*Journal of Species Research* 5(3):541-546, 2016

# New record of three aquatic species of Enchytraeidae (Annelida: Clitellata) from Korea

Jeounghee Lee[1] and Jongwoo Jung[1,2,*]

[1]*The Division of EcoCreative, Ewha Womans University, Seoul 03760, Republic of Korea*
[2]*Department of Science Education, Ewha Womans University, Seoul 03760, Republic of Korea*

**Correspondent: jongwoo@ewha.ac.kr*

Enchytraeidae is one of the largest groups in Clitellata. They are commonly found in soil and aquatic environments and play important roles in these ecosystems. It is not easy to study enchytraeid clitellates because of difficulty in distinguishing morphologies between closely related species. In Korea, 29 species have been reported in this family. Of these, 27 species are terrestrial and only two species are aquatic. Here, we report three aquatic enchytraeid species new to Korea: *Fridericia glandifera* Friend, 1913, *Henlea montana* Rota, 1994 and *Marionina brendae* Bretscher, 1899.

Keywords: aquatic Clitellata, Enchytraidae, *Fridericia*, *Henlaena*, *Marionina*

© 2016 National Institute of Biological Resources
DOI:10.12651/JSR.2016.5.3.541

## Introduction

Family enchytraeidae is one of the largest groups in clitellate annelids. It contains more than 700 species (Schmelz and Collado, 2015). Most of them dwell in terrestrial habitats, but some genera and species are aquatic or amphibious in both habitats (Giani, 1976; Timm, 1994; Rota and Healy, 1999; Schmelz, 2003; Erséus, 2005). They play important roles in the soil and sediment ecology as environmental indicator species as they could be useful parameters for soil quality assessments (Didden, 1993; Graefe, 1993; Graefe and Schmelz, 1999). It is difficult to identify enchytraeid species due to strong morphological resemblance between closely related species in the location of chaetae and the shape of the reproductive organs, etc (Schmelz, 1996; Mastamoros, 2011). There have been many studies on this group of animal in Asia, and most of them focused on terrestrial specie. However, a few species aquatic or semi-aquatic species have been reported (Yamaguchi, 1953; Torii and Ohtaka, 2007; Wang and Cui, 2007; Chen and Xie, 2008; Torii, 2012). According to recent studies about this group of animals in Korea, 27 terrestrial species and 2 aquatic species have been reported (An and Yang, 2009; Dózsa-Farkas and Hong, 2010; Christensen and Dózsa-Farkas, 2012; Dózsa-Farkas *et al*., 2014). Two aquatic species, however, were undetermined: *Henlea* sp. 1 and *Mesenchytreanus* sp. 1 (Park *et al*., 2013). Here, we report three aquatic enchytraeid species new to Korea: *Fridericia glandifera* Friend, 1913, *Henlea montana* Rota, 1994 and *Marionina brendae* Bretscher, 1899.

## Materials and Methods

Worms were collected from reservoirs and streams of two locations, Anmyeondo Island and Geojedo Island in Korea. All specimens were collected in spring season to observe mature sex organs. We shoveled mud and sediment in sampling locations. Part of samples were fixed in either 8% formalin or 80% ethanol solution, and the others were not fixed to observe specimens alive. Living and fixed specimens were examined with a SMZ-168 stereomicroscope (Motic, Hong Kong). For species identification, samples were mounted on slide glasses with Canada balsam following the protocol of Erséus (1994). The mounted slides were examined under BX41 research microscope (Olympus, Tokyo, Japan) and then were identified to morphospecies following Schmelz and Collado (2010) and Schmelz (2003). Pictures of morphological characters were taken with the camera DP22 (Olympus, Tokyo, Japan) attached to the research microscope. Specimens are deposited in the National Institute of Biological Resources (NIBR), the Republic of Korea.

