

Japanese earthworms (Annelida: Oligochaeta): a review and checklist of species

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Abstract

The current revision provisionally lists 77 valid earthworm taxa in seven families from Japan, with approximately 80 further names (ca. 50% of the total) either in synonymy or retained as *species incertae sedis*. About 30 species are known introductions 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). However, a definitive work on the systematics of Japan's earthworms is pending and the current revision aims only to provide a *status quo* and to track changes from the last comprehensive revision by Easton (1981) that listed 74 taxa. Subsequently, 60 or so new pheretimoid names were added by Ishizuka in 1999-2001, but only a few are considered valid taxa with the remainder being synonyms or *species incertae sedis*. The substitute name '*Pheretima palarva* Blakemore **nom. nov.**' is provided for one of Ishizuka's junior homonyms (*Pheretima parvula*).

While much of Easton's synopsis is supported, *Pontodrilus* is now placed in Megascolecidae sensu Blakemore (2000) rather than Acanthodrilidae sensu Gates (1959); *Amyntas carnosus* (Goto & Hatai, 1899) is removed from synonymy of *Amyntas gracilis*; and an informal *Amyntas corticis* species-complex is established to accommodate the various morphs of this widely distributed species group. *Pheretima* (*Parapheretima*) *koellikeri* Michaelsen, 1928 is herein considered synonymous with the prior *Metaphire vesiculata* (Goto & Hatai, 1899), thereby removing the genus *Pheretima* sensu stricto from the Japanese list. *Polypheretima* is also removed from Japanese indigeneity as the original description of *Polypheretima iizukai* (Goto & Hatai, 1899) failed to report intestinal caeca and inspection of fresh material allows its placement in synonymy of *Amyntas fuscatus* (Goto & Hatai, 1898). Easton (1981) had listed this taxon as *Metaphire fuscata* but further demonstration of superficial male pores qualify it for *Amyntas*. Conversely, presence of copulatory pouches make *Metaphire hilgendorfi* (Michaelsen, 1892), *Metaphire communissima* (Goto & Hatai, 1898), and *Metaphire megascolidioides* (Goto & Hatai, 1899) new combinations by transfer from *Amyntas*. The *Metaphire hilgendorfi* / *Amyntas tokioensis* species-complex (*Amyntas hilgendorfi* species-complex sensu Easton 1981) remains one of the most intractable and pressing problems for comprehension of the Japanese fauna as most of the component taxa, e.g. *Metaphire agrestis* (Goto & Hatai, 1899), are parthenogenetically degraded morphs as yet unaffiliated with their ancestral and biparental populations. Resolution may be sought employing combinations of morphological and molecular (RNA, DNA) techniques to determine specific affinities while also complying with requirements of the International Code of Zoological Nomenclature (ICZN 1999).

Key words: taxonomy, *Pheretima*, *Metaphire hilgendorfi* / *Amyntas tokioensis*, *A. corticis* species-complex, parthenogenetic polymorphism

Introduction

Taxonomic background. Despite recent revisions (Easton 1981; Ishizuka 1999a, 2000c 2001), 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., see also below) 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 Code of zoological nomenclature (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. 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 1900b: "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. 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 have 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 adjacent to Japan.

Oriental earthworm faunas tend to be dominated by megascolecoid 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 meroic nephridia. Comprehensive reports of pheretimoid taxa have been presented by Michaelsen (1900b) who listed all 167 species then known, and 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. Those Japanese pheretimoids revisited in the paper by Nakamura (1999b, published on 20 December) were preceded and anteceded with reviews by Ishizuka (1999a, published on 27 February; 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 Binominal Nomenclature (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.

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-lobed]).
3. Modification of caeca in segment 27 (simple or complex).

These caecal states condense 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").

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 names 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. in the original description of *Perichaeta iizukai* Goto & Hatai, 1899 (see below) and in some synonyms of *Amyntas minimus* (see Sims & Easton 1972: 224). Moreover, for lobate/serrate caeca, 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". 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, moreover, the North American genus *Toutellus* Fender & McKey-Fender, 1990 has several pairs of intestinal caeca in series.

Parthenogenetic polymorphism. Current field studies support literature reports of a high frequency of polymorphism in Japanese 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,

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

Genus	Testes segments	Intestinal caeca origin	Male pores *	Nephridia on spermathecae*
<i>Amyntas</i>	10+11, 10 or 11	25, 26-28	superficial	no/yes
<i>Begemius</i>	11 only	25	superficial	no
<i>Metaphire</i>	10+11, 10 or 11	27	pouched	no
<i>Pheretima</i>	10+11	27	pouched	yes
<i>Pithemera</i>	10+11 or 11	22-24	superficial	no
<i>Polypheretima</i>	10+11 or 11	absent	superficial or pouched	no

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

Crescentic marks around the male pores (which characterize *Begemius* 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 *Amyntas*, *Metapheretima* and *Metaphire*, or aborted; when present, the diverticula are simple (cf. multilocular in *Archipheretima*).

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.

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 spermathecae, 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 detailed by Blakemore (2000, 2002).

Japanese studies on variability of genital structures, reproductive processes and breeding habits for parts of the *Metaphire hilgendorfi* / *Amyntas 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 (currently ICZN 1999) 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). However, 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 if based on morphs or parthenogenetic forms (ICZN 1999: Art. 17.3), it is preferable these 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 Japan in 2001/2002 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 (1900b), 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. Blakemore 2000, 2002).

Systematics results – taxonomy and checklist of Japanese earthworms

- * = exotic/introduced
- = native/endemic
- # = uncertain affinities
- syn. = synonyms (not all syn. given for common exotics, as they may be readily found elsewhere).

Family Moniligastridae

- #1. *Drawida hattamimizu* Hatai, 1930.
- *2. *Drawida japonica* (Michaelsen, 1892) (syn. *grahami*).
- #3. *Drawida keikiensis* Kobayashi, 1938.
- #4. *Drawida koreana* Kobayashi, 1938.
- 5. *Drawida moriokaensis* Ohfuchi, 1938.
- #6. *Drawida nemora* Kobayashi, 1936.
- 7. *Drawida ofunatoensis* Ohfuchi, 1938.
- 8. *Drawida tairaensis* Ohfuchi, 1938.

Family Biwadrilidae

- 9. *Biwadrilus bathybates* (Stephenson, 1917) (syn. *miyashitai*).

Family Lumbricidae

- *10. *Allolobophora parva* Eisen, 1874.
Aporrectodea caliginosa species-group sensu Blakemore (2002). Included species reported from Japan:
 *11. *Aporrectodea caliginosa* (Savigny, 1826).
 *12. *Aporrectodea trapezoides* (Dugès, 1828).
 *13. *Aporrectodea tuberculata* (Eisen, 1874).
 *14. *Aporrectodea rosea* (Savigny, 1826).
 *15. *Dendrobaena octaedra* (Savigny, 1826).
Dendrodrilus rubidus species-complex sensu Blakemore (2002). Included subspecies reported from Japan:
 *16. *Dendrodrilus rubidus rubidus* (Savigny, 1826).
 *17. *Dendrodrilus rubidus tenuis* (Eisen, 1874).
Eisenia fetida species-complex sensu Blakemore (2002). Included species reported from Japan:
 *18. *Eisenia andrei* Bouché, 1963.
 *19. *Eisenia fetida* (Savigny, 1826).
 #20. *Eisenia japonica* (Michaelsen, 1891) (syn. *japonica gigantica*, *japonica minuta*).

Family Ocnerodrilidae

- *21. *Ocnerodrilus occidentalis* Eisen, 1878.

Family Acanthodrilidae

- *22. *Microscolex phosphoreus* (Dugès, 1837).

Family Octochaetidae

- *23. *Dichogaster bolau* (Michaelsen, 1891).
 *24. *Dichogaster saliens* (Beddard, 1893) (syn. *hatomaana*).

Family Megascolecidae sensu Blakemore (2000)

- #25. *Pontodrilus litoralis* (Grube, 1855) (syn. *marrionis*, *matsushimensis*).
 *26. *Perionyx excavatus* Perrier, 1872 (syn. *gruenewaldi*, *fulvus*, *?koboensis*, *?turaensis*).
 #27. *Amyntas acinctus* (Goto & Hatai, 1899) (syn. *?phaselus*; *?maculosus* Hatai, 1930 [non Gates, 1933 (= *malaca* Gates, 1936)]; *?kamitai*; *?phaselus tamurai*).
 #28. *Amyntas carnosus* (Goto & Hatai, 1899).
 -29. *Amyntas conformis* (Ishizuka, 2000). **comb. nov.**

Amyntas corticis species-complex.

Included species from Japan:

- *30. *Amyntas corticis* (Kinberg, 1867) (syn. *diffringens*; *?sanctaealena*; *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*; *?homoseta*; *?mori*; *toriii*; *clerica*; *campestris* Lee, 1952 [non Goto and Hatai, 1898]; *?hatomajimensis*; *imajimai* **syn. nov.**; *confusa* **syn. nov.**; *nipparensis* **syn. nov.**; *subrotunda* **syn. nov.**; *rufidula* **syn. nov.**; *silvestris* Ishizuka, 1999 **syn. nov.** [non Michaelsen, 1923]; *semilunaris* **syn. nov.**; *fulva* **syn. nov.**; *subterranea* **syn. nov.**; *subalpina* **syn. nov.**; *mutabilis* **syn. nov.**; *nubicola* **syn. nov.**; *hinoharensis* **syn. nov.**; *umbrosa* **syn. nov.**; *invisa* Ishizuka, 2000 **syn. nov.** [non Cognetti, 1913]; *monticola* Ishizuka, 2000 **syn. nov.** [non Beddard, 1912]; *nigella* **syn. nov.**; *?setosa* Ishizuka et al., 2000 **syn. nov.** [non Cognetti, 1908]].
 -31. *Amyntas distichus* (Ishizuka, 2000). **comb. nov.**
 -32. *Amyntas ellipticus* (Ishizuka, 1999). **comb. nov.**
 -33. *Amyntas flavescens* (Goto & Hatai, 1898) (syn. *producta*; *houletti* *bidenryoana*; *leucocirca*: Ohfuchi, 1956 [?non Chen, 1933]; *noharuzakiensis*).
 -34. *Amyntas fuscatus* (Goto & Hatai, 1898) (syn. *grossa*; *iizukai* **syn. nov.**; *montana* Ishizuka, 1999 **syn. nov.** [non Kinberg, 1867]; *atrurubens* **syn. nov.**; *alpestris* **syn. nov.**; *dura* **syn. nov.**; *turgida* **syn. nov.**; *argentea* **syn. nov.**; *?flavida* **syn. nov.**; *?lactea* **syn. nov.**; *?mitakensis* **syn. nov.**).
 #35. *Amyntas glabrus* (Gates, 1932) (syn. *tenellula*; *vieta*; *papilio*: Ohfuchi, 1956 [?non Gates, 1930]).
 *36. *Amyntas gracilis* (Kinberg, 1867) (syn. *hawayana*; *bermudensis*; *mandhorensis*; *?mauritanica*; *?kamakurensis*; *?parvula* Goto & Hatai, 1898 [non Ohfuchi, 1956; nec Ishizuka et al., 2000]; *?decimpapillata*; *?kagoshimensis*; *autumnalis* **syn. nov.**).
 -37. *Amyntas habereri* (Cognetti, 1906).
 *38. *Amyntas hupeiensis* (Michaelsen, 1895) (syn. *?hypogaea* **syn. nov.**; *?edoensis* **syn. nov.**).
 -39. *Amyntas japonicus* (Horst, 1883).

