : Ishizuka, 2001: 94, figs, 1-10 (some figures inadvertently inverted).


Distribution: Japan and Korea.

Remarks: Michaelsen (1900) repeated Goto & Hatai’s statement that the intestinal caeca were paired, thus Easton (1981) had them as simple; Ishizuka (2001: 94) figures them as multiple, and inspection of newly collected material confirms this latter condition. These plus five pairs of spermathecae and male pores on 19 are characteristic. The male pores are on the tips of small eversible penes that are usually withdrawn in copulatory pouches (pers. obs.), thereby qualifying this taxon for inclusion in *Metaphire*. It is worrying that the original authors had only a single specimens and could not distinguish its manicate caeca, thus casting into doubt some of their other descriptions. This species is particularly common in parklands around Kamakura, including road-side drains at Kuzuharagaoka Shrine and under rocks inside the grounds of the Kotokuin (Daibutsu) Temple (pers. obs.).

*Metaphire parvula* (Ohfuchi, 1956)


Pheretima mediparvula: Nakamura, 1999: 2 nom. nov. pro Pheretima parvula Ohfuchi (non Goto & Hatai). [Under ICZN (1999: Art. 59.4) a secondary junior homonymy replacement name can be retained as a junior synonym, but see notes below].


Distribution: Japan (Sonai, Iromote-jima, Ryukus).

Remarks: Sims & Easton (1972: 224; 239) have this species in a Metaphire planata (Gates, 1926) species-group and note: Pheretima parvula Ohfuchi, 1956: 152 [non Perichaeta parvula Goto & Hatai, 1898 (= species incertae sedis)], whereas Easton (1981) placed Goto & Hatai’s taxon in unlikely synonymy of Amynthas gracilis. In disregard of all this, Ishizuka (1999a: 63) proposed "Pheretima OHFUCHI, 1956 nom. n." [sic] as a replacement name for Metaphire parvula, but this formulation is invalid (e.g. under ICZN 1999: Art. 11.2). In a later publication, Nakamura (1999b: 2, 28) similarly proposed the unnecessary name "Pheretima mediparvula nom. nov." for Pheretima parvula Ohfuchi, 1956, believing it to be a secondary homonym. Next, Ishizuka (2000c: 76) in a nonsence sentence has “Ph. Ohfuchi” [sic] that is yet possibly a mistake for some other taxon, and later Ishizuka (2001: 101) cites "P. ohbuchii nom. n." [sic] as an invalid nomen nudum and/or nomen dubium which possibly is also supposed to refer to this taxon. Whereas the former editions of the Code had expressly excluded junior synonyms from entering into homonymy (thereby possibly invalidating Ishizuka’s and Nakamura’s actions) these were permitted under ICZN (1999: 59.1, that took effect after 1st January, 2000); however, under ICZN (1999: Art. 59.4) the original Ohfuchi name is reinstated. Further confusion from application of the name “Pheretima parvula” recently proposed
for degraded parthenogenetic morphs by Ishizuka et al. (2000b: 186) is resolved herein by
provision of a new replacement name for them: *Pheretima palarva* Blakemore **nom. nov.**

**Metaphire penguana** (Rosa, 1890)

*Perichaeta penguana* Rosa, 1890:113, figs. 6-8. Type locality Rangoon. Types in Genoa.

*Amyntas penguanus* [sic]: Michaelsen, 1899:7.

*Pheretima penguana*: Michaelsen, 1900: 292; Gates, 1972: 207 (syn. *saigonensis*).

*Pheretima saigonensis* Omodeo, 1957: 327. Type locality Saigon. Types in Verona?


Diagnosis: Spermathecal pores in 6/7/8/9. Male pores within copulatory pouches on
segment 18. Genital markings large paired in segment 17/18 and 18/19. Intestinal caeca
simple.

Distribution: South-east Asia (and Okinawa, Japan?).

Remarks: Gates (1972: 208-209) questions the true identity of the Ryukyu Island's record
for this species by Ohfuchi (1956), although Easton (1981) lists it on the justification that
the correct assignment to a species was not made. It is an unconfirmed Japanese record.

**Metaphire riukiuensis** (Ohfuchi, 1957)

*Pheretima riukiuensis* Ohfuchi, 1957: 248, fig. 21. From Ryukus. Types?


Diagnosis: Spermathecal pores in 5/6/7/8/9. Male pores within copulatory pouches (or
seminal grooves?) occupying 17-19. Genital markings absent. Intestinal caeca simple
with incised margins.

Distribution: Ryukyu Islands.
Remarks: Easton (1981:48, 58) states that it is not certain whether *Metaphire riukiuensis* has male pores in copulatory pouches (= *Metaphire*) or in seminal grooves (= *Amynthas*). Sims & Easton (1972) have this species in a *Metaphire ignobilis* species-group implying their earlier acceptance of the former state.