## Results and Discussion

Phylum Annelida Linnaeus, 1758
Class Clitellata Linnaeus, 1740
Order Enchytraeida
Family Enchytraeidae Vejdovský, 1879
Genus *Fridericia* Michaelsen, 1889

***Fridericia glandifera* Friend, 1913 (Fig. 1A-E)**
*Friderica glandifera* Friend, 1912: 40
*Friderica glandifera* Freiend, 1913: 263-265, Figs. 24-27; Černosvitov, 1937: 202-203, Fig. 9; Nielsen and Christensen, 1959: 71: "sp. dub."
*Fridericia callosa* Eisén, 1978; Giani, 1979: 354-355.

**Material examined.** 1 individual was collected from Seungeon-ri, Anmyeon-eup, Taean-gun, Chungcheongnam-do. E: 126°19′57.63″ N: 36°30′44.89″, 23 May 2013 (collector: Lee J). One individual mounted on a slide was deposited at NIBR (KOSPIV0000193706).
**Measurement.** Length 8.42 mm, width 0.32-0.46 mm, number of segments 58 in fixed state.
**Diagnosis.** Color reddish. Brain slightly concave anteriorly, rounded posteriorly (Fig. 1A). Chaetae beginning from II, arranged in fan-like bundles, with straight distally and strongly bent proximally without nodulus (Fig. 1B). Chaetae of XII lacking. Clitellum elevated conspicuously, from mid XI to XIII, girdle-shaped, cells in dense, indefinite rows (Fig. 1C). Oesophageal appendages short, unbranched. Spermathecae in V, ampullae joint proximally, unequally large, diverticula-like protrusions (Fig. 1D, E).
**Remarks.** This species can be confused with *Fridericia parathalassia* Schmelz, 2002. *Fridericia parathalassia* is common and widespread in soils close to the marine shoreline (Schmelz and Collado, 2010). But this specimen has collected in freshwater environment.
**World distribution.** Denmark, England, France, Germany.

Genus *Henlea* Michaelsen, 1889

***Henlea montana* Rota, 1994 (Fig. 2A-F)**
*Henlea montana* Rota, 1994: 246-248, Fig. 3A-F.

**Material examined.** 1 individual was collected from Seungeon-ri, Anmyeon-eup, Taean-gun, Chungcheongnam-do. E: 126°19′57.63″ N: 36°30′44.89″, 23 May 2013 (collector: Lee J). One individual mounted on a slide was deposited at NIBR (KOSPIV0000193704).
**Measurement.** Length 9.12 mm, width 0.32-0.44 mm, number of segments 63 in fixed state.