- 40. *Amyntas kunigamiensis* (Ishizuka & Azama, 2000). **comb. nov.**
- 41. *Amyntas micronarius* (Goto & Hatai, 1898) (syn. *?shimaensis*; *?yamizoyamensis*; *?obtusa*).
- *42. *Amyntas minimus* (Horst, 1893) (syn. *pusilla* Ude, 1893 [non Ohfuchi, 1956]; *enchytraeoides*; *zoysiae*; *?fungina*; *?muta*; *ishikawai*; *humilis*).
- *43. *Amyntas morrissi* (Beddard, 1892) (syn. *barbadensis*; *?pallida*; *hawayana lineata*; *exiloides*: Ohfuchi, 1956 [non Chen, 1936]; *elongata*: Ohfuchi, 1956 [non Perrier, 1872]).
- 44. *Amyntas obscurus* (Goto & Hatai, 1898) [non Spencer, 1893].
- *45. *Amyntas papulosus* (Rosa, 1896) (syn. *papulosa sauteri*; *composita*; *rockefelleri*).
- 46. *Amyntas parvicystis* (Goto & Hatai, 1899) [syn. *?verticosa* cf. *tokioensis*].
- 47. *Amyntas quintanus* (Ishizuka, 1999). **comb. nov.**
- *48. *Amyntas robustus* (Perrier, 1872) (syn. *masatacae*; *campestris* Goto and Hatai, 1898 [non Lee, 1952]; *?zavatarii*; *ornata*; *?sheni*; *lauta*; *corrugata*).
- 49. *Amyntas scholasticus* (Goto & Hatai, 1898).
- 50. *Amyntas yambaruensis* (Ishizuka & Azama, 2000). **comb. nov.**
- *51. *Metaphire californica* (Kinberg, 1867) (syn. *modesta*; *molesta*; *sakaguchii*; *sonaiensis*).
- Metaphire hilgendorfi* / *Amyntas tokioensis* species-complex [*Amyntas hilgendorfi* species-complex sensu Easton (1981)].
- Included species recorded from Japan:
- 52. *Amyntas ambiguus* (Cognetti, 1906).
- 53. *Amyntas bimaculatus* (Ishizuka, 1999b). **comb. nov.** (syn. *silvatica* **syn. nov.**).
- 54. *Amyntas gomejimensis* (Ohfuchi, 1937).
- 55. *Amyntas purpuratus* (Ishizuka, 1999b). **comb. nov.**
- 56. *Amyntas surcatus* (Ishizuka, 1999b). **comb. nov.**
- 57. *Amyntas tappensis* (Ohfuchi, 1935).
- 58. *Amyntas tokioensis* (Beddard, 1892) (syn. *verticosa* **syn. nov.**).
- 59. *Amyntas vittatus* (Goto & Hatai, 1898).
- 60. *Amyntas yunoshimensis* (Hatai, 1930).
- 61. *Metaphire agrestis* (Goto & Hatai, 1899) (syn. *hataii*, *striata* **syn. nov.**).
- 62. *Metaphire communissima* (Goto & Hatai, 1899). **comb. nov.** (syn. *Perichaeta sieboldi*: Goto & Hatai, 1898 [non *Megascolex sieboldi* Horst, 1883 (= *Metaphire sieboldi*); *sieboldi lenzi*; *florea* **syn. nov.**]).
- #63. *Metaphire hilgendorfi* (Michaelson, 1892). **comb. nov.** (syn. *rokugo*; *?schizopora*; *?irregularis* Goto & Hatai, 1899 [non Spencer, 1895]; *glandularis*).
- #64. *?Metaphire levis* (Goto & Hatai, 1899).
- 65. *Metaphire servina* (Hatai & Ohfuchi, 1937).
- #66. *Metaphire vesiculata* (Goto & Hatai, 1899) (syn. *?koellikeri* **syn. nov.**; *?okutamaensis* **syn. nov.**; *?biggiberosa* **syn. nov.**).
- *67. *Metaphire yamadai* (Hatai, 1930) (syn. *soulensis*).
- [End of *M. hilgendorfi* / *A. tokioensis* species-complex].
- #68. *Metaphire megascolidioides* (Goto & Hatai, 1899). **comb. nov.**
- 69. *Metaphire parvula* (Ohfuchi, 1956) [non Goto & Hatai, 1898; nec Ishizuka et al., 2000].
- *70. *Metaphire peguana* (Rosa, 1890) (syn. *saigonensis*).
- 71. *Metaphire riukiuensis* (Ohfuchi, 1957).
- *72a. *Metaphire schmardae schmardae* (Horst, 1883) [non *Megascolex schmardae* Michaelson, 1897], (syn. *triphyla*; *kikuchii*).
- *72b. *Metaphire schmardae macrochaeta* (Michaelson, 1899).
- 73. *Metaphire sieboldi* (Horst, 1883) [non *Perichaeta sieboldi*: Beddard, 1892b: 759; Goto & Hatai, 1898: 65 (= *Metaphire communissima*)], (syn. *setosa* Cognetti, 1908 [non Ishizuka et al., 2000]).
- 74. *Metaphire tosaensis* (Ohfuchi, 1938).
- 75. *Metaphire yezoensis* (Kobayashi, 1938).
- *76. *Pithemera bicincta* (Perrier, 1875).
- Polypheretima elongata* species-complex [*Metapheretima elongata* species-complex sensu Sims & Easton (1972); Easton (1976)].
- Included species reported from Ryukus:
- *77. *Polypheretima elongata* (Perrier, 1872) [non *Pheretima elongata*: Ohfuchi, 1956 (= *Amyntas morrissi*)], (syn. *biserialis*, *acystis*, *monocystis*, *aelongata*).
- # Species incertae sedis [i.e., “of uncertain taxonomic position” (ICZN 1999: Glossary)].
- Amyntas hibernus* (Ishizuka, 1999). **comb. nov.**
- Amyntas illotus* (Gates, 1932) species-group sensu Sims & Easton (1972).
- Included names recorded from Japan:
- Amyntas assaceus* (Chen, 1938) [syn. *medipusillus* Nakamura, 1999 nom. nov. pro *Pheretima pusilla* Ohfuchi, 1956 (non Ude,

1893) **syn. nov.**; ?*Amyntas proasacceus* Tsai et al., 2001 **syn. nov.**].

Amyntas illotus: Ohfuchi, 1956: 136 [non Gates, 1932: 397].

Amyntas imperfectus (Ishizuka, 1999). **comb. nov.**

'*Pheretima*' *oyuensis* Ohfuchi, 1937.

[End of *A. illotus* species-group].

Amyntas octo (Ishizuka, 2000). **comb. nov.**

Amyntas stipatus (Ishizuka, 1999). **comb. nov.**

Amyntas tamaensis (Ishizuka, 1999). **comb. nov.**

'*Pheretima*' *aokii* Ishizuka, 1999.

'*Pheretima*' *conjugata* Ishizuka, 1999.

'*Pheretima*' *parlarva* Blakemore. **nom. nov.** pro *P. parvula* Ishizuka et al., 2000. [non *Perichaeta parvula* Goto & Hatai, 1889 (?= *A. gracilis*), nec *Pheretima parvula* Ohfuchi, 1956 (= *Metaphire parvula*)]. [Name formed according with ICZN (1999: Arts. 8, 57.2, 60.3, 67.8, 72.7) to provide a public and permanent record for replacement of a junior homonym].

(* = exotic/introduced, - = native/endemic, # = uncertain affinities, syn. = synonyms).

Details of revisions with taxonomic diagnoses

Family Moniligastridae

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 Moniligastridae 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

Drawida hattamimizu Hatai, 1930a: 485. From Hata & Kanazawa. Types not known.

Distribution: Japan (Hokkaido, Kanazawa, Hata 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.

Drawida japonica (Michaelsen, 1892)

Moniligaster japonicus Michaelsen, 1892: 232. From Japan. Types in *Hamburg Museum*: 403 (Reynolds & Cook, 1976), but stated by Michaelsen as in (*Humboldt Museum?*) Berlin: 2122.

Drawida japonica: Michaelsen, 1900: 115, 1910: 48; Easton, 1981: 37.

Drawida japonica typica: Michaelsen, 1910:49.

Drawida grahami Gates, 1935: 3. From Suifu, Szechuan. Type USNM: 20093.

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.

Remarks: Michaelsen (1910: 48-52, 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. Nevertheless, Gates (1972: 244) was of the opinion that this species came originally from the Indian Himalayas and questioned the identification of some earlier records from outside the Japan/Korea area. Easton (1981: 37) included only Japanese and Korean records in his distribution range for this taxon. Identification confirmed from inspection of new material by current author.

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 Biwadrilidae

Biwadrilus bathybates (Stephenson, 1917)

Criodrilus bathybates Stephenson, 1917: 96. From Biwa-ko. Types are four immatures in Calcutta Museum.

Criodrilus miyashitai Nagase & Nomura, 1937: 361.
Biwadrilus bathybates: Easton, 1981: 40 (syn. *miyashitai*).

Distribution: Known only from the Lake Biwa region of central Honshu, Japan.

Remarks: The family and genus are monotypic.

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).

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

Allolobophora parva Eisen, 1874

Allolobophora parva Eisen, 1874:46. Locality Mt Lebanon, New York. Types in US National Museum.

Allolobophora beddardi Michaelsen, 1894:182. Locality USA. Types Hamburg: 153.

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

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

Eisenia parva: Pop, 1948: 89,123; Bouché, 1972: 386; Zicsi, 1982: 436.

Bimastos parvus: Gates, 1972: 87 (syn. *beddardi*, ?*longicinctus*); Easton, 1981: 41 (syn. *beddardi*); Sims & Gerard, 1985: 48; 1999: 48.

Allolobophora parva: Easton, 1983: 475 (syn. *beddardi*, *parva udei*, *constricta germinata*).

Distribution: Cosmopolitan species indigenous to Palaearctic; fairly common in Japan (endemic?).

Remarks: Easton (1983) appears to reject the synonymy by Gates (1972) in *Allolobophora parva* of *Bimastos longicinctus* Smith & Gittings, 1915 which he provisionally retains 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 transferred to the genus *Allolobophoridella* Mršić, 1990.

Aporrectodea rosea (Savigny, 1826)

Enterion roseum Savigny, 1826: 182.

Eisenia rosea: Easton, 1981: 44.

Aporrectodea rosea: Easton, 1983: 477.

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

Remarks: This species is widely reported from around the world mainly by introduction and has numerous synonymies (e.g., see Gates 1972, 1974; Sims & Gerard 1985, 1999).

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 Hokkaido (endemic?).

Remarks: Parthenogenetic polymorphs are common (e.g. Sims & Gerard, 1985: 72).

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, 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 Berlin: 2115 & 2117.

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

Allolobophora japonica f. *gigantica* Oishi: 1934:134.

Allolobophora japonica f. *minuta* Oishi: 1934:134.

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

Diagnosis: Lumbricine setae closely paired. Spermathecal pores in 9/10/11 in c or cd lines. Clitellum 23,24-31. Tubercula pubertatis as raised papillae on 27 and 29.

Distribution: Considered endemic to Japan and Korea, despite a report from Germany (Graff 1954); also listed in a Red Data Book of the Russian Federation (Anon 1997) so it may 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 subspecific rank, they were later combined under *E. japonica* by Easton (1983:480). Gates (1975) provides a detailed account of this species.

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 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

Ocnerodrilus occidentalis Eisen, 1878

Ocnerodrilus occidentalis Eisen, 1878: 10. From Fresno, California. Types missing from Humboldt Museum, Berlin: 2363.

Ocnerodrilus occidentalis: Easton, 1981:45.

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

Remarks: Small species often overlooked. Gates (1972: 274) considered *Ocnerodrilus occidentalis* to be a parthenogenetically degraded complex.

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.

Microscolex phosphoreus: Easton, 1981: 45.

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 bolau (Michaelsen, 1891)

Benhamia bolavi Michaelsen, 1891: 9 (corr. *bolau*). Type locality Bergedorf near Hamburg. Types in Hamburg: 285; also other institutions as listed in Reynolds & Cook (1976: 80).

Dichogaster bolau: Easton, 1981: 46.

Distribution: Cosmopolitan species (indigenous to Africa); Japanese report from Okinawa.

Remarks: Small species often overlooked.

Dichogaster saliens (Beddard, 1893)

Microdrilus saliens Beddard, 1893: 683. From Kew Gardens, London. Types lost?

Dichogaster hatomaana Ohfuchi, 1957: 259.

Dichogaster saliens: Easton, 1981: 46 (syn. *hatomaana*).

Distribution: Cosmopolitan species (?indigenous to Africa), reported once from Ryukyus.

Remarks: Small species often overlooked and under-reported (see Blakemore 2002).

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. 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): Megascolecoid 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 Megascolecidae sensu Blakemore (2000) rather than Acanthodrilidae where it had been placed by some earlier authors.

Pontodrilus litoralis (Grube, 1855)

Lumbricus litoralis Grube, 1855: 127 [et *litoralis* Grube, 1855; nec Dalyell, 1853]. Type locality in French Riviera. Types in Humboldt Museum, Berlin: 216.

Pontodrilus marionis Perrier, 1874: 1582.

Pontodrilus bermudensis Beddard, 1891: 96.

Pontodrilus matsushimensis Iizuka, 1898: 21; Easton, 1981: 45.

Pontodrilus matsushimensis chathamensis Michaelsen, 1899: 220.

Plutellus (*Pontodrilus*) *matsushimensis indica* Michaelsen, 1935: 106.

Pontodrilus litoralis: Easton, 1984: 114 (syn. *bermudensis*, *matsushimensis*, *albanyensis*, *cygni*, *indica* Michaelsen, 1935, *gracilis*).

Remarks: For full diagnosis, distribution and discussion of synonymy, see Easton (1984: 114-116) and Blakemore (2000, 2002).

Genus *Perionyx* Perrier, 1872

Type species and locality: *Perionyx excavatus* Perrier, 1872: 126 from Vietnam.

Diagnosis (from Gates, 1972): Megascolecoid with racemose prostates, perichaetine setae and holoic nephridia. Gizzard absent or weak in segment 5; calciferous glands, intestinal caeca, and intestinal gizzards absent. Dorsal pores present.

Distribution: Home territory in Himalayan region; two species widely transported.

Perionyx excavatus Perrier, 1872

Perionyx excavatus Perrier, 1872: 126. From Saigon. Types in Paris Museum.