*Metaphire sieboldi* (Horst, 1883)


*Perichaeta sieboldii* : Rosa, 1891: 401; Horst, 1898; [non *Perichaeta sieboldii* : Goto & Hatai, 1898:65 (= *Metaphire communissima*), ? nec *Perichaeta sieboldi* : Beddard, 1892b: 759 (possibly part of hilgendorfi complex)].

*Perichaeta sieboldi* [sic lapsus]: Michaelsen, 1892: 235.

*Amynatas sieboldi* [sic]: Michaelsen, 1899: 4.


*Pheretima setosa* Cognetti, 1908: 1, fig. 1 [non *Pheretima setosa* Ishizuka et al., 2000b (= *A. corticis*)]. From Tokushima-ken, Shikoku. Types in British Museum: 1908:1.29-31.


Diagnosis: Large blue species (up to 270 mm long by 10 mm wide). Spermathecal pores in 6/7/8/9. Male pores within shallow copulatory pouches on segment 18. Genital
markings absent. Intestinal caeca manicate.

Distribution: Japan.

Remarks: This was the first species formally described from Japan. Sims & Easton (1972: 237) have this species in an *Amythas sieboldi* species-group although its male pores in copulatory pouches qualify it for inclusion in *Metaphire* as per Easton (1981). The diagnosis of the *M. hilgendorfi* complex would encompass this species, yet its distinctive blue colour, at least in matures, serves to separate it. Specimens recently collected by the author from around Kochi, Skikoku where it is common in natural woodlands.

*Metaphire tosaensis* (Ohfuchi, 1938)

*Pheretima tosaensis* Ohfuchi, 1938c: 58, figs. 3-5. From a cave entrance at Tosa. Types?


Distribution: Shikoku, Japan.

Genus *Pheretima* Kinberg, 1867

Type species: *Pheretima montana* Kinberg, 1867: 102 [non Ishizuka, 1999c] from Tahiti.

Taxonomic note: The genus *Amythas* has page priority over *Pheretima* in Kinberg, 1867 (two other of Kinberg’s genera names, *Nitocris* and *Rhodopis*, were preoccupied). However, the prior *Perichaeta* Schmarda, 1861 is still an available name despite disuse after 1899 through its synonymy with *Megascolex* Templeton, 1855 (see Michaelsen, 1900; Sims & Easton, 1972: 175-176; Blakemore, 2002). Reviews by Nakamura (1999b)
and Ishizuka (1999a, 2000c, 2001) should have considered such points before reverting to
the use of *Pheretima* in preference to *Amythas* and/or *Metaphire*.

**Diagnosis:** Pheretimoids with intestinal caeca near 27; male pores in copulatory pouches;
nephridia present on the spermathecal ducts.

**Distribution:** Endemic in the Malaysian sub-region to New Guinea. Japan is not now
considered part of the range (see below); some species peregrine, but not confirmed from
Japan.

**Remarks:** Sims & Easton (1972), allowed only species complying with the characteristics
of the type-species, i.e., having nephridia on the spermathecal ducts, are placed under
*Pheretima*. The generic allocation of degraded morphs lacking spermathecae and/or male
pores cannot easily be determined. Two subgenera are included: Subgenus *Pheretima*
Kinberg, 1867 with type species *Pheretima (Pheretima) montana* (Kinberg, 1867) from
Tahiti; and subgenus *Parapheretima* Cognetti, 1912 with type species *Pheretima*
(*Parapheretima*) *aberrans* (Cognetti, 1911) from New Guinea. These two subgenera are
separated on absence or presence of secretory diverticula on the copulatory pouches, and
are distributed in Indonesia/Malaysia and Borneo/New Guinea, respectively. Synonymy
of *Pheretima (Parapheretima) koellikeri* (Michaelsen, 1928) with *Metaphire vesiculata*
by Easton (1981) and Blakemore (2003) had previously removed this genus from the
Japanese list due to priority, but it is herein restored to *Metaphire* with provisos noted
below.

??*Metaphire koellikeri* (Michaelsen, 1928)

*Fig 6.* of male pore and a spermatheca from Michaelsen (1928: figs. 1, 2).
Pheretima sp. (Köllickeri) (sic - nomen nudum) Michaelsen, 1903: 100.

?Pheretima köllikeri Michaelsen, 1928 : 8, figs. 1, 2 (et P. koellikeri). From “Japan”. Types possibly in Hamburg although collector A. v. Kölliker was from Munich Museum.


Distribution: "Japan", Sims & Easton (1972: 221) thought it possibly introduced.