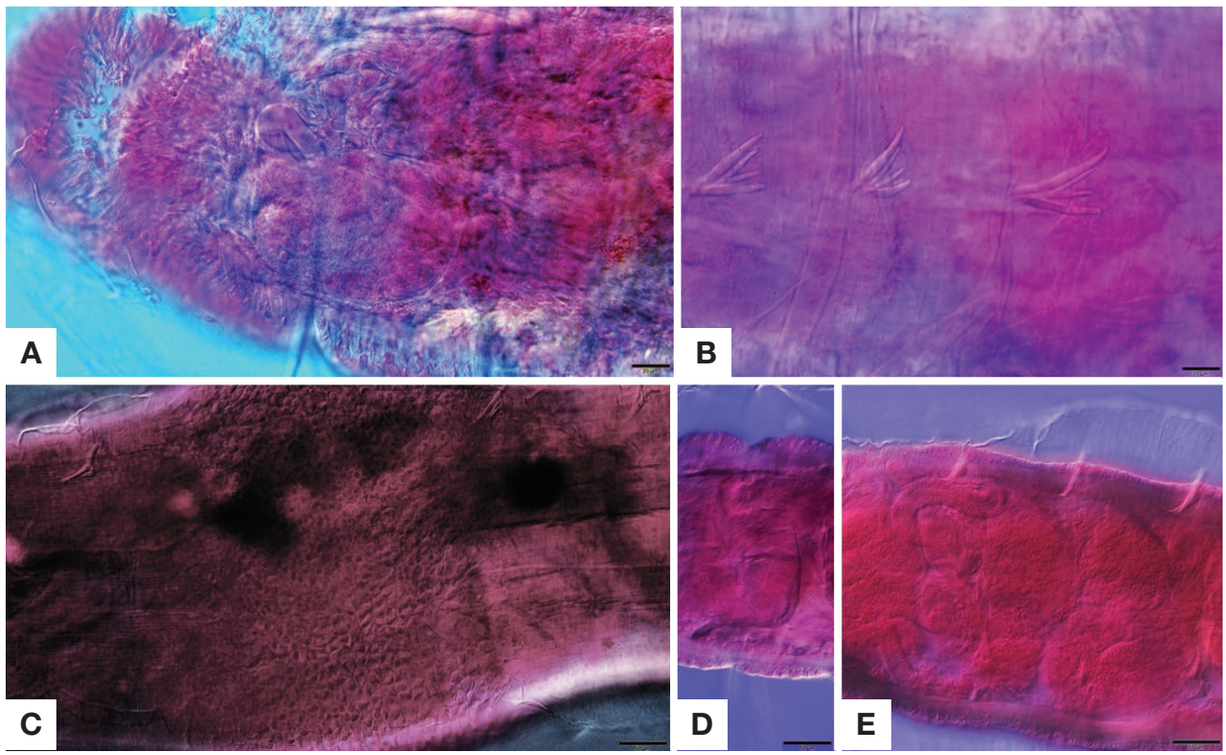


**Fig. 1.** *Fridericia glandifera*. A. shape of brain; B. a ventral chaetal bundle; C. clitellum; D. oesophageal appendages; E. spermatheca (Scale bars: A, B = 10 μm, E, F = 20 μm, H-J = 10 μm).