Perionyx excavatus: Michaelsen, 1900: 208 (syn. *gruenewaldi*); Gates, 1972:141 (syn. *fulvus*, *?koboensis*, *?turaensis*); Sims & Gerard, 1985: 134 (syn. *Perionyx* sp. Friend, 1911:188).

Perionyx gruenewaldi Michaelsen, 1891:33.

Perionyx fulvus Stephenson, 1916:322.

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. For full descriptions see Gates (1972); Blakemore (1994, 1999, 2002).

Genus *Amyntas* Kinberg, 1867

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

Taxonomic note: Kinberg (1867) spelt the genus name *Amyntas* (p. 97) and *Amyntas* (p. 101), the former spelling has priority, the latter was preoccupied. Moreover, *Amyntas* has page priority over *Pheretima* Kinberg, 1867: 102 (see also Sims & Easton, 1972: 176).

Diagnosis (from Sims & Easton, 1972): Pheretimid 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: 268) was that species were assumed to belong to *Amyntas* rather than *Metaphire* unless re-examination of types shows them to have copulatory pouches; thus they attributed specimens lacking male pores to *Amyntas* by default. *Pheretima* species erected by Ishizuka (1999-2001) are mostly transferred to either one or other of these genera.

Amyntas acinctus (Goto & Hatai, 1899)

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

Pheretima acincta: Michaelsen, 1900: 252.

Amyntas acinctus: Beddard, 1900: 650; Sims & Easton, 1972: 235 [*hawayanus* (= *gracilis*) group]; Easton, 1981: 48 (syn. ?*phaselus* Hatai, 1930; ?*maculosus* Hatai, 1930; ?*kamitai* Kobayashi, 1934; ?*phaselus tamurai* Kobayashi, 1938).

(*Pheretima phaselus* Hatai, 1930b: 659 [sic])?

(*Pheretima maculosus* Hatai, 1930b: 661 [sic])? [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 and invalid replacement name "*Pheretima medimaculosa*" 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].

(*Pheretima kamitai* Kobayashi, 1934: 5)?

(*Pheretima phaselus tamurai* Kobayashi, 1938: 411)?

Diagnosis: Length 130 mm. Spermathecal pores in 5/6/7/8 (spermathecal diverticula twice as long as ampullae). Male pores superficial on largish porophores (or slightly invaginate?). Genital markings absent. Intestinal caeca simple often with incised margins. Although named for two acitellate specimens, matures would presumably be clitellate.

Distribution: (from Easton, 1981) Japan (Hokkaido to Kyushu) and Korea. However, Hokkaido reports need verification against *Metaphire yezoensis* (Kobayashi, 1938).

Remarks: Easton (1981) tentatively put *Amyntas phaselus* (Hatai, 1930), *Metaphire maculosa* (Hatai, 1930), *Amyntas kamitai* (Kobayashi, 1934) and *Amyntas phaselus tamurai* (Kobayashi, 1938) in synonymy of *Amyntas acinctus*. These taxa remain in synonymy pending further investigation. 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*'. These actions are not supported here and *Metaphire yezoensis*, although similar, is maintained separately as per Easton (1981).

Sims & Easton (1972: 236, 245) have *Amyntas phaselus phaselus* and *Amyntas phaselus tamurai* subspecies but do not mention *Amyntas phaselus typicus* (Kobayashi, 1938) incorrectly cited by Ishizuka (1999a: 64) as "*Pheretima phaselus* HATAI 1930 var. *typica* KOBAYASHI, 1938". Sims & Easton (1972: 239) place *Pheretima maculosa* Hatai, 1930 and *Pheretima yezoensis* Kobayashi, 1938 in a *Metaphire merabahensis*-group, but Ishizuka (2001: 86) figures "*Pheretima maculosa* Ishizuka, 2000" (lapsus for Hatai's species of 1930, cf. Ishizuka 2001:12,102) with superficial male pores qualifying for inclusion, as here, in *Amyntas* (however his figure has the segments miscounted and it is also possible that the specimen is merely an *Amyntas gracilis*). Hong et al. (2001) describe a superficially and morphologically similar Korean species, *Amyntas minjae* Hong, 2001, that they compare with *A. phaselus* and *A. kamitai*. Moreover, *A. assacceus* as described herein is also similar to these taxa.

Amyntas carnosus (Goto & Hatai, 1899)

Perichaeta carnosus Goto & Hatai, 1899: 15, fig. 4.
From Tokyo. Types?

Pheretima carnosus: Michaelsen, 1900: 260.

Amyntas carnosus: Sims & Easton, 1972: 235 [in *A. hawayanus* (= *gracilis*) group].

Diagnosis: Three pairs of spermathecal pores in 5/6/7/8 (or sometimes four pairs in 5/6-8/9). Genital markings closely paired anteriorly in 7,8-9 and sometimes also in 18 and 19, with another pair posteriorly on 18 just median to the line of the male pores. Intestinal caeca simple.

Distribution: Japan, Korea and, in addition to these locations given by Easton (1981), from China - Jiangsu, Zhejiang, Anhui, Shandong, Hong Kong, Sichuan, Beijing.

Remarks: While Gates (1972: 149) implied this taxon may be the same as *Megascolex diffringens* Baird, 1869 (= *Amyntas corticis* Kinberg) that has four pairs of spermathecal pores, Easton (1981: 50) tentatively included *P. carnosus* in synonymy of *Amyntas gracilis* apparently accepting three pairs of spermathecae in 5/6/7/8 as per the original description and as in Michaelsen (1900b: 260). Nevertheless, it appears different from *A. gracilis* by its markings described as more closely paired, almost mid-ventral, in 7,8-9 and 18, 19. Thus it is provisionally restored from Easton's synonymy in the present account pending further investigation of its affinities that possibly extend to sexathecals morphs of *A. morrisi*. [The Chinese distributions above are from Chinese Agricultural Academy of Science website <http://www.agrionline.net.cn/zhuanti/index.htm> whence *Pheretima carnosus* Goto & Hatai 1899 is described with either three or four pairs of spermathecae in 5/6/7/8,8/9]. Ishizuka's *A. distichus* is similar to the octothecal forms. New taxa from Korea by Hong & James (2001b), especially *Amyntas youngtai* (that has its figured segments miscounted) and *A. sangyeoli*, are particularly similar to, and possibly synonymous with, *A. carnosus*.

***Amyntas conformis* (Ishizuka, 2000). comb. nov.**

Pheretima conformis Ishizuka, 2000e: 182.

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 *Amyntas* species have spermathecae in 5/6/7/8/9 including members of the *Amyntas corticis* species-complex, for which this species may well qualify for inclusion (as with Ishizuka's almost identical *P. monticola*), although Ishizuka (2000e: 185) compares his species only to *Amyntas brevicingulus* (Chen, 1938) that has spermathecae in 5/6/7/8 and belongs to the *Amyntas hawayanus* (= *gracilis*) group of Sims & Easton (1972). Ishizuka (2000e) makes no comparison with his subsequent *P. monticola* [non Beddard, 1912] despite the obvious similarities.

***Amyntas corticis* species-complex**

Included species from Japan.

***Amyntas corticis* (Kinberg, 1867)**

Perichaeta corticis Kinberg, 1867: 102. Type locality Oahu. Types in Stockholm: 1947.

Megascolex diffringens Baird, 1869a: 40, figs. 1-3 & 1869b: 387 Type locality Plas Machynlleth, North Wales. Syntype in British Museum: 1869:1.2.1.

?*Megascolex (Perichaeta) sanctaehelenae* 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 Fiji. Types in Humboldt Museum, Berlin: 705.

Megascolex indicus Horst, 1883: 186 [non *Perichaeta indica*: Horst, 1885: 4 (= *Pheretima darnleiensis*) from Sims & Easton (1972: 260)]. Types in Leiden Museum: 1917-1918.

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.

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 - adiverticulate spermathecae in 5/6/7/8.

Perichaeta divergens Michaelsen, 1892: 243, fig. 21; Michaelsen, 1900: 264 [syn. ?*fuscata*, ?*campestris*, ?*kamakurensis*, ?*parvula*, ?*heteropoda*, ?*obscura*, ?*scholastica*, ?*decempapillata* (sic), ?*flavescens*, ?*producta*, ?*micronaria* all of Goto & Hatai, 1898; (some of these synonyms were revoked by subsequent workers)]. Male pores inconspicuous; prostates absent; spermathecae, sometimes adiverticulate opening in 5/6/7/8/9. From Japan.

- Types in Humboldt Museum, Berlin: 2116 (lost?).
- Perichaeta nipponica* Beddard, 1892b: 760. From Japan. Types missing.
- ?*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. (*Pheretima marenzelleri* Cognetti, 1906: 780)? From Yokohama, Japan. Types?
- ?*Pheretima silvestrii* Cognetti, 1909: 266.
- Pheretima divergens yunnanensis* Stephenson, 1912.
- ?*Pheretima pingi* Stephenson, 1925b: 891 [cf. *Amyntas fuscatus*].
- Perichaeta mirabilis*: Gates, 1934: 50 [?non Bourne, 1887:669].
- ?*Pheretima kyamikia* Kobayashi, 1934:1. From Korea.
- ?*Pheretima sheni* Chen, 1935: 38 [athecal morphs, cf. *Amyntas robustus*, *A. illotus*]. From Hong Kong. Types in U.S. National Museum: 20181.
- ?*Pheretima directa* Chen, 1935: 47.
- Pheretima oyamai* Ohfuchi, 1937: 62; Ishizuka 2001: 105 [misspelt "oyama"].
- Pheretima tajiroensis* Ohfuchi, 1938: 46.
- ?*Pheretima homoseta* Chen, 1938:414.
- ?*Pheretima morii* Kobayashi, 1938:161.
- Pheretima tori* Ohfuchi, 1941: 244, figs. 1-2.
- Pheretima clerica* Benham 1947.
- Pheretima campestris* Lee, 1952 [placed in synonymy of *Perichaeta peregrina* Fletcher, 1887 (= *Amyntas 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 and Hatai, 1898 (= *Amyntas robustus*). Under ICZN (1999: Art. 60) this secondary junior homonymy replacement name is unnecessary and invalid since available and valid synonyms exist for this taxon].
- (*Pheretima hatomajimensis* Ohfuchi, 1957: 245)?
- Pheretima diffringens*: Gates, 1972: 149; [syn. (some in part, but not all accepted subsequently) *californica*, *campestris* Lee, 1952, *cingulata*, *clerica*, *corticis*, *divergens*, *heterochaeta*, *heteropoda*, *indica*, *mirabilis*, *molokaiensis*, *nipponica*, *peregrina*, *perkinsi*, *sanctaelenae*, *silvestrii*, *tajiroensis*, *torii*, possibly also: ?*carnosa*, ?*directa*, ?*homoseta*, ?*kyamikia*, ?*morii*, ?*oyamai*, ?*pingi*]; Gates, 1972: 177 (syn. *heterochaeta*, *divergens yunnanensis*, *mirabilis*: Gates, 1934 [?non Bourne, 1887]); Gates, 1972: 217 (?syn. *sheni*); Gates, 1972b: 18, 27 (syn. *divergens*, *heterochaeta*, *heteropoda*, *indica*, *nipponica*, *oyamai*, *tajiroensis*, ?*tori*)
- Amyntas corticis*: Sims and Easton, 1972: 235; Easton, 1981: 49-50 (syn. *diffringens*, *divergens*, ?*hatomajimensis*, *heterochaeta*, *heteropoda*, ?*ijimai*, *indica* Horst, 1883 [laps. for *indicus*], ?*marenzelleri*, *nipponica*, *oyamai*, *tajiroensis*, *tori*); Easton 1982: 726-728 (syn. *diffringens*, *peregrina*, *heterochaeta*); Easton, 1984: 118 (syn. *subquadrangula*); Sims & Gerard, 1985: 128; 1999: 128 (syn. *diffringens*, *indicus* Horst, 1883, *nipponica*).
- Pheretima imajimai* Ishizuka, 1999c: 114-116, figs. 56-65, table 3. **syn. nov.**
- Pheretima confusa* Ishizuka, 1999c: 116-119, figs. 66-74, tables 4,6. **syn. nov.**
- Pheretima nipparensis* Ishizuka, 1999c: 119-121, figs. 75-84, tables 5,6. **syn. nov.** [misspelt "*Pheretima nipparaensis*" in Ishizuka (2001: 91)].
- Pheretima subtrotunda* Ishizuka, 2000b: 13-15, figs. 1-7, tab. 1. **syn. nov.**
- Pheretima rufidula* Ishizuka, 2000b: 15-16, figs. 8-14, tab. 1. **syn. nov.** [misspelt "*P. rufidura*" in Ishizuka (2001: 14, 30)].
- Pheretima silvestris* Ishizuka, 2000b: 18, figs. 23-29, tab. 1. **syn. nov.** [Non *Pheretima silvestris* Michaelsen, 1923 (non *Pheretima silvestrii* Cognetti, 1909, now also in *Amyntas*)]. [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. **syn. nov.** [misspelt "*Pheretima qasemilunaris*" in Ishizuka (2001: 16)]. For adiverticulate specimens that otherwise appear to comply with *A. corticis*.
- Pheretima fulva* Ishizuka, 2000b: 21-22, figs. 37-47, table 3. **syn. nov.**
- Pheretima subterranea* Ishizuka, 2000b: 22-25, figs. 48-56, table 3. **syn. nov.**
- Pheretima subalpina* Ishizuka, 2000b: 25-27, figs. 57-67, tables 2-3. **syn. nov.**
- Pheretima mutabilis* Ishizuka, 2000e: 179-180, figs. 1-9, tab. 1. **syn. nov.**
- Pheretima nubicola* Ishizuka, 2000e: 180-182, figs. 10-18, tab. 1. **syn. nov.**

Pheretima hinoharensis Ishizuka, 2000e: 187, figs. 35-42, tab. 1. **syn. nov.** [misspelt "*P. hinoharensis*" in Ishizuka (2001: 11, 78, 101)].