Remarks: Easton's synonymy of Pheretima koellikeri with Metaphire vesiculata had assumed this species lacked nephridia on the spermathecal ducts (Michaelsen's figure 2 does not show any) and that M. vesiculata lacked them too (but had secretory glands?). However, Goto & Hatai (1899: fig. 15) did not show any such glands for their P. vesiculata and, moreover, a characteristic of Metaphire is having stalked glands, rather than secretory diverticula, on the copulatory pouches (Sims & Easton, 1972: 215, 221).

Sims & Easton (1972: 222) only provisionally placed koellikeri in the subgenus Pheretima (Parapheretima) because Michaelsen (1928:11) had remarked on its similarity to other members that also had secretory diverticula on their copulatory pouches; confirmation of presence of nephridia on the spermathecal diverticula is required for
membership (and Michaelsen's figure, reproduced here does not show them), thus this species is provisionally placed in *Metaphire* but may require allocation to another, possibly new, genus.

**Genus Pithemera** Sims & Easton, 1972

Type species and locality: *Perichaeta bicincta* Perrier, 1875 from the Philippines.

Diagnosis: Pheretimoids with superficial male pores and intestinal caeca paired (sometimes a mid-ventral caecum) in or near segment 22 (rarely 24).

Distribution: Mostly Oceania, the type-species cosmopolitan by introduction.

**Pithemera bicincta** (Perrier, 1875)


*?Perichaeta violacea* Beddard, 1895: 407 (= *Pheretima, Amynthas*). From Penang.

Syntypes (Sims & Easton, 1972: 181) British Museum 1904:10.5.185/187 [Non *Perionyx violaceus* Horst, 1893].

*?Pheretima aimerikiensis* Ohfuchi, 1941: 302, fig. VIII. From Aimeriki, Palao - synoynym as per Blakemore (2003: 43, addenda).


Distribution: Widely distributed species also recorded from Japan (Ryukus).
Genus *Polypheretima* Michaelsen, 1934

Type species: *Perichaeta stelleri* Michaelsen, 1892.

Diagnosis: Pheretimoids with male pores superficial or in copulatory pouches; intestinal caeca absent.

Distribution: Endemic to Vietnam, Malaysia, Indonesia and New Guinea regions; a few species peregrine. With the removal of *Polypheretima iizukai* (Goto & Hatai, 1899) to synonymy of *Amynthas fuscatus*, the genus is no longer considered indigenous to Japan. Sims & Easton (1972: 252) and Easton (1976) established an informal species complex for taxa related to *Metapheretima elongata* (= *Polypheretima elongata*).

*Polypheretima elongata* (Perrier, 1872)


*Perichaeta biserialis* Perrier, 1875: 1044; Beddard, 1889:63, figs. 4, 7; Michaelsen, 1900: 256 (syn. *acystis*, *monocystis*); Ishizuka, 2001: 100 (misspelt "bicerialis"). Types in Paris: 635-644 [despite overlap, both sets of Paris Museum specimen numbers are from Reynolds & Cook (1976)].


*Perichaeta monocystis* Horst, 1899: 202 (lapsus pro acystis Beddard, 1895).

*Amynthas elongata* : Beddard,1900: 650.


*Pheretima aelongata* Gates, 1926: 444 (misspelling or illegal emendation).


Diagnosis: Spermathecal pores absent or multiple in 5/6 or 6/7 or 5/6/7. Male pores in copulatory pouches on 18. Genital markings large, paired in line with male pores on 19-24. Intestinal caeca absent.

Distribution: Indigenous range Java, Bali, and Lombok, but widely distributed in other regions by introduction. For full distributions and synonymy, see Sims & Easton (1972: 252); Easton (1976; 1979); and Blakemore (2002).

Remarks: Gates (1972: 183) remarked that the specimens identified by Ohfuchi (1956: 148) as P. elongata were mistaken and that other specimens referred to P. biserialis by Ohfuchi (1956: 151) were more likely to have been P. elongata. Easton (1981: 61) and Shih et al. (1999: 438) attribute Ohfuchi’s (1956: 148) specimens to Amynthas morrisi.

In ignorance of these misidentifications and of taxonomic protocol, Ishizuka (1999a: 63; 2001: 101) has the prior and valid Perichaeta elongata Perrier, 1872 as “syn. n.” of Pheretima morrisi (Beddard, 1892). This action can be ignored.

Family Glossoscolecidae
[See Blakemore (2002) for family/genus details].

Pontoscolex corethrurus (Müller, 1857)

Lumbricus corethrurus Fritz Müller, 1857: 113. [Type locality Itajahy, Brazil. Types not located]. [Note: date and page sometimes miscited as "1856: 26"].

Urochaeta hystrix Perrier, 1872: 142.

