



<http://dx.doi.org/10.11646/zootaxa.3881.5.1>

<http://zoobank.org/urn:lsid:zoobank.org:pub:FE9048E9-DE3A-4502-A95E-27EE8F706AC3>

New species of *Pheretima* (Oligochaeta: Megascolecidae) from the Mt. Malindang Range, Mindanao Island, Philippines

NONILLON M. ASPE¹ & SAMUEL W. JAMES²

¹Department of Natural History Sciences, Graduate School of Science, Hokkaido University, N10 W8, Sapporo 060-0810, Japan.
E-mail: nonillon_aspe@yahoo.com

²Department of Biology, University of Iowa, Iowa City 52242-1324, Iowa, USA. E-mail: samuel-james@uiowa.edu

Abstract

We provide descriptions, with illustrations of internal structures, for 18 new species of *Pheretima* from Mt. Malindang, Misamis Occidental Province, Mindanao Island, Philippines. Among the 18 species, 11 belong to the *P. sangirensis* species group, characterized by having a pair of spermathecal pores in the intersegmental furrow of 7/8 and lacking penial sheaths in the copulatory bursae: *P. maculodorsalis* n. sp., *P. tigris* n. sp., *P. immanis* n. sp., *P. lago* n. sp., *P. nunezae* n. sp., *P. boniaoi* n. sp., *P. malindangensis* n. sp., *P. misamisensis* n. sp., *P. wati* n. sp., *P. longiprostata* n. sp., and *P. nolani* n. sp. One species, *P. longigula* n. sp., belongs to the *P. montana* species group, characterized by having a pair of spermathecal pores in the intersegmental furrow of 7/8 and penial sheaths in the copulatory bursae. Two species, *P. vergrandis* n. sp. and *P. conceptionensis* n. sp., are monothechal. Three species, *P. adevai* n. sp., *P. lluchi* n. sp., and *P. potonganensis* n. sp., belong to the *P. darnleiensis* species group, characterized by having either four or five pairs of spermathecae from vi to ix, with a fifth pair variably present in segment v. One species, *P. subanensis* n. sp., is athecate. All species described here from the Mt. Malindang Range are probably native rather than introduced, and probably do not represent range extensions of species known from neighboring islands in Southeast Asia. We provide an identification key to the *Pheretima* species from Mt. Malindang.

Key words: Earthworm, terrestrial, tropical, taxonomy, new species, diversity

Introduction

Until recently, knowledge of the native earthworm fauna of the Philippines was very limited. Non-specialist biologists in the Philippines erroneously identified all earthworms there as *Lumbricus terrestris* Linnaeus, 1758, a species common to North America and Europe but not detected in recent studies in the Philippines. Organized research on earthworm diversity in the Philippines began after Lawrence Heaney and collaborators discovered that the Isarog shrew-rat (*Rhynchomys isarogensis* Musser & Freeman, 1981) and *Chrotomys gonzalesi* Rickart & Heaney, 1991 feed exclusively on earthworms. The desire of the mammalogists to identify the worms the rat feeds on led to the discovery of 10 new species collected in 1993, all belonging to perichaetine genera in the *Pheretima* complex (Sims & Easton 1972) in the family Megascolecidae (James 2004).

Pheretima Kinberg, 1867, a Southeast Asian group with a range extending from northern Australia to Myanmar and northward to Korea, became the largest genus of earthworms in the Megascolecidae *sensu* Gates (1959). Using computer-based phenetic analyses, Sims & Easton (1972) and Easton (1979) reallocated species in *Pheretima* auct. (pheretimoid species and subspecies) into 'convenient' species groups comprising 10 genera (*Amyntas*, *Archipheretima*, *Pheretima*, *Planapheretima*, *Metapheretima*, *Pithemera*, *Ephemitra*, *Metaphire*, *Polypheretima* and *Pleionogaster*). Blakemore (2007) estimated that among more than 1400 nominal taxa of pheretimoid earthworms (which include numerous synonyms, invalid names, and *lapsus*) there are roughly 930 valid species and subspecies in *Pheretima* auct. He acknowledged around 40 valid species of *Pheretima sensu stricto*, with the distributional range restricted to the Indo-Australian archipelago, Sumatra, and the Philippines.

As the result of taxonomic studies in the last decade, around 200 species of native earthworms representing 10 genera are now now identified from the Philippines (Blakemore 2007; James 2004, 2005, 2006, 2009; James *et al.*

Science Foundation grant (DEB-0072764) to S.W. James, and by a Hokkaido University Special Grant to N.M. Aspe.