Pheretima umbrosa Ishizuka, 2000e: 187-189, figs. 43-51, tab. 1. **syn. nov.**

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

Pheretima monticola Ishizuka, 2000e: 191-193, figs. 60-66, tab. 1. **syn. nov.** [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 synonyms exist. See also *A. conformis* (Ishizuka, 2000e)].

?*Pheretima pingi*: Ishizuka, 2001: 82 [mistakenly cited as "*Pheretima pingi* Chen, 1938" - lapsus for *Amyntas pingi* (Stephenson, 1925), for figured specimen that appears to comply with *A. corticis* but cf. *A. fuscatus*].

Pheretima nigella Ishizuka et al., 2000b: 185. **syn. nov.** [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 adiverticulate 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 adiverticulate specimen that otherwise appears to comply with *A. corticis*.

Taxonomic notes: Michaelsen (1900b: 275) included the prior *Pheretima corticis* (Kinberg, 1867) in possible synonymy under *Pheretima indica* (Horst, 1883) s. strict., 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: *Amyntas indicus cameroni* (Stephenson, 1932) from the Malay Peninsula; *Amyntas indicus ceylonicus* (Michaelsen, 1897) from Sri Lanka; and *Amyntas perkinsi* (Beddard, 1896) from Halemanua and Kauai, Hawaii which was included by Michaelsen (1900b: 276) as a 'variety' of *indica*. Often *A. corticis* has been re-

ported 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 "corticis".

Diagnosis: *Amyntas* with four pairs of spermathecal pores ca. 0.3 body circumference apart in furrows 5/6/7/8/9. Genital markings small paired or variable near spermathecal and male pores. 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 1972a: 178), (cf. *Amyntas 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 southeast 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 (1972a: 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 (1972a: 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 *Amyntas 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 *Amyntas 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 *Amyntas 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 *Amyntas 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 *Amyntas fuscatus* (Goto & Hatai, 1898) and *Amyntas obscurus* (Goto & Hatai, 1898) but restoring *Pheretima parvula* (Goto & Hatai, 1898) as a separate species, even though it too has been considered a synonym of *Amyntas 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 (1972a), 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 invisita*. 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.

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 *Amyntas corticis*.

***Amyntas distichus* (Ishizuka, 2000). comb. nov.**

Pheretima disticha Ishizuka, 2000e: 185.

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 *Amyntas* species have spermathecae in 5/6/7/8/9 including the various members of the *Amyntas corticis* species-complex and possibly also *Amyntas carnosus*, which may well be its synonym; yet Ishizuka compares his species only to *Amyntas hexitus* (Chen, 1946) that has spermathecae in 7/8/9.

***Amyntas ellipticus* (Ishizuka, 1999). comb. nov.**

Pheretima elliptica Ishizuka, 1999d: 237.

Distribution: Japan.

Diagnosis: Spermathecal pores in 6/7/8/9. Male pores superficial. Genital marking absent. Intestinal caeca simple.

Remarks: Approximately 50 *Amyntas* species have spermathecae in 6/7/8/9, including *A. flavescens* from Japan; Michaelsen’s (1900a) *Amyntas asiaticus* is particularly similar.

***Amyntas 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 houletti bidenryoana* Ohfuchi, 1956: 169)? [Names sometimes misspelt as “*houletti*” and “*bidenryoana*” or “*bidenryyoana*”].

(*Pheretima leucocirca*: Ohfuchi, 1956: 174 [?non Chen, 1933: 262])? [Misidentification].

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

Amyntas flavescens: Easton, 1981: 50 (syn. ?*producta*, ?*houletti bidenryoana*, ?*leucocirca*: Ohfuchi, 1956 [?non Chen, 1933], ?*noharuzakiensis*).

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 (1900b: 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 houletti bidenryoanus* (Ohfuchi, 1956) in synonymy of *A. flavescens*. However, Gates (1972a: 192) and Sims & Easton (1972: 237, 243) had earlier recognized its specific status separate from *Metaphire houletti* (Perrier, 1872), thus it was assigned as *Amyntas bidenryoanus*. It is provisionally retained in synonymy of *A. flavescens* despite Ishizuka (1999a: 60) inexplicably and erroneously listing the prior *Metaphire houletti* in synonymy of *Amyntas bidenryoanus*, both of which he reverted to *Pheretima*, actions that can be ignored.

Amyntas fuscatus (Goto & Hatai, 1898)

Perichaeta fuscata Goto & Hatai, 1898: 66. Type locality Kamakura; Reynolds & Cook, 1976: 104 state “Typus perditus”, i.e., types lost.

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

Perichaeta iizukai Goto & Hatai, 1899: 14. **syn. nov.**; *Polypheretima iizukai*: Easton, 1979: 43; Easton, 1981: 61. Locality in Musashi, Saitama-ken. Types lost (Reynolds & Cook, 1976: 116).

Amyntas fuscatus: Sims & Easton (1972: 235, 242).

Metaphire fuscata: Easton, 1981: 57 (syn. ?*grossa*).

Pheretima montana: Ishizuka, 1999c: 103. **syn. nov.** (non *Pheretima montana* Kinberg, 1867: 102). [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, 92) the name “*Pheretima montivaga* Ishizuka, 1999” appears as a *nomen nudum* (under ICZN 1999: Arts. 13, 16) for this taxon (cf. Ishizuka, 2001: 102 where “*P. montana* Ishizuka, 1999” reappears). Transfer to *Amyntas* in synonymy with *Amyntas 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. **syn. nov.**

Pheretima alpestris Ishizuka, 1999c: 107. **syn. nov.**

Pheretima dura Ishizuka, 1999c: 105. **syn. nov.**

Pheretima turgida Ishizuka, 1999c: 110. **syn. nov.**

Pheretima argentea Ishizuka, 1999c: 112. **syn. nov.** [misspelt “*argentina*” in Ishizuka, 2001: 101].

Pheretima flavida Ishizuka, 2000b: 16. **syn. nov.?**

Pheretima lactea Ishizuka, 2000b: 28. **syn. nov.?**

Pheretima mitakensis Ishizuka, 2000b: 28. **syn. nov.?**

Distribution: 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 (or possibly intermediately superficial). Genital marking variable: absent, or sometimes median to spermathecal pores post-setally on 5-8, and usually serial and in line with male pores post-setally in some or all of 17-26. 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 region 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 the Kamakura type-locality. *Perichaeta iizukai* was almost certainly misdescribed regarding 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.

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 *Amyntas diffringens* (= *A. corticis*) species group and *P. grossa* in a *Metaphire malayana* species-group, both groups with spermathecae in 5/6/7/8/9. 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 *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 his *A. flavidus*.

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 *Amyntas 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 *Amyntas* rather than *Metaphire*.

Notwithstanding this interpretation of the taxa, the 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).

Amyntas glabrus (Gates, 1932)

Pheretima glabra Gates, 1932: 395; Gates, 1972a: 187 (syn. *tenellula*, *vieta*). From Nam Hpen Noi, Burma (= Myanmar). Types missing.

Pheretima tenellula Gates, 1932: 398. From Kwang Yeh, Myanmar. Types none.

Pheretima vieta Gates, 1936: 462. From Peng Sai, Myanmar. Types none.

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

Amyntas glabrus: Sims & Easton, 1972: 242; Easton, 1981: 50 (syn. *vieta*, ?*papilio*: Ohfuchi, 1956).

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

Distribution: Myanmar and Japan (Kyushu and Ryukyus).

Remarks: Gates (1972a: 187-188) described this species as parthenogenetic with several known morphs. Gates (1972a: 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.

Amyntas gracilis (Kinberg, 1867)

Nitocris gracilis Kinberg, 1867: 112. Type locality Rio de Janeiro. Types in Stockholm: 1944 (Reynolds & Cook, 1976: 108), immatures (Sims & Easton, 1972:214).

Perichaeta hawayana Rosa, 1891: 396. From Hawaii. Type in Vienna (Gates, 1972a: 189).

Perichaeta bermudensis Beddard, 1892a: 160. Syntypes in British Museum: 1904:10.5.1362-5.

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

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

(*Perichaeta kamakurensis* Goto & Hatai, 1898: 68)? From Tokyo and Kamakura. Types? Spermathecae diverticulate opening in 5/6/7/8.

?(*Perichaeta parvula* Goto & Hatai, 1898: 68)? [non Ohfuchi, 1956 (= *Metaphire parvula*); nec Ishizuka et al., 2000b (= *Pheretima palarva* Blakemore)]. From Kamakura. Types? Spermathecae adiverticulate opening in 5/6/7/8; prostates aborted; 32 mm.

(*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 hawayana: Michaelsen, 1900: 271, 316 [syn. *bermudensis*, ?*mauritiana*]; Gates, 1972a: 189, 217 [syn. ?*barbadensis* (part), *mandhorensis*, ?*mauritiana*].

Amyntas gracilis: Sims & Easton, 1972: 235; Easton, 1981: 50 (syn. *hawayana*, ?*kamakurensis*, ?*parvula* Goto & Hatai, *decimpapillata*, ?*carcosa*, ?*kagoshimensis*); Easton, 1982: 728 (syn. *hawayana*); Sims & Gerard, 1985: 130 (syn. *hawayana*).

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

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

Diagnosis: *Amyntas* 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 quadrithelial 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. morrisoni*), but these may actually be referable to the *Amyntas morrisoni* 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 carcosa* (Goto & Hatai, 1899), in synonymy of *Amyntas gracilis*. However, it is unlikely that *Pe. 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. assacceus*). In the current account, *P. carcosa* is removed from synonymy due to its closely paired genital markings, and is provisionally restored as *Amyntas carnosus*.

Amyntas habereri (Cognetti, 1906)

Pheretima habereri Cognetti, 1906: 777. From Yokohama. Types not known.

Amyntas habereri: Easton, 1981: 51

Diagnosis: 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 in line with male pores. Intestinal caeca manicate, each with about 10 diverticula.

Distribution: Japan (Yokohama).

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

Amyntas hupeiensis (Michaelsen, 1895)

Perichaeta hupeiensis Michaelsen, 1895: 35. From Hupei province, China. Types missing.

Pheretima hupeiensis: Michaelsen, 1900: 273.

Amyntas hupeiensis: Easton, 1981: 53.

?*Pheretima hypogaea* Ishizuka, 1999d: 234. **syn. nov.** [misspelt “*hypogae*” in Ishizuka, 2001: 11, 101].

?*Pheretima edoensis* Ishizuka et al., 2000b: 181. **syn. nov.**, [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. hupeiensis* or *A. obscurus*, most likely the former].

Diagnosis: Spermathecal pores paired in 6/7/8/9. 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.

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

Remarks: *Amyntas hupeiensis* is distinguished from the similar *Metaphire bahli* and *M. peguana* by its superficial male pores. Gates (1972a: 213) says that the Chinese species, *Amyntas 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. Although Ishizuka (2001: 54) attempts to differentiate his two taxa from *A. hupeiensis* on the basis of colouration, it is possible that they are synonymous; alternatively, Ishizuka's two names may be synonyms of *Amyntas obscura* (see also *A. micronarius*). The description of *Pheretima edoensis* is highly confused regarding the number of spermathecal pores, but by careful interpretation there is nothing substantial to differentiate it from *Amyntas hupeiensis* which was also claimed from the same site (Ishizuka et al., 2000b: 183).

Amyntas japonicus (Horst, 1883)

Megascolex japonicus Horst, 1883: 192. From "Japan". Types in Leiden: 1809.

Perichaeta japonica: Beddard, 1895:426.

Pheretima japonica: Michaelsen, 1900: 279.

Amyntas japonicus: Easton, 1981: 54.

Diagnosis: Spermathecal pores in 6/7/8. Male pores superficial on segment 18 in seminal grooves which extend into 17. Genital markings absent. Intestinal caeca manicate.

Distribution: "Japan" (Horst, 1883).

Remarks: Not subsequently found although seminal grooves are reported for Ryukyu species (see *A. glabrus*, *M. riukiensis*). Ishizuka (2001) overlooked this species.