Urochaeta corethrura: Perrier, 1874: 379.
**Pontoscolex arenicola** Schmarda, 1861: 11 (part, type), fig. 157 (http://biodiversity.uno.edu/~worms/docs/schmarda.html); Beddard, 1892: 126, figs. 3 and 6. [Note: Schmarda (1861) confused two species under the same name without giving a type specimen although his figure (fig. 157) was the same as the specimen that Beddard (1892: 126, figs. 3, 6) separated as *Pontoscolex arenicola* (= *Pontoscolex corethrurus*), the other he named *Diachaeta littoralis* Beddard, 1892. From tidal beaches Port Royal, Jamaica; "arenicola" or "harenicola" translates as "sand or beach-loving or dwelling". Types in Vienna Museum.

**Urochaeta dubia** Horst,1885: 7. [Type locality Sumatra].

**Urochaeta, sp.** Beddard, 1887:160, Pl V, figs. 4-9 (= *P. corethrurus*), [From Queensland].

**Urochaeta australiensis** Beddard, 1891: 278.


**Pontoscolex corethrurus mexicana** Eisen, 1896: 8.


**Diagnosis:** Body pigmentless; clitellum pale or yellow saddle shaped in 15-22,23. Setae 8 per segment; in the posterior part of the body in quincunx (alternating regularly from segment to segment). Three pairs of calciﬁerous glands visible through the cuticle in front of clitellum. Prostomium forms "proboscis". Spermathecal pores at 6/7-8/9. Female and male pores difﬁcult to locate (in 14/15 and 19/20 or 20/21, respectively). [Full description in Blakemore (2002)].
**Distribution**: Pan-tropical; supposedly "the most widely distributed earthworm" (Gates, 1972: 55); classed as geophagous, endogeic, eurytopic (and euryhaline?); its common occurrence in coastal areas suggests marine transportation (by drifting?), its close association with rivers also indicates a possible mechanism of transportation (of cocoons). Human mediated transportation is probably also important. Full distribution is given in Blakemore (2002). Japanese records are from Yona, northern Okinawa, (collected by R.J.B on 20.xi.2005 from soil by drain in *Castanopsis sieboldii* forested hills above Ryukyu Univeristy Forestry Research Centre). **New record for Okinawa/Japan** [not known from mainland Japan although Nakamura (1994) reports it from Ogasawara (= Bonin Islands)].

**Species incertae sedis** i.e., species names “of uncertain taxonomic position” - ICZN (1999: 106, Glossary).

Most parthenogenetically degraded morphs, precipitously given species names that remain available pending synonymy or unification with their biparental/ancestral forms.

*Amyntas hibernus* (Ishizuka, 1999)


Diagnosis: Monotypic; based on a single degraded morph with defective spermathecae in 7/8/9; superficial male pores; genital markings absent; prostate glands absent; and intestinal caeca simple.

Remarks: The male organs and spermathecae would presumably differ in ‘normal’ amphimixic specimens and this degraded morph is possibly merely part of the inadequately described *A. imperfectus* which itself may actually comprise more than one taxon.
Amynthas illotus species-group sensu Sims & Easton (1972).

Amynthas illotus species-group Sims & Easton, 1972: 236 [included names: ambiguus (Cognetti, 1906: 782) (non Cognetti, 1913); assacceus (Chen, 1938); illotus (Gates, 1932); irregularis (Goto & Hatai, 1899); pusillus (Ohfuchi, 1956) (non Ude, 1893); sheni (Chen, 1935); Metaphire varians (Chen, 1938) (part, non type – other components of this hodge-podge had spermathecal pores in 5/6, or 5/6/7)]; Easton, 1981: 53 [included Japanese names: illota: Ohfuchi, 1956, (non Gates, 1932); pusilla Ohfuchi, 1956 (non Ude, 1893); oyuensis Ohfuchi, 1937].

Diagnosis: Spermathecal pores absent (at least in designated holotypes?) i.e., thecate parthenogenetic morphs. Male pores superficial (?or absent). Intestinal caeca simple. Gates’s original two illotus specimens were 150-160 by 5-6 mm size with 120 segments. Ohfuchi’s specimens were 125-155 mm with 125-144 segments; A. assacceus is in the size range 30-80 mm long; and ‘Pheretima’ oyuensis is perhaps smaller, about 50-55 mm with 75-93 segments.

Remarks: In anticipation of synonymy with thecate species once additional data become available, Easton (1981: 53) maintained these degraded morphs under an Amynthas illotus species-group, rather than listing them partly as incertae sedis as per Sims & Easton (1972: 223) and as listed herein. For convenience, Easton’s list had three Japanese ‘species’: Amynthas ‘illotus’ sensu Ohfuchi (1956:136) (non Gates, 1932: 397); A. pusillus (Ohfuchi, 1956) [now placed in synonymy with Amynthas assacceus (Chen, 1938)]; and ‘Pheretima’ oyuensis Ohfuchi, 1957; to which we can add yet other unresolved degraded morphs named Pheretima imperfecta by Ishizuka (1999d). Remaining members of the A. illotus species-group from other than Japanese reports are Amynthas assacceus (syn. pusillus: Ohfuchi, 1956, ?proasacceus Tsai et al., 2001); A. catenus Tsai et al., 2001 from Taiwan; A.
hohuanmontis Tsai et al., 2002 from Taiwan; and A. sheni (Chen, 1935) from Hong Kong (but cf. A. corticis or A. robustus).