References

- Aspe, N.M. (2006) *Diversity and Distribution of Earthworms in Mt. Malindang, Philippines*. M.S. Thesis, School of Graduate Studies, MSU-Iligan Institute of Technology, Iligan City, Philippines, 172 pp.
- Aspe, N.M., Nuñez, O.M. & Torres, M.A. (2009) Diversity and distribution of earthworms in Mt. Malindang, Philippines. *Journal of Nature Studies*, 8, 59–67.
- Bantaowong, U., Chanabun, R., Tongkerd, P., Sutcharit, C., James, S.W. & Panha, S. (2011) A new species of the terrestrial earthworm of the genus *Metaphire* Sims & Easton, 1972 from Thailand with redescription of some species. *Tropical Natural History*, 11, 55–69.
- Beddard, F.E. (1912) The Oligochaeta terricolae of the Philippines. Part 1. The genus *Pheretima*. *Philippine Journal of Science*, 7, 79–203. [series D]
- Beddard, F.E. (1892) On some species of the genus *Perichaeta* (*sensu stricto*). *Proceedings of the Zoological Society of London*, 1892, 153–172.
- Blakemore, R.J. (2006) A series of searchable texts on earthworm biodiversity, ecology and systematics from various regions of the world. 2nd Edition. N. Kaneko & M.T. Ito (Eds). COE Soil Ecology Research Group. Yokohama National University, Japan. Available from: <http://bio-eco.eis.ynu.ac.jp/eng/database/earthworm/%5D> (Accessed 8 Nov 2013)
- Blakemore, R.J. (2007) Updated checklist of pheretimoid (Oligochaeta: Megascolecidae: *Pheretima* auct.) taxa, 109 pp. Available from: <http://www.annelida.net/earthworm/Pheretimoids.pdf> (Accessed 8 Oct 2013)
- Blakemore, R.J., Csuzdi, C., Ito, M.T., Kaneko, N., Kawaguchi, T. & Schilthuizen, M. (2007) Taxonomic status and ecology of Oriental *Pheretima darnleiensis* (Fletcher, 1886) and other earthworms (Oligochaeta: Megascolecidae) from Mt Kinabalu, Borneo. *Zootaxa*, 1613, 23–44.
- Chang, C.H., Shen, H.P. & Chen, J.H. (2009) *Earthworm Fauna of Taiwan*. Biota Taiwanica. National Taiwan University Press, Taiwan, 177 pp.
- Cognetti, D.M.L. (1913) Oligochetes (de Ceram et de Waigeu). *Bijdragen tot de Dierkunde*, 19, 37–41.
- Cognetti, D.M.L. (1922) Descrizione di tre nuovi megascolecini. *Bollettino dei Musei di Zoologia et Anatomia comparata della Reale Università di Torino*, 37, 1–6.
- Darmawan, A., Raffiudin, R. & Widarto, T.H. (2012) Morphological characters and histology of *Pheretima darnleiensis*. *Hayati Journal of Biosciences*, 19, 44–48. <http://dx.doi.org/10.4308/hjb.19.1.44>
- de Queiroz, A. (2005) The resurrection of oceanic dispersal in historical biogeography. *Trends in Ecology and Evolution*, 20, 68–73. <http://dx.doi.org/10.1016/j.tree.2004.11.006>
- Easton, E.G. (1979) A revision of the 'acaecate' earthworms of the *Pheretima* group (Megascolecidae: Oligochaeta): *Archipheretima*, *Metapheretima*, *Planapheretima*, *Pleionogaster* and *Polypheretima*. *Bulletin of the British Museum of Natural History (Zoology)*, 35, 1–126.
- Edwards, C.A. & Bohlen, P.J. (1996) *Biology and Ecology of Earthworms*. Third Edition. Chapman and Hall, London, UK, 433 pp.
- Gates, G.E. (1935) On some earthworms from East Perak and Christmas Island. *Bulletin of the Raffles Museum*, 10, 80–95.
- Gates, G.E. (1937) Notes on some species of *Drawida* and *Pheretima* with descriptions of three new species of *Pheretima*. *Bulletin of the Museum of Comparative Zoology at Harvard College*, 80, 305–335.
- Gates, G.E. (1959) On a taxonomic puzzle and the classification of the earthworms. *Bulletin of the Museum of Comparative Zoology at Harvard College*, 121, 229–261.
- Gates, G.E. (1961) On some species of the oriental earthworm genus *Pheretima* Kinberg, 1867. *Zoologische Mededelingen*, 37, 293–312.
- Gates, G.E. (1971) On reversions to former ancestral conditions in megadrile oligochaetes. *Evolution*, 25, 245–248. <http://dx.doi.org/10.2307/2406517>
- Gates, G.E. (1972) Burmese earthworms – an introduction to the systematics and biology of megadrile oligochaetes with special reference to Southeast Asia. *Transactions of the American Philosophical Society*, 62, 1–327. <http://dx.doi.org/10.2307/1006214>
- Fletcher, J.J. (1887) Notes on Australian earthworms part III. *Proceedings of the Linnean Society of New South Wales*, 1, 943–973.
- Hall, R. (1996) Reconstructing cenozoic SE Asia. In: Hall, R. & Blundell, D.J. (Eds.), *Tectonic evolution of SE Asia*. Vol. 106. Geological Society of London Special Publications, pp. 153–184.
- Heaney, L.R. (1985) Zoogeographic evidence for Middle and Late Pleistocene land bridges to the Philippine Islands. *Modern Quaternary Research in Southeast Asia*, 9, 127–144.
- Hong, Y. & James, S.W. (2008a) Nine new species of earthworms (Oligochaeta: Megascolecidae) of the Banaue rice terraces,