Amyntas kunigamiensis (Ishizuka & Azama, 2000). **comb. nov.**

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

Note: Authorship cited as in Ishizuka (2001: 101) rather than "Ishizuka et al." as would be recommended by ICZN (1999: Art. 51C).

Diagnosis: Spermathecal pores in 6/7/8/9. Male pores superficial. Genital marking small near spermathecal (and male) pores, or absent. Intestinal caeca simple, incised. Length 120-262 mm.

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 *Amyntas asiaticus* Michaelsen, 1900, as well as *A. robustus* as discussed below. Approximately 50 other *Amyntas* species have spermathecae in 6/7/8/9 including *Amyntas bidenryonanus* (= *Amyntas flavescens*) also known from Okinawa (cf. *A. yambaruensis*).

Amyntas micronarius (Goto & Hatai, 1898)

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

(*Perichaeta shimaensis* Goto & Hatai, 1899: 15)? From Shima, Gumma-ken. Types?

Pheretima micronaria: Michaelsen, 1900: 316 ("perhaps belonging in *P. divergens*"); Ishizuka, 2001: 79 (segments miscounted).

(*Pheretima yamizoyamensis* Ohfuchi, 1935: 413)? [Name sometimes misspelt "*yamijoyamensis*" e.g. Reynolds & Cook (1976: 191)]. From Yamizo-san, Fukushima-ken. Types?

(*Pheretima obtusa* Ohfuchi, 1957: 244)? From Sonai, Sakishima. Types?

Amyntas micronarius: Sims & Easton, 1972: 235; Easton, 1981: 54 (syn. ?*shimaensis*, ?*yamizoyamensis*, ?*obtusa*).

Diagnosis: Spermathecae, sometimes adiverticulate, with pores in 5/6/7/8/9. Male pores superficial on segment 18. Genital markings paired almost intersegmental and just median to the lines of the male pores in 17/18, 18/19 and, if *shimaensis* is included, sometimes 19/20. Intestinal caeca simple.

Distribution: Japan, from Hokkaido to Ryukus.

Remarks: Michaelsen (1900b: 316) thought that this taxon, along with eleven other of Goto & Hatai's names, may be closely related to *P. divergens* (= *Amyntas corticis*) whereas Easton (1981) maintained it. However, it is possible that this taxon is closely related to Goto & Hatai's prior *Amyntas*

obscurus, despite the extra pair of spermathecae. Ishizuka's *P. hinoharaensis* may also be synonymous and, moreover, Ishizuka's *Pheretima hypogaea* and *Pheretima edoensis* with three pairs of spermathecae, and *P. tamaensis* with two (adiverticulate) 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), from its description is apparently closer to *Amyntas fuscatus*.

Amyntas 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 (= *A. assaccus*)]. [Taxonomic note: Easton (1979: 119) states that *minimus* (Horst, 1893) has priority over *pusilla* Ude, 1893].

Pheretima enchytraeoides Michaelsen, 1916: 33. Type locality in Queensland.

Pheretima zoysiae Chen, 1933: 288. Type locality Chekiang. Types in Smithsonian.

?*Pheretima fungina* Chen, 1938: 389.

?*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".

Pheretima minima: Gates, 1961: 298 (syn. *pusilla* Ude, *enchytraeoides*); Gates, 1972a: 201 (syn. *humilis*, *zoysiae*, *fungina*, *muta*, *ishikawai*).

Amyntas minimus: Easton, 1979:119 (syn. *pusilla* Ude, *enchytraeoides*); Easton, 1981: 55 (syn. *zoysiae*, *ishikawai*); Easton, 1982: 728 (syn. *enchytraeoides*, *pusilla* Ude); Easton, 1984: 118.

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 (1972a: 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.

Amyntas 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 (1972a) not listed in Reynolds & Cook (1976).

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

?*Perichaeta pallida* Michaelsen, 1892 (Sept.): 227 (cf. *A. gracilis*).

Pheretima barbadensis: Michaelsen, 1900: 254, 316 (syn. *pallida* Michaelsen, 1892, *amazonica* Rosa, 1894: 14, *sanctijacobi* Beddard, 1895: 61, *cupulifera* Fedarb, 1898: 445). [It is not certain that all of these synonyms follow *barbadensis* into synonymy of *morrisi* - see remarks below].

Pheretima morrisi: Michaelsen, 1900: 287; Gates, 1972a: 202 (syn. *hawayana lineata*).

Pheretima hawayana lineata Gates, 1926: 154.

Pheretima exiloides: Ohfuchi, 1956: 142 [non Chen, 1936]. [Misidentification].

Pheretima elongata: Ohfuchi, 1956: 148 [non Perrier, 1872: 124 (= *Polypheretima elongata*)]. [Misidentification].

Amyntas morrisi: Sims & Easton, 1972: 236, figs. 1A, 1H; Easton, 1981: 55 (syn. *exiloides*: Ohfuchi, 1956, *elongata*: Ohfuchi, 1956); Easton, 1982: 729, fig. 4c; Sims & Gerard, 1985: 132, fig. 47a (syn. *barbadensis*, *mauritaniana*).

Diagnosis: Spermathecal pores in 5/6/7. Male pores superficial on segment 18. Genital markings small on pre- and postclitellar segments, single median in 6-8. Intestinal caeca incised.

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

Remarks: Gates (1972a: 203) presumed this species to be biparental (i.e., not parthenogenetic). Sims & Gerard (1985, 1999) include both Beddard's *barbadensis* and *mauritaniana* in *A. morrisi*. Beddard's *barbadensis* comprised more than one species (and it is probable that his specimen "b" with three pairs of spermathecae is actually *A. gracilis*), but his specimens "a" (the primary type?) and especially "c" are closer to the current species. According to Michaelsen (1900b: 254), *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 *A. gracilis* requires further research. It is more likely that *A. mauritiana* is a variation of *A. gracilis*, lacking the anterior pair of spermathecae, as was suggested by Michaelsen (1900b: 316), Gates (1972a: 217), and Blakemore (2002: 177). Ohfuchi (1956) misidentified *P. morrissi* as both *Pheretima exiloides* and as *Pheretima elongata*, according to Gates (1972a: 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 morrissi* (Beddard, 1892). This action can be ignored (see *Polypheretima elongata* below).

***Amyntas obscurus* (Goto & Hatai, 1898)**

Perichaeta obscura Goto & Hatai, 1898: 70 [non *Perichaeta obscura* Spencer, 1893: 3 (= *Diporochoeta obscura*)]. From Kamakura. Types?

Pheretima obscura: Michaelsen, 1900: 316 (“perhaps belongs in *P. divergens*”); Ishizuka, 1999a: 63; 2001: 103.

Amyntas obscurus: Sims & Easton, 1972: 237; Easton, 1981: 56.

Taxonomic Remark: according to ICZN (1999: Art. 23.9.5) the junior primary homonymy by Goto & Hatai (1898) of *Perichaeta obscura* Spencer, 1893 (= *Diporochoeta obscura*), as noted in Reynolds & Cook (1969: 146), is not replaced and prevailing usage is maintained as the two taxa have not been considered congeneric after 1899, e.g. Michaelsen (1900b) at least had them in separate genera.

Diagnosis: Spermathecal pores postsetal on 6, 7, and 8 (or 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 (1900b) described the spermathecal pores as being on small papillae in 6/7/8/9 just in front of the intersegments and he thought this species was possibly synonymous with *P. divergens* (= *Amyntas 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.

***Amyntas papulosus* (Rosa, 1896)**

Perichaeta papulosa Rosa, 1896: 525. Type locality Balighe, Sumatra. Types in Genoa Museum: 44034; other material in British Museum (Sims & Easton, 1972:181).

Pheretima papulosa var. *sauteri* Michaelsen, 1922: 26. Type locality Dorf Kosempo, Taiwan. Types in Leiden: 1814.

Pheretima composita Gates, 1932: 430. Type locality Kengtung. Types none.

Pheretima rockefelleri Chen, 1933: 238. Type locality Linhai, Chekiang, China. Types in U.S. National Museum.

Pheretima papulosa: Michaelsen, 1900: 291; Gates, 1972a: 206 (syn. *papulosa sauteri*, *composita*, ?*rockefelleri*).

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

Diagnosis: Spermathecal pores in 5/6/7/8. Male pores superficial on segment 18. Genital markings small pre- and postsetal on 6-9 and 17-19. Intestinal caeca simple. Size range 45-78 mm.

Distribution: Japan, China, Taiwan, and south-east Asia.

Remarks: This species may be easily confused with *A. gracilis*, differing only in its genital markings, and possibly its slightly smaller size. Gates (1972a: 207) dismisses Ohfuchi's (1956: 164) report from the Ryukyu Islands of *P. papulosa* var. “*sauteria*”. Inexplicably, Ishizuka (1999a: 64, 65) resurrected both “*Pheretima papulosa* (ROSA, 1896) var. *sauteria* OHFUCHI, 1956” (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 1972a).

***Amyntas 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*”).

Amyntas parvicystis: Sims & Easton, 1972: 237; Easton, 1981: 56.

Diagnosis: Spermathecal pores presetal on 7 and 8 (or more likely in 6/7/8?). Male pores superficial on segment 18. Genital markings as paired glandular pores near the spermathecal pores 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, maintained separately by Easton (1981), was thought a possible variety of *Amyntas tokioensis* (Beddard, 1892) by Michaelsen (1900b) and, maybe because of this, was placed by Ishizuka (1999a: 66) in synonymy of "*Pheretima tokioensis*" that is currently included in the *Metaphire hilgendorfi* species-complex characterized by intestinal caeca that are manicate. *A. parvicystis* was originally described with a single pair of caeca with the "external margins frizzled" and stated to be similar to the condition found in *Amyntas 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 had earlier misdescribed the multiple caeca of their *M. megascolidoides*. 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 some reason 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 (1941b)] and, if the caeca are manicate, most likely it is merely a synonym of *A. tokioensis* [for which Ishizuka's *P. verticosa* is also a synonym, and his figures (Ishizuka, 1999b: 50, figs. 75-83) comply 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 incised intestinal caeca and a similar distribution of genital markings.

Amyntas quintanus (Ishizuka, 1999). **comb. nov.**

Pheretima quintana Ishizuka, 1999d: 239.

Diagnosis: Spermathecal pores in 4/5/6/7/8/9. Male pores superficial. Genital marking near male pores on 18. Intestinal caeca simple.

Distribution: Japan.

Remarks: Approximately 14 *Amyntas* species have spermathecae in 4/5/6/7/8/9, possibly including *Amyntas 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 may itself be a synonym of *A. obscurus*.

Amyntas robustus (Perrier, 1872)

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

Perichaeta robusta Perrier, 1872: 112. Locality Mauritius or Manila? Types in Paris.

Perichaeta masatakae Beddard, 1892b: 761. [Note: Sims & Easton (1972: 181, 244), Reynolds & Cook (1976: 134), and Easton (1981) spell Beddard's species "mastakae", while Michaelsen (1900b: 282) has it, as here, as *P. masatakae*]. From "Japan". Syntypes in British Museum, 1904:100:5:91-2.

Perichaeta campestris Goto & Hatai, 1898: 67 [non *Pheretima campestris* Lee, 1952: 39 which Lee (1959: 327) placed in synonymy of *Amyntas peregrinus* (= *Amyntas corticis*); Nakamura (1999b: 2) proposed a replacement name "*Pheretima medicampestris*" for Lee's *campestris*, but under ICZN (1999: Art. 60) this secondary junior homonymy replacement name is unnecessary and invalid since available and valid synonyms exist]. From Kamakura. Types not known.

Pheretima lauta Ude, 1905: 405 (429?). Types in Hamburg Museum.

?*Pheretima zavataarii* Cognetti, 1909:1. From Madagascar.

Pheretima ornata Gates, 1927:20. From Laisho. Types in Indian and U.S. National Museums.

Pheretima corrugata Chen, 1931: 131. Types in Smithsonian Institution.

??*Pheretima sheni* Chen, 1935: 38 [cf. *A. corticis*, *A. illotus*]. From Hong Kong. Types in U.S. National Museum: 20181.

Pheretima robusta: Michaelsen, 1900: 299; Gates, 1972a: 216 (syn. *ornata*, *?zavatarii*, *?sheni*).
Amyntas robustus: Sims & Easton, 1972: 234; Easton, 1981: 56 (syn. *campestris* Goto & Hatai, 1898 [non Lee, 1952], *corrugata*, *lauta*, *mastakae* [sic]).

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 1972a).

Distribution: Widespread species by introduction, found in China (homeland?), Taiwan, Korea, 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 may be in synonymy as it differs only in an extra pair of spermathecal pores in 6/7. Easton (1981) also had *Amyntas 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. Gates (1972a: 216-218) said *A. robustus* was a parthenogenetic species complex that possibly involved athecal *Amyntas sheni* (Chen, 1935) and morphs with various spermathecal deformities; and he thought it especially similar to, and possibly a junior synonym of, *Amyntas aspergillum* (Perrier, 1872:118) which is known from China (Fuchow, Amoy and Kowloon) as well as Taiwan (Taipei). *A. aspergillum* has spermathecae in 7/8/9 but tends to a larger size of 180-375 mm, and has a possible junior synonym in the Taiwanese *Perichaeta takatorii* Goto & Hatai, 1898 according to Michaelsen (1900b: 318).