Amynthas illotus species-group included species names reported from Japan:-

Amynthas assacceus (Chen, 1938)

Pheretima assacceus Chen, 1938: 382. From Hainan Island. Types?


Amynthas assacceus [sic, lapsus]: Tsai et al., 2001: 284 [syn. pusilla Ohfuchi, 1956 (non Ude)].

Pheretima medipusilla Nakamura, 1999b: 2 nom. nov. pro Pheretima pusilla Ohfuchi, 1956: 138 [non Perichaeta pusilla Ude, 1893 (= Amynthas minimus)]. [Nakamura (1999b:2) had proposed the then unnecessary replacement name Pheretima medipusilla for Ohfuchi’s name and, although in former editions of the Code junior synonyms had been expressly excluded from entering into homonymy, under ICZN (1999: Arts. 59.1; 60.3) which came into effect on 1st January, 2000, replacement of a secondary junior homonym without known synonyms is accepted as a valid nomenclatural act, albeit Tsai et al. (2001: 284; 2002) later found a synonym. Thus, if Nakamura’s pusilla belongs in Amynthas whence Ude’s pusilla resides, then for a brief period Nakamura’s replacement name perhaps was valid and so it remains available (ICZN, 1999: Art. 10.6)]. From Iriomote-jima, Sakishima, Ryukyus. Type unknown.

?Amynthas proasacceus Tsai et al., 2001: 282 [sic]. From Taiwan.

Diagnosis of Amynthas assacceus: Morphs variously degraded parthenogenetically; either lacking spermathecae (types), or having them intermittently in some or all of 6-8; male
pores superficial on large flat porophores on 18, or aborted; intestinal caeca simple. Size range, ca. 30-80 mm long (cf. *A. minimus*).

Distribution: Hainan, Taiwan, Ryukyus.

Remarks: Nakamura (1999b: 2, 20) proposed the replacement name "*Pheretima medipusilla*" for the name cited in Easton (1981: 54) as *Amynthas pusillus* (Ohfuchi, 1956), while Ishizuka (2000c; 2001) appears to have completely overlooked the conflicts in these names. The specimens described as *A. proasacceus* were thought by Tsai *et al.* (2001: 285) to be closely related to the ancestral forms of *A. assacceus* and are consequently placed in provisional synonymy of this prior taxon which, nevertheless, retains its *incertae sedis* status, at least in the Japanese fauna. A possibly similar taxon is *Perichaeta parvula* Goto & Hatai, 1898 from Kamakura described on a specimen that was small (32 mm) with adiverticulate spermathecae in 6-8 and that lacked male pores and genital markings.

*Amyntas illotus* (Gates, 1932).


From Ishigaki and Iriomote Islands (Ibaruma, Hatoma-jima, Hoshidate)).


Remarks: The diagnosis of *Amyntas illotus* (Gates, 1932: 397) was restricted by Gates (1972: 196) to exclude the Japanese specimens identified by Ohfuchi (1956), but no alternative was provided, and Easton (1981) believed that a new name was not warranted for
these parthenogenetically degraded morphs. Gates (1972: 196) also surmized that his subsequent *Amynthas youngi* (Gates, 1932: 406) (with types either lost or in Calcutta Museum: 3077) may be one possible candidate for his species’s H morph, although information was lacking for confirmation of this. Tsai et al. (2002) give distribution of *A. illotus* as Yunnan (China) and Ishigaki Island, apparently accepting Ohfuchi’s records, even though the diagnosis of these latter specimens differed considerably from Gates’s original. Thus it is an unlikely Japanese record.

*Amynthas imperfectus* (Ishizuka, 1999)


Remarks: Described as either lacking spermathecae (holotype?), or having them adiverticulate in 5/6 (one side), or 7/8 (one side); genital markings absent; caeca simple; size range 49-92 mm. The condition in the holotype is not explicitly stated and this name may be a ‘grab bag’ of degraded morphs of more than one unresolved species. Parts are possibly in synonymy with ‘*Pheretima’ ouyensis’ if, as Ishizuka states, they are distinguishable from this by the presence of male pores and occasional spermathecal pores (see also *A. hibernus, A. minimus, P. ouyensis, P. palarva*).

[?*Metaphire varians* (Chen, 1938).

*Pheretima (Pheretima) varians* Chen, 1938: 385. From Hainan. Types?

*Amynthas variens* (sic lapsus pro *varians*): Sims & Easton, 1972: 236.