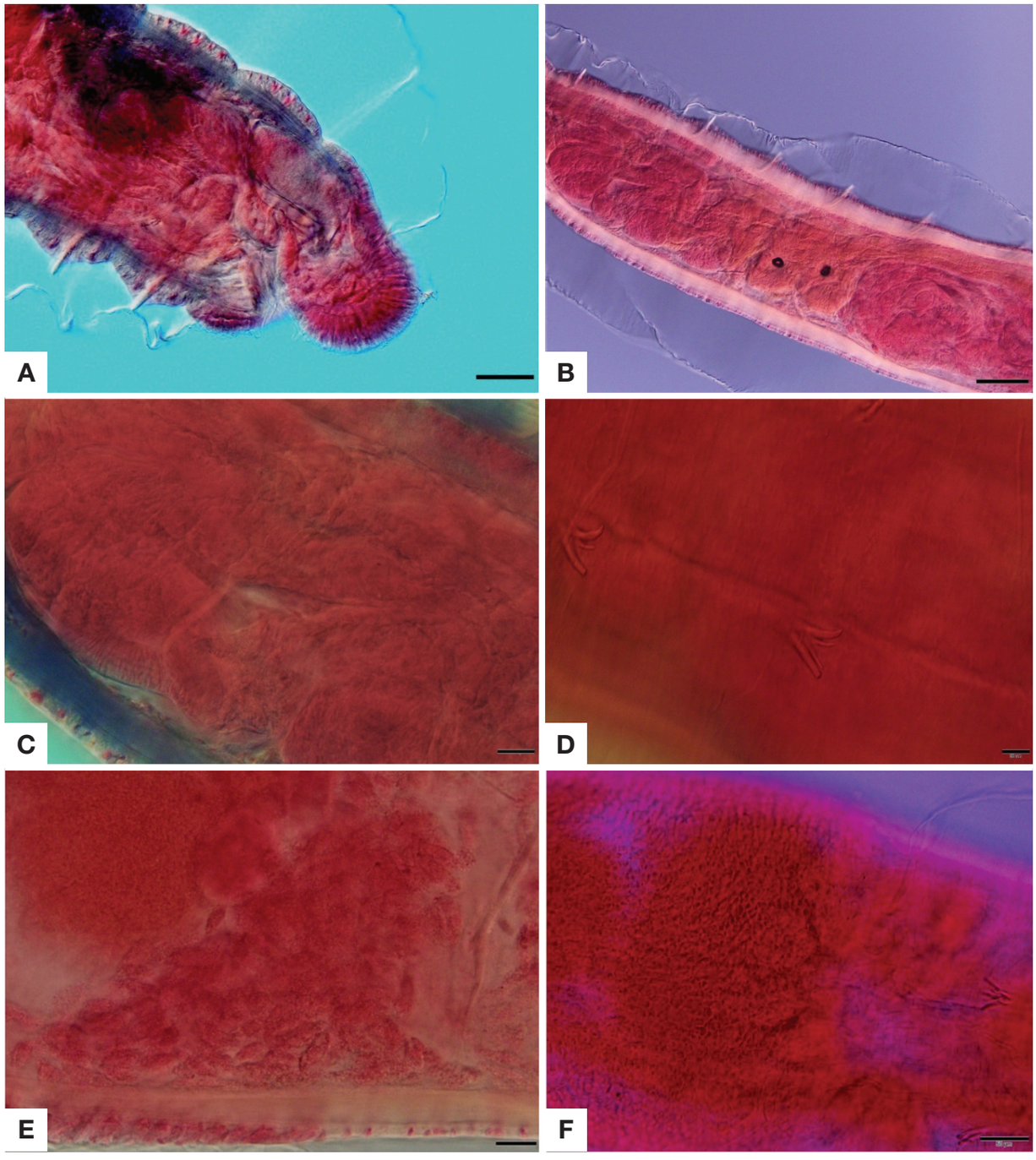


**Fig. 2.** *Henlea montana*. A. shape of brain; B. anterior body region; C. spermatheca; D. chaetae per bundles; E. coelomocyte; F. clitellum (Scale bars: A = 50 μm, B = 100 μm, C-F = 20 μm).

**Diagnosis.** Brain slightly concave posteriorly (Fig. 2A). Pharyngeal glands in VI (Fig. 2B). Spermathecal ectal large, conspicuous, stalked, surrounding thickened distal end of ectal duct in a rosette-like (Fig. 2C). Chaetae slightly bent, in fan-shaped arrangement (Fig. 2D). Coelomocytes mucocytes, finely vesicular (Fig. 2E). Clitellum griddle-shaped, reticulate pattern (Fig. 2F).

**Remarks.** At first glance, the shape of chaetae looked like *Fridericia* species, so we thought it would be belong to the genus *Fridericia*. However, other morpho-

logical features of our specimen correspond to the previous description of the species by Rota (1994). Above all, it has petaloid glands around the spermathecae orifice (Fig. 2C).

**World distribution.** Italy, Ireland, Turkey.

Genus *Marionina* Michaelsen, 1890

***Marionina riparia* Bretscher, 1899 (Fig. 3A-F)**

*Marionina riparia* Bretscher, 1899: 400; Michaelsen, 1900: 77; Nielsen and Christensen, 1959: 120-121, Figs. 168-172; Kasprzak, 1972: 25-27, Figs. 6-7; Kasprzak, 1986: 168-170, Figs. 399, 412, 427, 580-593; Rota and Healy, 1994: 65.

*Enchytraeoides riparius* Černosvitov, 1928: 12-14, Fig. 2.

*Pachydrilus* (*Marionina*) *riparius* Černosvitov, 1942: 211-212, Figs. 40-50.

**Material examined.** 1 individual was collected from Siljeon-ri, Hacheong-myeon, Geoje-si, Gyeongsangnam-do. E: 128°39′23.65″, N: 34°58′27.35″, 25 Apr 2013 (collector: Lee J). One individual mounted on a slide was deposited at NIBR (KOSPIV0000193714).