In the current studies a Japanese specimen was identified that, apart from its spermathecae in 6/7/8/9, was identical with sympatric specimens attributable to *A. robustus* (pers. obs.), which is why this option is given in the above diagnosis. Moreover, two taxa with spermathecae in 6/7/8/9 recently described from Okinawa are similar on most points to *Amyntas robustus* from which they were inadequately differentiated (see *A. kunigamiensis* and *A. yambaruensis* both from Ishizuka et al., 2000a).

Amyntas scholasticus (Goto & Hatai, 1898)

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

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

Amyntas scholasticus: Easton, 1981: 57.

Diagnosis: Spermathecal pores in 4/5/6/7/8 (not 4/5/6/7/8/9). Male pores superficial on segment 18. Genital markings absent. Intestinal caeca simple. Spermathecae partly with and partly without diverticula. Prostatic gland present, duct aborted (always?).

Distribution: Japan (Tokyo).

Remarks: Michaelsen (1900b) 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 *Amyntas 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 (1900b), placed this species in synonymy of "*Pheretima divergens*" which is now in synonymy of *Amyntas 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 parthenogenetically 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.

Amyntas yambaruensis (Ishizuka & Azama, 2000). **comb. nov.**

Pheretima yambaruensis Ishizuka et al., 2000a: 90.

Note: Authorship cited as in Ishizuka (2001: 101) rather than "Ishizuka et al." as would be recommended by ICZN (1999: Art. 51C).

Diagnosis: Spermathecal pores in 6/7/8/9. Male pores superficial. Genital marking small near spermathecal and male pores. Intestinal caeca simple, incised.

Distribution: Japan (Okinawa).

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

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, 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 *Amyntas*. These authors further assumed a taxon to belong in *Amyntas* unless copulatory pouches were proven; thereby several members of the *Metaphire hilgendorfi* species-complex are provisionally retained in *Amyntas*.

Metaphire californica (Kinberg, 1867)

Pheretima californica Kinberg, 1867: 102. From San Francisco. Type in Stockholm: 160.

Pheretima modesta Michaelsen, 1927: 88.

Pheretima molesta Gates, 1932: 420.

(*Pheretima sakaguchii* Ohfuchi, 1938c: 53)?

(*Pheretima sonaiensis* Ohfuchi, 1956: 154)?

Pheretima californica: Gates, 1972a: 174 (syn. *modesta*, *molesta*).

Metaphire californica: Easton, 1981: 57 (syn. *?sakaguchii*, *?sonaiensis*).

Diagnosis: Spermathecal pores in 7/8/9 (rarely 6/7/8/9). Male pores in copulatory pouches on segment 18. Genital markings absent. Intestinal caeca simple and often, but not always, with incised margins.

Distribution: Oriental origin, widely distributed globally by human activities. In Japan, known from Honshu to Okinawa (Easton, 1981).

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).

Metaphire hilgendorfi / *Amyntas tokioensis* species-complex

Amyntas tokioensis species-group (part) Sims & Easton, 1972: 237.

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

Composite “Distribution, Diagnosis and Remarks” for this spp-complex are given below.

Included species recorded from Japan:

Amyntas ambiguus (Cognetti, 1906)

Pheretima ambigua Cognetti, 1906: 782 [non *Pheretima barbara ambigua* Cognetti, 1913: 302 (= *Pheretima (Parapheretima) barbara ambigua*). Note: under ICZN (1999: Art. 57.2 Examples) this latter name is a primary homonym that is permanently invalid but is not replaced here]. From Yokohama. Type in Vienna: 3979.

Amyntas ambiguus: Sims & Easton, 1972: 236, 240 (*Amyntas illotus* species-group); Easton, 1981: 51.

Remarks: Lacking spermathecae, but presumably with manicate intestinal caeca.

Amyntas bimaculatus (Ishizuka, 1999b). **comb. nov.**

Pheretima bimaculata Ishizuka, 1999b: 42.

Pheretima silvatica Ishizuka, 1999b: 46. syn. nov.

Remarks: Descriptions of these two species are confused regarding the distribution of genital markings, but both are mutually similar and also resemble *Amyntas tappensis* (Ohfuchi, 1935) thereby possibly qualifying for synonymy with it in *A. vittatus* - see also ‘*Pheretima conjugata*, *A. purpuratus*, *A. silvaticus*, *A. surcatus*, and ‘*Pheretima aokii*’.

Amyntas gomejimensis (Ohfuchi, 1937)

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

Amyntas gomejimensis: Sims & Easton, 1972: 237 (*tokioensis*-group); Easton, 1981: 52; Ishizuka, 1999a: 59 (misspelled “gomejimaensis”).

Remarks: Stated by Ohfuchi (1937: 19) to resemble *Pheretima servinus* (= *Metaphire servina*) in all characters except for its lack of genital markings; thus, because no fully mature specimens were found, it is possibly in synonymy of that taxon.

***Amyntas purpuratus* (Ishizuka, 1999b). comb. nov.**

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

Remarks: The description is confused regarding the distribution of anterior genital markings, and it is probable that this species, as with *Amyntas bimaculatus*, is similar to *Amyntas tappensis* (Ohfuchi, 1935) and therefore in synonymy of *A. vittatus*.

***Amyntas surcatus* (Ishizuka, 1999b). comb. nov.**

Pheretima surcata Ishizuka, 1999b: 48; 2001: 63.

Remarks: Poorly differentiated from Ishizuka’s *Amyntas bimaculatus* and thus similar to *Amyntas tappensis* (Ohfuchi, 1935) and therefore possibly also in synonymy of *A. vittatus*.

***Amyntas tappensis* (Ohfuchi, 1935)**

Pheretima tappensis Ohfuchi, 1935: 409, figs. 1-5. Types?

Amyntas tappensis: Sims & Easton, 1972: 237; Easton, 1981: 52.

Remarks: Described with spermathecae in 6/7/8 and manicate intestinal caeca, this taxon is possibly in synonymy of *Amyntas vittatus* or, if the male pores are in copulatory pouches, it may be more closely related to *Metaphire servina*.

***Amyntas tokioensis* (Beddard, 1892)**

Perichaeta tokioensis Beddard, 1892b: 762 [Published December, 1892 according to Michaelsen, 1900: 272]. From Japan (Tokyo). Holotype in British Museum: 1904.10.5.166 (inspected by Sims & Easton, 1972: 181, 191).

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

Amyntas tokioensis: Sims & Easton, 1972: 237; Easton, 1981: 51.

Pheretima verticosa Ishizuka, 1999b: 50, figs. 75-83. **syn. nov.**

Remarks: 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 anteriorly on 8

and 9 (or more likely 7 and 8 according to the position of the internal glands?) just medial to the spermathecal pores, with two or three glandular pores near to and medial to the male pores (all markings with glands internally). Spermathecae as in *Perichaeta rokugo* (= *M. hilgendorfi* i.e., with diverticula long and widened proximally). Michaelsen (1900b) reported the intestinal caeca form as “usual”, but Sims & Easton (1972:191) state it is multiple (= manicate). Michaelsen also thought that *A. parvicystis* (Goto & Hatai, 1899) was possibly a variety of *A. tokioensis* and it is the current author’s opinion that the various degraded morphs of *A. vittatus* and *A. tappensis* may also be synonymous, and therefore so too are all of these taxa’s synonyms. *A. tokioensis* may then be the representative taxon of an *Amyntas* species-complex currently combined, uncomfortably, within the *Metaphire hilgendorfi* species-complex, that would be redefined to accept spermathecal pores as absent, or in 6/7/8, or just in 7/8.

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).

***Amyntas vittatus* (Goto & Hatai, 1898)**

Perichaeta vittata Goto & Hatai, 1898: 74. From Tokyo, Kamakura. Types?

Pheretima vittata: Michaelsen, 1900: 312; Ishizuka, 2001: 64.

Amyntas vittatus: Sims & Easton, 1972: 236; Easton, 1981: 51.

Distribution: Japan and Korea.

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. Their material lacked male pores and prostates, but one of their “numerous” specimens was stated to have a pair of spermathecae in 8 with pores in 7/8. As noted under the account of *Metaphire hilgendorfi* herein, it is possible that Goto & Hatai’s subsequent *P. irregularis* is also a more degraded morph of *A. vittatus*. Several variable specimens newly collected from Tokyo and studied by the current author agree with *A. vittatus* and also merge characteristics with *A. schizoporus* and *M. 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*.

Moreover, Ishizuka (2001: 61, 64) also shows specimens claimed to be either *Pheretima irregularis* or *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 opening in 6/7/8. It is further possible that Ohfuchi's *P. tappensis* is also in synonymy along with its various junior synonyms comprising several of Ishizuka's proposed taxa (e.g. *conjugata*, *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 the prior *A. tokioensis*, as discussed under that taxon's account.

***Amyntas yunoshimensis* (Hatai, 1930)**

Pheretima yunoshimensis Hatai, 1930b: 655; Ishizuka (1999a: 67) [name misspelt "*yunoshimaensis*"]; Ishizuka, 2001: 105 [name misspelt "*yunishimaensis*"]. From Hokkaido. Types?

Amyntas yunoshimensis: Sims & Easton, 1972: 237; Easton, 1981: 52.

Remarks: Sims & Easton (1972: 237) have this taxon partly in an *Amyntas tokioensis*-group with spermathecal pores in 6/7/8, and partly in an "*Amyntas sieboldi*-group" with spermathecal pores in 6/7/8/9; accordingly, this latter condition is added to the *hilgendorfi*-complex diagnosis (cf. Easton, 1981).

***Metaphire agrestis* (Goto & Hatai, 1899). comb. nov.**

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

Pheretima agrestis: Michaelsen, 1900: 313 ("*possibly a variety of P. hilgendorfi*"); Ishizuka et al., 2000b: 179 [confused description has "Three pairs of spermathecal pores in 6/7/8", thus a possible misidentification]; Ishizuka, 2001: 67, 103 (syn. *hataii*).

Amyntas agrestis: Beddard, 1900: 637; Sims & Easton, 1972: 235; Easton, 1981: 51.

Pheretima hataii Ohfuchi, 1937a: 13, fig. 1. From near Morioka. Types unknown.

Pheretima striata Ishizuka, 1999b: 53. **syn. nov.**

Distribution: From Japan and Korea (e.g. Hong et al., 2001: 265) and reported as introduced into North America (e.g. Edwards & Lofty, 1977: 63).

Diagnosis: Spermathecae paired in 5/6/7/8; markings as closely paired dark patches or stripes on 7 and/or 8 and sometimes on 6 or 18 also, that lack glands internally; male pores, when present, slightly invaginated; intestinal caeca manicate.

Remarks: Male pores were not observed in the original type description, but having them in slight copulatory pouches (as in specimens of synonymous *Metaphire hataii*) would qualify this taxon for inclusion in *Metaphire*. 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 retained separately, as *Amyntas agrestis* and *Metaphire hataii* by Sims & Easton (1972) and Easton (1981) on the basis of possible 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 although possibly not the holotype despite the figure legends for Ishizuka's figs. 91-101 being confused) had male pores and some examples of *P. agrestis* and/or *P. striata* shown in Ishizuka (2001: 67) also had large paired presetal papillae on 18, as were described for a few of Goto & Hatai's original specimens. The original description included a few specimens that lacked genital markings and these would presumably be indistinguishable, apart perhaps from convoluted spermathecal diverticula, from Goto & Hatai's subsequent *M. communissima*.

***Metaphire communissima* (Goto & Hatai, 1899). comb. nov.**

?*Perichaeta sieboldi*: Beddard, 1892b:759 (cf. *Metaphire hilgendorfi*; *M. sieboldi*).

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

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

Perichaeta sieboldi lenzi Michaelsen, 1899: 9. Types missing.

Pheretima communissima: Michaelsen, 1900: 262 [syn. *Perichaeta sieboldii*: Goto & Hatai, 1898: 65 (non Horst, 1883), *sieboldi* var. *lenzi*]; Ishizuka, 2001: 66.

Amyntas communissimus: Sims & Easton, 1972: 235 (syn. *sieboldi lenzi*); Easton, 1981: 51 (syn. *sieboldi*: Goto & Hatai, 1898).

Pheretima florea Ishizuka, 1999b: 52. **syn. nov.** [misspelt “*frolea*” in Ishizuka (2001: 66)]. From Mt. Daibosatsu-toge (in Yamanashi-ken), four types in Tokyo National Science Museum.

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 (1900b: 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 (1900b: 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 (1900b: 262) as 90-250 mm; and spermathecal ampullae stated to be “shovel-shaped” in *florea* as opposed to “globular” in *communissima*, even though Michaelsen (1900b: 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 *M. agrestis* 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 be ignorant of 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 Yamanashi-ken in about the middle of the known range.