- Philippines. *Revue Suisse de Zoologie*, 115, 341–354.
- Hong, Y. & James, S.W. (2008b) Three new earthworms of the genus *Pheretima* (Oligochaeta: Megascolecidae) from Mt. Makiling, Luzon Island, Philippines. *Zootaxa*, 1695, 45–52.
- Hong, Y. & James, S.W. (2008c) Two new earthworms of the genus *Pheretima* (Oligochaeta: Megascolecidae) from Mt. Isarog, Luzon Island, Philippines. *Journal of Natural History*, 42, 1565–1571.
<http://dx.doi.org/10.1080/00222930802000398>
- Hong, Y. & James, S.W. (2009) New earthworms of the *Pheretima urceolata* species group (Oligochaeta: Megascolecidae) from southern Luzon, Philippines. *Zootaxa*, 2059, 33–45.
- Hong, Y. & James, S.W. (2010) Six new earthworms of the genus *Pheretima* (Oligochaeta: Megascolecidae) from Balbalan-Balbalasang, Kalinga Province, the Philippines. *Zoological Studies*, 49, 523–533.
- Hong, Y. & James, S.W. (2011a) New species of *Pheretima*, *Pithemera*, and *Polypheretima* (Clitellata: Megascolecidae) from Kalbaryo, Luzon Island, Philippines. *Raffles Bulletin of Zoology*, 59, 19–28.
- Hong, Y. & James, S.W. (2011b) New earthworm species of the genus *Pheretima* (Clitellata: Megascolecidae) from Mountain Province, Philippines. *Journal of Natural History*, 45, 1769–1788.
<http://dx.doi.org/10.1080/00222933.2011.560726>
- Horst, R. (1893) Descriptions of earthworms. No. 7. On Malayan earthworms. *Nores Leyden Museum*, 15, 316–329.
- James, S.W. (2004) New species of *Amyntas*, *Pheretima*, *Pleionogaster* (Oligochaeta: Megascolecidae) of the Mt. Kitanglad Range, Mindanao Island, Philippines. *Raffles Bulletin of Zoology*, 52, 289–313.
- James, S.W., Hong, Y. & Kim, T.H. (2004) New earthworms of *Pheretima* and *Pithemera* (Oligochaeta: Megascolecidae) from Mt. Arayat, Luzon Island, Philippines. *Revue Suisse de Zoologie*, 111, 3–10.
- James, S.W. (2005) New genera and species of pheretimoid earthworms (Clitellata: Megascolecidae) from southern Luzon, Philippines. *Systematics and Biodiversity*, 2, 271–79.
<http://dx.doi.org/10.1017/S1477200004001446>
- James, S.W. (2006) The earthworm genus *Pleionogaster* (Clitellata: Megascolecidae) in southern Luzon, Philippines. *Organisms, Diversity & Evolution*, 8, 1–20.
- James, S.W. (2009) Revision of the earthworm genus *Archipheretima* Michaelsen (Clitellata: Megascolecidae), with descriptions of new species from Luzon and Catanduanes Islands, Philippines. *Organisms, Diversity & Evolution*, 9, 244.e1–244.e16.
- Joshi, R.C., Matchoc, O.R.O., Cabigat, J.C. & James, S.W. (1999) Survey of earthworms in the Ifugao Rice Terraces, Philippines. *Journal of Environmental Science and Management*, 2, 1–12.
- Kinberg, J.G.H. (1867) Annulata nova. *Ofvers K. Vetensk Academy, Ford Stockholm*, 23, 97–103.
- Lee, K.E. (1981) Earthworms (Annelida: Oligochaeta) of Vanua Tu (New Hebrides Islands). *Australian Journal of Zoology*, 29, 535–572.
<http://dx.doi.org/10.1071/ZO9810535>
- Linnaeus, C. (1758) *Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis*. Salvii, T. (Ed.), Stockholm, Sweden, 823 pp.
- Mallari, N., Tabaranza, B. Jr. & Crosby, M. (2001) *Key Conservation Sites in the Philippines*. Bookmark, Philippines, 485 pp.
- Michaelsen, W. (1891) Oligochaeten des Naturhistorischen Museum in Hamburg IV. *Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten*, 8, 1–4.
- Michaelsen, W. (1896) Oligochaeten. In: Kükenthal, W. (Ed.), *Ergebnisse einer zoologischen Forschungsreise in den Molukken und Borneo. Abhandlungen der Senckenbergischen naturforschenden Gesellschaft*, 23, 192–243.
- Michaelsen, W. (1899) Terrikolen von verschiedenen Gebieten der Erde. *Mitteilungen aus dem Naturhistorischen Museum in Hamburg*, 16, 1–122.
- Michaelsen, W. (1900) *Oligochaeta*. Friedländer & Sohn, Berlin, 571 pp.
- Müller, F. (1857) Description of a new earthworm (*Lumbricus corethrurus*). *Annals and Magazine of Natural History*, 20, 13–15.
<http://dx.doi.org/10.1080/00222935709487865>
- Musser, G.G. & Freeman, P.W. (1981) A new species of *Rhynchomys* (Muridae) from the Philippines. *Mammalogy Papers, University of Nebraska State*, 16, 153–159.
- Ohfuchi, S. (1938) New and little known forms of earthworms, *Pheretima* from Nippon. *Research Bulletin Saito Ho-on Kai Museum*, 15, 53–66.
- Ohfuchi, S. (1957) On a collection of terrestrial Oligochaeta obtained from the Riu-Kiu Islands, together with a notes on their geographical distribution (Part 2). *Journal of Agricultural Science, Tokyo*, 3, 243–261.
- Rickart, E.A., Heaney, L.R. & Uzzurum, R.C.B. (1991) Distribution and ecology of small mammals along an elevational transect in southeastern Luzon, Philippines. *Journal of Mammalogy*, 72, 458–469.
<http://dx.doi.org/10.2307/1382128>
- Rosa, D. (1891) Die exotischen Terrikolen des k. k. naturhistorischen Hofmuseums. *Annalen des K. K. Naturhistorischen Hofmuseums*, 6, 379–406. [Wien]
- Rosa, D. (1898) On some new earthworms in the British Museum. *Annals and Magazine of Natural History*, 2, 276–290. [Series 7]
- Sims, R. & Easton, E. (1972) A numerical revision of the earthworm genus *Pheretima* with the recognition of new genera and