Remarks: Male pores, spermathecae and genital markings sometimes absent. Athecal (?not primary type) components are unlikely to be in the *A. illotus* species-group; other components had spermathecal pores in 5/6, or 5/6/7. Described as 15-130 mm by 1-4mm
with 78-148 segments. Setae 20-100, always present on first segment. GMs numerous papillae in pre- and post-setal rows on 15,16-18 and 6,7-8,9; or only two large ones presentally on 17 in line with male porophores; or totally absent. Male pores (when present) on penes that are presumably retractable into copulatory pouches (hence Metaphire). Possibly a hodge-podge of degraded morphs for more that one species but unusual in all having setae on first segment, perhaps providing a means to identify the various components. From Hainan, NOT known from Japan but degraded morphs are possible to confuse with it.

‘Pheretima’ oyuensis Ohfuchi, 1937.


_Pheretima cyuensis_ (sic, laps. pro _oyuensis_): Sims & Easton, 1972: 225.


Remarks: Sims & Easton (1972: 225) have as _incerta sedis_ this degraded morph of an unknown species originally described as lacking spermathecae, genital markings, male pores, and prostates. The original description was based on two specimens that measured 50 and 55 mm and that had simple caeca and may thus be similar to _A. minimus_ or possibly implicated in a species group not dissimilar to that involving _A. assacceus_ (Chen, 1938). From Akita, northern Honshu, Japan.

[End of _Amynthas illotus_ species-group].

_Amynthas octo_ (Ishizuka, 2000).


Diagnosis: Size 70-100 mm; adverticulate spermathecae in 5/6/7/8/9; male pores
superficial; genital markings combined with male pores; prostate glands present; intestinal caeca simple.

Remarks: Degraded morphs with defective spermathecae (no diverticula) perhaps similar to *A. stipatus* (cf. *Amynthas corticis*).

*Amynthas stipatus* (Ishizuka, 1999).


Diagnosis: Spermathecae addiverticulate in 6/7/8/9; male pores superficial; genital markings stated to be absent but actually appear in figures just before and after male pores and almost combine just medially to each of them (possibly interpretable as 'bean-shaped'); prostate glands "often absent" (holotype?); intestinal caeca simple.

Remarks: Ancestral populations expected to have complete prostates and spermathecae. Similar to *A. phaselus* but spermathecal pores said to be in 6/7/8/9 rather than 5/6/7/8.

*Amynthas tamaensis* (Ishizuka, 1999).


Diagnosis: Spermathecae addiverticulate in 6/7/8; male pores, if present superficial (at least in type); genital markings absent, or in some of 17/18/19 median to male pore line; prostate glands absent (always?); intestinal caeca simple. Size: 60-90 mm.

Remarks: Ancestral populations expected to have complete prostates and spermathecae. Possibly synonymous with *Amynthas micronarius*. Alternatively if male pores were
non-superficial, then it would belong in *Metaphire*.


*Pheretima parvula* Ishizuka et al., 2000b: 186, figs. 17-24 (description, figure legends and scale bars are contradictory, confused, and intermixed). [Non *Perichata parvula* Goto & Hatai, 1898 (?= *Amynthas gracilis*); nec *Pheretima parvula* Ohfuchi, 1956 (= *Metaphire parvula*)]. [Note: this name mis-cited and misspelt as ‘*Pheretima parvola* Ishizuka, 2000’ by Ishizuka (2001: 12, 69, 102) and “*P. parvora*” by Ishizuka (2001: 46)]. From The Imperial Palace, Tokyo, the types are stated to be in National Science Museum, Tokyo (Holotype NSMT -An 340, two paratypes An341).

Remarks: The replacement name, *P. palarva*, was provided for this junior (secondary and primary) homonym under ICZN (1999: Arts. 53.3, 57.2, 60.3, 67.8, 72.7) to provide a public and permanent record for replacement of a primary homonym. Ishizuka’s (2001) subsequent misspellings or *lapsus calami* are not valid substitute names. Ishizuka et al. (2000b) originally applied this name to variously degraded morphs (lacking spermathecal diverticula, genital markings, prostate glands and, sometimes, the male pores) of some as yet undetermined taxonomic affinities. The spermathecal pores were described in 6/7/8 “and occasionally absent, variable in number”, with the “duct occasionally absent; diverticulum absent”. The caeca are simple and it is possible that these small specimens (46-62 mm) are in the same synonymy as would be *P. oyuensis*, but Ishizuka et al. (2000b: 188) confuse the number of spermathecae present in the comparison with this taxon; or they may belong in the same synonymy as *Amynthas imperfectus* (Ishizuka, 1999). In comparison, *Metaphire parvula* (Ohfuchi, 1956) also has spermathecae in 6/7/8 and lacks genital markings but has male pores in copulatory pouches unlike those of *P. palarva* that appear to be superficial.
(when present). Because the states of the male pores and spermathecal ducts in the holotype are not explicitly stated, this taxon is retained as *incertae sedis*. No nephridia were described on the nephridial ducts, a prerequisite for *Pheretima*, thus this dubious taxon is perhaps better described as "*Amynthas? palavarus*".