Metaphire hilgendorfi (Michaelsen, 1892). **comb. nov.**

Perichaeta hilgendorfi Michaelsen, 1892: 235, fig. 15 (published in September, 1892). From ‘Japan’ (Hakodate, Yokohama and possibly another locality). Types of all five varieties in Humboldt Museum, Berlin: 2123, 2114, 2149 (all possibly lost).

Perichaeta rokugo Beddard, 1892b: 756, tab. 32, figs. 1-7 (published in December, 1892). From ‘Japan’. Types in British Museum: 1904.10.5.144-145.

?*Perichaeta schizopora* Goto & Hatai, 1898: 76. From Tokyo. Types? Spermathecal pores in 7/8, spermathecae irregular; prostates aborted.

?*Perichaeta irregularis* Goto & Hatai, 1899: 13 [non *Perichaeta irregularis* Spencer, 1895: 288 (= *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 have not been considered congeneric after 1899, e.g. Michaelsen (1900b) at least had them in separate genera (see also Blakemore, 2000: 298)]. From Uwajima and Takahashi. Types unknown. Spermathecae, genital markings, male pores and prostates aborted.

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 hilgendorfi: Michaelsen, 1900: 272; 313, 315, 317 [syn. *rokugo*, *sieboldi*: Beddard, 1892 [non Horst, 1883 (= *Metaphire sieboldi*)], *levis*, ?*agrestis*, ?*glandularis*, ?*schizopora*]; Beddard, 1900: (syn. *rokugo*, *irregularis* Goto & Hatai, *schizopora*); Ishizuka, 2000d; 2001: 61, 103 [syn. *glandularis* (misspelt “*galndularis*”), *rokugo*].

Amyntas hilgendorfi: Easton, 1981: 51 (appearing to accept Beddard's 1900 synonymy of *rokugo*, *irregularis*, *schizopora* rather than Michaelsen's synonymies).

Remarks: Diagnoses of the various forms of this taxon from Michaelsen (1892, 1900b) are: with spermathecal pores in 6/7 and/or 7/8 or 5/6/7/8; genital markings as presetal, central patches with several internal pore-glands in 8 and/or 9, and often in 17 and/or 18; and with intestinal caeca manicate. *Perichaeta glandularis* was described by Goto & Hatai (1899) with markings in 7 and 17/18 and figured with male pores in copulatory pouches, but in other regards complies with Michaelsen's α morph.

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 *Amyntas*. Although Michaelsen (1900b) 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) which he variously dates as either "1898" or "1899".

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 the current author's opinion they are both possibly in synonymy of *A. vittatus*). Michaelsen (1900b) included *P. levis* in his *P. hilgendorfi* synonymy, but it was maintained separately, at least by Easton (1981), and is provisionally retained herein as *Metaphire levis* although it too may actually belong in synonymy of *A. vittatus*.

The list of included species in the "*Amyntas hilgendorfi* species-complex" by Easton (1981) was fairly extensive and he appeared to accept the synonymies of *A. hilgendorfi* s. strict. by Beddard (1900) rather than those by Michaelsen (1900b).

?*Metaphire levis* (Goto & Hatai, 1899)

Perichaeta levis Goto & Hatai, 1899: 20, fig. 12. From Takahashi and Kumamoto (Kyushu). Types missing (Reynolds & Cook, 1976).

Metaphire levis: Sims & Easton, 1972: 238 (*Metaphire glandularis* species-group); Easton, 1981: 51 (genus not stated).

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

Distribution: Japan and reported as introduced into North America by Easton (1981: 53).

Remarks: Possibly this species name is in synonymy of *M. hilgendorfi* as was indicated by Michaelsen (1900b: 272) [cf. Easton (1981) who appears to have maintained them separately] or, more likely in the current author's opinion, it is in synonymy with *Amyntas vittatus*.

Metaphire servina (Hatai & Ohfuchi, 1937)

Pheretima servinus Hatai & Ohfuchi, 1937: 1. Types? *Metaphire servina*: Sims & Easton, 1972: 238 (*Metaphire glandularis* species-group); Easton, 1981: 59.

Diagnosis: Spermathecal pores in 6/7/8. Male pores within copulatory pouches on 18. Genital markings small, paired median to male pores equatorially on 18. Intestinal caeca manicate.

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* (= *Metaphire agrestis*) 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 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.

Metaphire vesiculata: Sims & Easton, 1972: 238 (*Metaphire glandularis* species-group).

Pheretima sp. Michaelsen, 1903: 100.

?*Pheretima köllikeri* Michaelsen, 1928: 8 (et *P. koellikeri*). **syn. nov.** From "Japan". Types?

Pheretima (Parapheretima) koellikeri: Easton, 1981: 60 (syn. *Pheretima* sp. Michaelsen, 1903, ?*vesiculata*).

?*Pheretima okutamaensis* Ishizuka, 1999b: 38. **syn. nov.**

?*Pheretima biggiberosa* Ishizuka, 1999b: 38. **syn. nov.**

Diagnosis: Spermathecal pores in 6/7/8. Male pores within copulatory pouches on 18 (with secretory diverticula internally). Genital markings absent. Intestinal caeca manicate. (Nephridia absent from spermathecal ducts).

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)]. Synonymy of *Pheretima koellikeri* assumes this species lacks nephridia on the spermathecal ducts and, if so, removes this genus from the Japanese list. Sims & Easton (1972: 222) only provisionally placed this species 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. Nevertheless, a characteristic of *Metaphire* is having stalked glands, rather than secretory diverticula, on the copulatory pouches (Sims & Easton, 1972: 215, 221).

Ishizuka (1999a: 65) has *P. vesiculata* (with spermathecae in 6/7/8) in unlikely synonymy with *Metaphire schmardae* (with spermathecae in 7/8/9), 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*, along with *P. koellikeri*, pending further resolution. Affinities may be with the *M. hilgendorfi* species complex into which this taxon is newly accommodated herein.

Metaphire yamadai (Hatai, 1930)

Pheretima yamadai Hatai, 1930b: 664. From Hata, Kobe, etc. Types?

Pheretima soulensis Kobayashi, 1938b: 131. From Korea. Types ?

Metaphire yamardai [sic, lapsus for *yamadai*]: Sims & Easton, 1972: 238 (*Metaphire glandularis* species-group); Easton, 1981: 60 (syn. *soulensis*).

Diagnosis: Spermathecal pores in 6/7/8/9. Male pores within copulatory pouches occupying 17-19. Genital markings small, median to spermathecal pores on 7 and 8 and within copulatory pouches. Intestinal caeca manicate.

Distribution: Japan, China, Korea (Kobayashi, 1939).

Remarks: Some accounts (erroneously?) have spermathecal pores in 5/6/7/8. This taxon is a new combination in the *M. hilgendorfi* species complex.

Diagnosis of *Metaphire hilgendorfi* species-complex: Spermathecal pores absent, 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. Male pores absent, irregular, or superficial (*Amyntas*), or in copulatory pouches (*Metaphire*). Genital markings absent, or as clusters of papillated pores, or as indistinct pigmented areas on pre- and postclitellar segments. Intestinal caeca manicate originating in segment 26 or 27.

[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, itself an important taxonomic character, may vary considerably in these parthenogenetic morphs].

This diagnosis above is based on the original descriptions, information given by Michaelsen (1900b) and Easton (1981) and personal observations.

Distribution of *Metaphire hilgendorfi* species-complex: Japan, Korea; 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), are: *guc heoensis* Song & Paik, 1970; *jiriensis* Song & Paik, 1971;

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.

Remarks on *Metaphire hilgendorfi* species-complex: Resolution of the *Metaphire hilgendorfi* 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 *Amyntas* 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 the manicate species *Amyntas tokioensis* (Beddard, 1892) is the representative of an *Amyntas* group that can be separated off from the *Metaphire hilgendorfi* species-group.

***Metaphire megascolidioides* (Goto & Hatai, 1899) comb. nov.**

Perichaeta megascolidioides Goto & Hatai, 1899: 21, fig. 16. From Tokyo. Types?

Pheretima megascolidioides: Michaelsen, 1900: 283; Ishizuka, 2001: 94, figs, 1-10.

Amyntas megascolidioides: Sims & Easton, 1972: 236; Easton, 1981: 54.

Diagnosis: Spermathecal pores in 4/5/6/7/8/9. Male pores in slight copulatory pouches on segment 19. Genital markings small paired in line with male pores on 17, 18 and 20. Metandric. Intestinal caeca manicate main sac with additional appendages (= multiple).

Distribution: Japan and Korea.

Remarks: Michaelsen (1900b) repeated Goto & Hatai's statement that the intestinal caeca were paired, thus Easton (1981) had them as simple; Ishizuka (2001) 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 (pers. obs.).

***Metaphire parvula* (Ohfuchi, 1956)**

Pheretima parvula Ohfuchi, 1956: 152 [non *Perichaeta parvula* Goto & Hatai, 1898: 68 (?= *Amyntas gracilis*); nec *Pheretima parvula* Ishizuka, et al., 2000b (= '*Pheretima palarva* Blakemore **nom. nov.**)]. From Sonai, Iriomote-jima. Types?

Metaphire parvula: Sims & Easton, 1972: 239 (*M. planata* group); Easton, 1981: 58.

Diagnosis: Spermathecal pores in 6/7/8. Male pores within copulatory pouches on segment 18. Genital markings absent. Intestinal caeca simple.

Distribution: Japan (Sonai, Iriomote-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 *Amyntas 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 nonsense

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 on 1 January 2000); however, under ICZN (1999: Art. 59.4) the original 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 peguana (Rosa, 1890)

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

Amyntas peguanus: Michaelsen, 1899:7 [sic].

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

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

Metaphire peguana, Sims & Easton, 1972:239 (*peguana*-group); Easton, 1981: 58.

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 (1972a: 208-209) questions the true identity of the Japanese 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 a doubtful Japanese record.

Metaphire riukiensis (Ohfuchi, 1957)

Pheretima riukiensis Ohfuchi, 1957: 248. From Ryukus. Types?

Metaphire riukiensis: Sims & Easton, 1972: 238; Easton, 1981: 58.

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 riukiensis* has male pores in copulatory pouches (= *Metaphire*) or in seminal grooves (= *Amyntas*). Sims & Easton (1972) have this species in a *Metaphire ignobilis* species-group implying their earlier acceptance of the former state.

Metaphire schmardae schmardae (Horst, 1883)

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 (1900b) 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 reported as in Vienna: 3970 by Reynolds & Cook (1976).

Perichaeta triphyla Beddard, 1896:205.

Amyntas schmardae: Michaelsen, 1899: 13 [sic].

Perichaeta schmardae: Michaelsen, 1899: 224 [non *Perichaeta schmardae*: Michaelsen, 1892: 235 (= *P. schmardae* macrochaeta)].

Pheretima schmardae: Michaelsen, 1900: 302 (syn. *trityphla*); Ishizuka, 2001: 30; 56.

Pheretima kikuchii Hatai & Ohfuchi, 1936: 767.

Metaphire schmardae schmardae: Sims & Easton, 1972:217, 239.

Metaphire schmardae: Easton, 1981: 58 [syn. *kikuchii* (and, by reference to Michaelsen, 1892: 235 possibly including *macrochaeta*)].

Diagnosis: Golden grey and about 80-90 mm long. Spermathecal pores in 7/8/9. Male pores within copulatory pouches on segment 18; [Ishizuka (2001: 30, 56) figures these as large and eversible, each with two penes]. Genital markings absent. Intestinal caeca manicate.

Distribution: Japan, China, Taiwan and introduced to other countries around the world. Described as "wide ranging allochthonous" by Sims & Gerard (1999: 132) who also note that it was misidentified as *Metaphire sumatrana* (Horst, 1883) by Beddard (1892a: 155).

Remarks: Michaelsen (1900b:302) and Sims & Easton (1972: 239) list subspecies: *Metaphire schmardae schmardae* (Horst, 1883) and *Metaphire schmardae macrochaeta* (Michaelsen, 1899); this latter subspecies is recorded from Japan and China (Tiensin) by Michaelsen (1900b:302) and is there-

fore provisionally restored to the Japanese list (cf. Easton, 1981). If specimens lacked male pores (and spermathecae), then they would possibly comply with parts of the *M. hilgendorfi* species complex.

Metaphire schmardae macrochaeta (Michaelsen, 1899)

Perichaeta schmardae: Michaelsen, 1892: 235.

Perichaeta schmardae var. *macrochaeta* Michaelsen, 1899: 227. From "Japan". Types lost.

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

Metaphire schmardae macrochaeta: Sims & Easton, 1972: 239; ?Easton, 1981: 58 (by reference to Michaelsen, 1892: 235).

Diagnosis: As *M. 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 (1900b: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.

Metaphire sieboldi (Horst, 1883)

Megascolex sieboldi Horst, 1883: 191 [non *Perichaeta sieboldi*: Goto & Hatai, 1898 (= *Metaphire communissima*)]. From "Japan". Types in Leiden: 1825.