an appendix on the earthworms collected by the Royal Society North Borneo Expedition. *Biological Journal of the Linnean Society*, 4, 169–268.

<http://dx.doi.org/10.1111/j.1095-8312.1972.tb00694.x>

Schmarda, L.K. (1861) *Neue wirbellose Thiere beobachtet und gesammelt auf einer Reise un die Erde 1853 bis 1857. 2, Turbellarian, Rotatorien und Anneliden*. W. Engelmann, Leipzig, 164 pp.

Tsai, C.F., Shen, H.P. & Tsai, S.C. (2004) *Endemicity and altitudinal stratification in distribution of megascolecid earthworms in the Centro-Western Taiwan*. Vol. 6. Endemic Research Institute, Chichi, Taiwan, 18 pp.

Tsai, C.F., Tsai, S.C. & Shen, H.P. (2004) A new gigantic earthworm of the genus *Metaphire* Sims and Easton (Megascolecidae: Oligochaeta) from Taiwan with reference to evolutionary trends in body sizes and segment numbers of the *Pheretima* genus-group. *Journal of Natural History*, 38, 877–887.

<http://dx.doi.org/10.1080/0022293021000053867>

Ude, H. (1905) Terricole Oligochäten von den Inseln der Sudsee u. verschiedenen andern Gebieten der Erde. *Zeitschrift für wissenschaftliche Zoologie*, 83, 405–501.

Vidal, N., Azvolinsky, A., Cruaud, C. & Hedges, B.S. (2008) Origin of tropical American burrowing reptiles by transatlantic rafting. *Biology Letters*, 4, 115–118.

<http://dx.doi.org/10.1098/rsbl.2007.0531>