Of equal concern is Ishizuka's (2001: 46, Tab. 3-39) claim for detailed ecological/life-cycle study over six summer months for this 'species' that is however unsupported by the original description in Ishizuka *et al.* (2000: 186; 194 Tab. 2) where (66 or 68??) specimens were collected on only four different days in July and August, 1996/7.

**Conclusions and Discussion**

The present review is an attempt to define the status quo of the species and to establish some nomenclatural stability. It is also cautionary in that taxonomic progress can only be made by resolving, as far as possible, the inherited conflicts in species descriptions. Adding names to the list without such foundations is counterproductive, but unfortunately this seems an accepted practice in some reports, and not just those from Japan; where possible these names have been reallocated as appropriate herein.

The taxonomic problems of the *Metaphire hilgendorfi* species-complex imposed by its parthenogenetic polymorphism have been reviewed and a partial solution, involving separation of those taxa with affinities to *Amynthas tokioensis* into a new species-group, has been proposed. Full resolution perhaps involves molecular analysis of types, comparison with the variability of field material, and classification using Gates’ codes for parthenogenetic morphs.

Understanding the earthworm diversity of any Oriental region requires
consideration of the species recorded from adjacent countries as distributions often overlap borders. The current review of Japanese earthworms provisionally lists only about 80 valid species belonging to 7 families, retaining most synonymies established by Easton (1981) and revising more recently erected taxa so that there are approximately an equal number of synonymous or uncertain names (i.e., ca. 80 species names or 50%). Of the putatively valid species, about 30 are known introductions and another 10-12 are possibly introduced species or have wider distributions, thus the probably number of wholly endemic taxa is approximately 38-40 species (ca. 50%). This diversity compares with approximately 41 species from Taiwan (with 18 native taxa); 105 from mainland China (82 native); 45 species from Korea (27 native, but other natives recently added); and 19 species from the historical region of Northeast China called Manchuria (5 native) [these totals from Tsai et al. (2000; 2001) who also give historical accounts and biogeographical notes for these regions]. Gates (1972) described about 174 mainly pheretimoid species from Myanmar (Burma) with much information of their relationships to other Oriental faunas. In contrast, the British Isles of similar size to Japan have only 48 taxa comprising species that are unlikely to be entirely endemic having colonized after the last ice age, and many of which are also recorded as common exotics elsewhere (Sims & Gerard, 1985; 1999). Approximately 160 species are known from North America that was also widely glaciated; ca. 350 species are reported from India; 193 species (170 native) from New Zealand that, like Japan, has recent volcanic activity; ca. 430 (with ca. 350 native) from Australian mainland; and 230 (with ca. 200 native) from Tasmania – all these species counts are from Blakemore (1999; 2000; 2002). These totals of the distribution and diversity of taxa within a particular region are sometimes merely indicative of the extent of the taxonomic effort there; yet, once the species
identifications are determined and the taxonomic tangles resolved, useful information can be extracted for the benefit of ecologists, environmental managers, and other interested researchers. Of particular interest is the influence of human migrations and commerce on the distribution of the cosmopolitan and peregrine species (see Blakemore, 2002), and the effect of these on the native faunas.

Continued revision of Oriental earthworms involving mining museum collections, directed field survey to resample missing types, objective analysis of molecular (DNA or RNA) sequences, and Gatesian codification for degraded morphs, would involve considerably greater allocation of funds and personnel resources than are presently available; however, modest studies along these lines have commenced and one anticipated product is an interactive computer guide to Japanese earthworms.

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References cited

[For earlier taxonomic references, see Michaelsen (1900), Stephenson (1930), Sims & Easton (1972), Easton (1981), or Sims & Gerard (1985; 1999).]
A valuable website resource with much information and images of Kyushu earthworms by Yasuaki Sugi is here - http://www.geocities.jp/homantaro/index.htm.


Beddard, F. E. (1892b). On some *Perichaetidae* from Japan. Zool. Jb. (Syst.) 6: 755-766. [Published December, 1892 according to Michaelsen (1900)].


http://www.nrel.colostate.edu/IBOY/australia_ap.html#earthworms


Blakemore, R.J., M.T. Ito & N. Kaneko (2007). Alien earthworms in the Asia/Pacific region with a checklist of species and the first records of *Eukerria saltensis* (Oligochaeta : Ocnerodrilidae) and *Eiseniella tetraedra* (Lumbricidae) from


Kobayashi, S. (1940). Terrestrial Oligochaeta from Manchoukou. Sci. Rep. Tohoku Imp.Univ. 15: 261-316. [This publication is sometimes dated "1941" and Numbered as "16", I have not seen the original, but I think the former is correct in both cases, as here. Note: Reynolds & Cook (1976) overlook this reference].