Perichaeta sieboldii: Rosa, 1891:401; Michaelsen, 1892: 235.

?*Perichaeta sieboldi*: Beddard, 1892b: 759.

Perichaeta siboldi [sic]: Michaelsen, 1892: 235.

Amyntas sieboldi [sic]: Michaelsen, 1899: 4.

Pheretima sieboldi: Michaelsen, 1900: 304 [non Goto & Hatai, (1898), 1899; syn. *P. sieboldi*: Beddard, 1892b: 759 (cf. *M. communissima*)].

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

Amyntas sieboldi: Sims & Easton, 1976: 213, 237.

Metaphire sieboldi: Easton, 1981: 59 [syn. *setosa*; Easton also notes: *sieboldi* Horst, 1883 non Goto & Hatai, 1898: 65; nec Beddard, 1892b: 759 (= *Metaphire communissima*, a part of the *Metaphire hilgendorfi* species-complex)].

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 *Amyntas sieboldi* species-group although its male pores in copulatory pouches qualify it for inclusion in *Metaphire* as per Easton (1981). Although the diagnosis of the *M. hilgendorfi* complex would encompass this species, its distinctive blue colour, at least, serves to separate it.

Metaphire tosaensis (Ohfuchi, 1938)

Pheretima tosaensis Ohfuchi, 1938c: 58, figs. 3-5. From Tosa. Types?

Metaphire tosaensis: Easton, 1981: 59.

Diagnosis: Spermathecal pores in 5/6/7/8/9. Male pores within copulatory pouches on 18. Genital markings absent. Intestinal caeca simple with incised margins.

Distribution: Japan.

Metaphire yezoensis (Kobayashi, 1938)

Pheretima yezoensis Kobayashi, 1938: 412. From Hakodate. Types?

Metaphire yezoensis: Easton, 1981: 60.

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

Distribution: Japan (Hokkaido).

Remarks: Sims & Easton (1972) have this species in a *Metaphire merabahensis* species-group but Ishizuka (1999a: 56) places it in synonymy of *Amyntas acinctus*. The two taxa are retained separately as per Easton (1981) pending further investigations.

Genus *Pheretima* Kinberg, 1867

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

Taxonomic note: The genus *Amyntas* 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 1900b, 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 *Amyntas* 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: Following Sims & Easton (1972), 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* removes this genus from the Japanese list.

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 bicincta Perrier, 1875: 1044. From Philippines. Types in Paris Museum.

Pithemera bicincta: Sims & Easton, 1972: 202; Easton, 1981: 60.

Diagnosis: Spermathecal pores in 4/5/6/7/8/9. Male pores superficial on 18. Genital markings large, paired median to male pores and extending into 17 and 19. Intestinal caeca simple originating in 22.

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 *Amyntas 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 elongata Perrier, 1872: 124. From Peru. Types in Paris Museum: 633-644.

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

Megascolex elongata: Vaillant, 1889: 81.

Perichaeta acystis Beddard, 1895: 423.

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

Amyntas elongata: Beddard, 1900: 650.

Pheretima elongata: Michaelsen, 1900:265; Gates, 1972a: 182 [syn. *aelongata* Gates, 1926: 444 (misspelling); non *elongata*: Ohfuchi, 1956:148 (= *A. morrisi*)].

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

Metapheretima elongata: Sims & Easton, 1972: 205 (syn. *biserialis*): Easton, 1976: 40.

Polypheretima elongata: Easton, 1979: 53 (syn. *biserialis*); Easton, 1981: 61 [syn. *biserialis*; non *elongata*: Ohfuchi, 1956 (= *Amyntas morrisi*)].

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) and Easton (1976, 1979).

Remarks: Gates (1972a: 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 *Amyntas morrisoni*. 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 morrisoni* (Beddard, 1892). This action can be ignored.

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

(Mostly parthenogenetically degraded morphs, precipitously given species names that remain available pending synonymy after unification with their biparental/ancestral forms).

Amyntas hibernus (Ishizuka, 1999). **comb. nov.**

Pheretima hiberna Ishizuka, 1999d: 233 [misspelt “*hiverna*” in Ishizuka, 2001: 101].

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’ amphimixis specimens and this degraded morph is possibly merely part of the inadequately described *A. imperfectus* which itself may actually comprise more than one taxon.

Amyntas illotus species-group sensu Sims & Easton (1972).

Amyntas 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); *variens* (Chen, 1938) (part – other components 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., athecate 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 *Amyntas 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’: *Amyntas illotus* sensu Ohfuchi (1956:136) (non Gates, 1932: 397); *A. pusillus* (Ohfuchi, 1956) [now placed in synonymy with *Amyntas 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 *Amyntas 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*).

Included species names reported from Japan:

Amyntas assacceus (Chen, 1938)

Pheretima assacceus Chen, 1938: 382, 401. From Hainan Island. Types?

Amyntas assacceus: Sims & Easton, 1972: 236 (*A. illotus* species-group).

Amyntas asacceus [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 (= *Amyntas minimus*)]. **syn. nov.** [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 *Amyntas* 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.

?*Amyntas proasacceus* [sic] Tsai et al., 2001: 282. **syn. nov.** From Taiwan.

Diagnosis of *Amyntas assacceus*: Morphs variously degraded parthenogenetically; either lacking spermathecae, 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 *Amyntas 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. Possibly a 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).

Pheretima illota Gates, 1932: 397; 1972a: 196 (?syn. *youngi* Gates, 1932: 406). Type locality To Noi, Myanmar. Types, missing.

?*Pheretima youngi* Gates, 1932: 406. Type locality Pang Wo, Myanmar. Types?

(*Pheretima illota*: Ohfuchi, 1956: 136 (non Gates, 1932: 397). [Misidentification]. From Ishigaki and Iriomote Islands (Ibaruma, Hatoma-jima, Hoshitate)).

Amyntas 'illotus': Easton, 1981: 53.

Remarks: The diagnosis of *Amyntas illotus* (Gates, 1932) was restricted by Gates (1972a: 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 (1972a: 196) also surmized that his subsequent *Amyntas 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 overlooking the type locality and accepting Ohfuchi's records, even though the diagnosis of these latter specimens differed considerably from Gates's original.

Amyntas imperfectus (Ishizuka, 1999). **comb. nov.**

Pheretima imperfecta Ishizuka, 1999d: 229.

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*' *oyuensis* 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. oyuensis*, *P. palarva*).

'*Pheretima*' *oyuensis* Ohfuchi, 1937.

Pheretima oyuensis Ohfuchi, 1937a: 24. From Akita-ken. Types?

Pheretima cyuensis [sic, lapsus pro *oyuensis*]: Sims & Easton, 1972: 225.

'*Pheretima*' *oyuensis*: Easton, 1981: 54.

Remarks: Sims & Easton (1972: 225) have as *incertae 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).

Amyntas octo (Ishizuka, 2000). **comb. nov.**

Pheretima octo Ishizuka, 2000b: 31.

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

Remarks: Perhaps similar to *A. stipatus* (cf. *Amyntas corticis*).

***Amyntas stipatus* (Ishizuka, 1999). comb. nov.**

Pheretima stipata Ishizuka, 1999d: 236.

Diagnosis: Spermathecae adiverticulate in 6/7/8/9; male pores superficial; genital markings stated to be absent but actually appear just before and after male pores and almost combine just medially to them; prostate glands often absent (holotype?); intestinal caeca simple.

Remarks: Ancestral populations expected to have complete prostates and spermathecae.

***Amyntas tamaensis* (Ishizuka, 1999). comb. nov.**

Pheretima tamaensis Ishizuka, 1999d: 231.

Diagnosis: Spermathecae adiverticulate in 6/7/8; male pores superficial; genital markings absent, or in 17/18 or in 17/18/19 or in 18/19 only; prostate glands absent; intestinal caeca simple.

Remarks: Ancestral populations expected to have complete prostates and spermathecae.

***'Pheretima' aokii* Ishizuka, 1999**

Pheretima aokii Ishizuka, 1999b: 36; Ishizuka et al., 2000b: 180.

Remarks: Described with adiverticulate spermathecae in 6/7/8 (sometimes lacking??), and lacking prostate glands and male pores. Genital markings are paired clusters of two or more papillae on 18 in the position of the male pores. Its manicate caeca probably place it in the *Metaphire hilgendorfi* species-complex and it is possibly synonymous with *Amyntas tappenensis* or *A. vittatus*. In Ishizuka et al. (2000b: 180) the distribution of this species is claimed to include Korea, but this is without obvious justification.

***'Pheretima' conjugata* Ishizuka, 1999**

Pheretima conjugata Ishizuka, 1999b: 34.

Remarks: Described as either having paired or unilateral spermathecal pores in 6/7 with deformed spermathecae, or lacking them completely, and lacking genital markings and male pores; size 90-140 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. Their manicate caeca probably place these specimens in one or more parts of the *Metaphire hilgendorfi* species-complex: most likely associated with *Pheretima irregularis*, from which Ishizuka (1999b) failed to adequately differentiate his specimens, and thus possibly linked to the prior *A. vittatus*.

***'Pheretima' palarva* Blakemore. nom. nov.**

Pheretima parvula Ishizuka et al., 2000b: 186, figs. 17-24 (descriptions, figure legends and scale bars are confused and intermixed). [Non *Perichata parvula* Goto & Hatai, 1898 (?= *Amyntas gracilis*); nec *Pheretima parvula* Ohfuchi, 1956 (= *Metaphire parvula*)]. [Note: this name mis-cited and misspelt as '*Pheretima parvula* Ishizuka, 2000' by Ishizuka (2001: 12, 69, 102) and "*P. parvora*" by Ishizuka (2001: 46)]. From Tokyo, the types are stated to be in National Science Museum, Tokyo.

Remarks: The replacement name, *P. palarva*, is 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 *P. oyuenensis*, 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 *Amyntas 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*. The replacement name is a Latinized anagrammatic derivation of the original name (gender: feminine).

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 in 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 has been proposed, involving separation of those taxa with affinities to *Amyntas tokioensis* into a new species-group. Full resolution perhaps requires 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 77 valid species belonging to 7 families, retaining most synonymies established by Easton (1981) and revising more recently erected taxa, resulting in an approximately 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 probable 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 (5 native) from the historical region of northeast China called Manchuria (these totals from Tsai et al. 2000, 2001 who also give historical accounts and biogeographical notes for these regions). Gates (1972a) described about 174 mainly pheretimoid species from Myanmar (Burma), with much information on 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 the 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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Addenda (added in proof, Oct. 2003)

Further taxonomic analysis indicated these recent changes:

Amyntas acinctus (Goto & Hatai, 1899) (syn. ?*phaselus*; ?*maculosus* Hatai, 1930 [non Gates, 1933 (= *malaca* Gates, 1936) nec *medimaculosa* Nakamura, 1999 (nom. nud.)]; ?*kamitai*; ?*serrata*, ?*phaselus tamurai*, *P. mutica* Chen, 1938 **syn. nov.**).

Amyntas carnosus (Goto & Hatai, 1899) (syn. *kyamikia* Kobayashi, 1934 **syn. nov.**; ?*youngtai* Hong & James, 2001 **syn. nov.**; *sangyeoli* Hong & James, 2001 **syn. nov.**).

Amyntas conformis (Ishizuka, 2000) (syn. *monticola* Ishizuka, 2000 [a permanently invalid primary homonym, non Beddard, 1912]).

Amyntas papulosus (Rosa, 1896) (syn. *papulosa sauteri*; *composita*; *rockefelleri*; *P. hsinpuensis* Kuo, 1985 **syn. nov.**).

Amyntas tappensis (Ohfuchi, 1935) (syn. *bimaculata* **syn. nov.**, *silvatica* **syn. nov.**, *surcata* **syn. nov.**, *odaesanensis* Hong & James, 2001 **syn. nov.**, *righii* Hong & James, 2001 **syn. nov.**, *fasciiformis* Hong & James, 2001 **syn. nov.**).

Amyntas tokioensis (Beddard, 1892) (syn. ?*parvicystis*; *verticosa* ; ?*eastoni* Hong & James, 2001 **syn. nov.**; ?*boletiformis* Hong & James, 2001 **syn. nov.**).

Metaphire yamadai (Hatai, 1930) (syn. ?*P. pectinifera* Michaelsen, 1931).

Pithemera bicincta (Perrier, 1875) (syn. ?*violacea* Beddard, 1895, ?*amerikiensis* Ohfuchi, 1941 **syn. nov.**).

Amyntas koreanus (Kobayashi, 1934) (syn. *P. conjugata* Ishizuka, 1999 **syn. nov.**).

Metaphire soulensis (Kobayashi, 1938) (syn. *P. shinkeiensis* Kobayashi, 1938 **syn. nov.**, *P. aokii* Ishizuka, 1999 **syn. nov.**).

The latter two taxa are restored as *incertae sedis* ("of uncertain taxonomic position") due to the nature of their various parthenogenetic degradations.