Michaelsen, W. (1892). Terricolen der Berliner Zoologischen Sammlung, II. Arch. Naturgesc. 58: 209-261. [Published September, 1892 according to Michaelsen (1900)].


(Megascolecidae: Oligochaeta) of the World. Edaphologia 64: 1-78. [In English, published December 20, 1999].


Table 1. Summary characters of the *Pheretima* group of genera (after Easton, 1982).

<table>
<thead>
<tr>
<th>Genus</th>
<th>Testes segments</th>
<th>Intestinal caeca origin</th>
<th>Male pores *</th>
<th>Nephridia on spermathecae*</th>
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</thead>
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<tr>
<td><em>Amynthas</em></td>
<td>10+11, 10 or 11</td>
<td>25,26-28</td>
<td>Superficial</td>
<td>No/Yes</td>
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<tr>
<td><em>Begemius</em></td>
<td>11 only</td>
<td>25,26</td>
<td>Superficial</td>
<td>No</td>
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<tr>
<td><em>Metapheretima</em></td>
<td>10+11, 10 or 11</td>
<td>Absent</td>
<td>Superficial or Pouched</td>
<td>Yes</td>
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<tr>
<td><em>Metaphire</em></td>
<td>10+11, 10 or 11</td>
<td>27</td>
<td>Pouched</td>
<td>No</td>
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<tr>
<td><em>Pheretima</em></td>
<td>10+11</td>
<td>27</td>
<td>Pouched</td>
<td>Yes</td>
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<tr>
<td><em>Pithemera</em></td>
<td>10+11, 11</td>
<td>22-24</td>
<td>Superficial</td>
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<tr>
<td><em>Polypheretima</em></td>
<td>10+11 or 11</td>
<td>Absent</td>
<td>Superficial or Pouched</td>
<td>No</td>
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</tbody>
</table>

*Specimens lacking male pores and/or spermathecae cannot easily be accommodated.

Crescentic marks around the male pores (which characterize *Begemius*, *Metapheretima* and occur in several species of some other genera) are not found in *Polypheretima*. In *Polypheretima* the spermathecae may also be multiple, i.e., polythecal as in some species of *Amynthas*, *Metapheretima*, and *Metaphire*, or aborted; when present, the diverticula are simple (cf. multilocular in *Archipheretima*).
Table 2. Page references for taxa mentioned in Ishizuka's 2001 summary.

<table>
<thead>
<tr>
<th>Species name (all &quot;Pheretima&quot;)*</th>
<th>Claimed Author*</th>
<th>Page</th>
<th>Notes</th>
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<tr>
<td>conjugata</td>
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*Spermathecae miscounted.
*Non Cognetti, 1913. Fig. 1 segments miscounted? Figure legends incorrect.
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Illegitimate names.
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*Many of these are incorrect citations. Total number of taxa claimed - 68; total number claimed authorship by Ishizuka - 52 (or 77%).

[End of Japanese Earthworms text].
Fig. 1 Biwadrilus bathybates (original figure RJB).
Fig. 2 Amyntas carnosus (Goto & Hatai, 1889)

top Goto & Hatai original Fig. 4; bottom Ishimura Kobayashi, 1934

Fig. 2
Fig. 3 Amynthas micronarius (Goto & Hatai, 1898). Sketch of a Watarase specimen.
Fig. 3.1 *Amyntas agrestis* (Goto & Hatai, 1899). Sketches of two specimens from Ami, Ibaraki-ken (collected by author, August, 2006), plus original text-figure of a spermatheca.
Fig 4.1 Fig 4.2 M. schmardae, eversible male pores and intromittent organs and manicate (or multiple) intestinal caeca (after Hatai & Ohfuchi, 1936, for their P. kikuchii synonym).
Fig. 5. *Amynthas agrestis* compared with *M. hilgendorfi* from Hatai (1930; figs. 1-3).
Fig. 5.1 *Amynthas tokioensis* (Beddard, 1892). Sketch of previously dissected type specimen.
Fig. 5.2 *Amynhas tokioensis* (Beddard, 1892). Sketch of internal arrangement of spermathecal and male field of type (not to scale). X - site of previously removed genital gland, spermatheca, and prostate gland. (Spermatheca in 8lhs was loose in the jar).
Fig. 4.3 Amyntas tokioensis.
Top from Goto & Hatai (1889); Bottom, spermatheca from Ishizuka (2001: 61) "P. irregularis (Goto & Hatai, 1899)," but it is actually A. tokioensis.
Fig 6 P. koellikeri figure of male pore and a spermatheca from Michaelsen (1928: figs.
Fig. 7 *Metaphire hataii* (Ohfuchi, 1937). Based on original figures.