**Measurement.** Length 2.40 mm, width 0.06-0.18 mm, number of segments 24 in fixed state.

**Diagnosis.** Brain two times as long as wide, lightly concave anteriorly, strongly concave posteriorly (Fig. 3A).

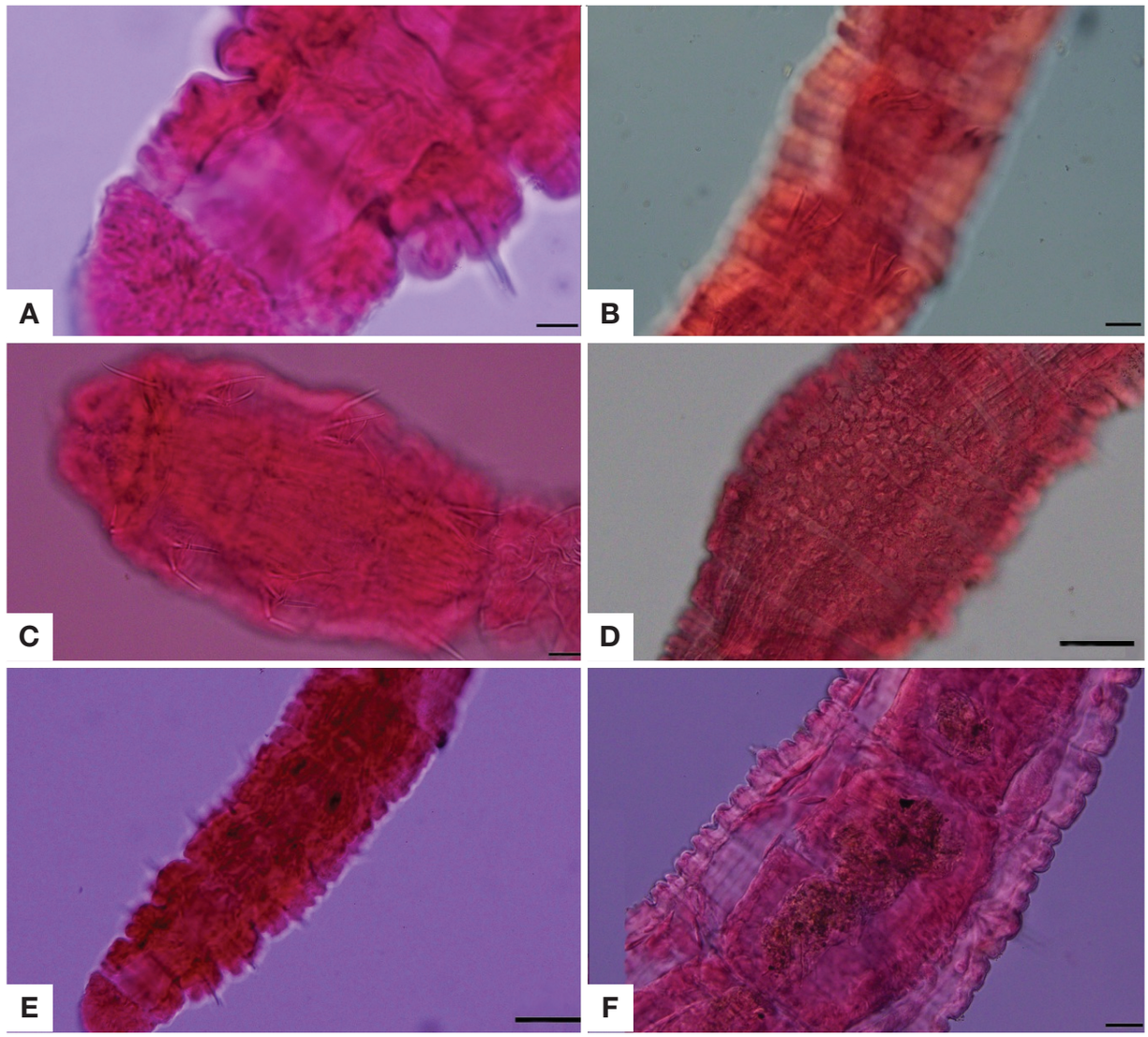


**Fig. 3.** *Marionina riparia*. A. shape of brain; B. anterior ventral chaetae; C. posterior ventral chaetae; D. clitellum; E. spermatheca; F. Coelemocytes (Scale bars: A, F = 10 μm, B, C = 20 μm, D, E = 50 μm).

Chaetae equal-sized within a bundle with straight, ental hook distinct (Fig. 3B, C). Clitellum with reticulate (Fig. 3D). Pharyngeal glands 3 pairs with a very narrow. Sperm funnel barrel-shaped, narrower toward the end. Paired spermathecal attached to the oesophagus (Fig. 3E). Coelemocytes anucleate with spindle shape in vivo (Fig. 3F).

**Remarks.** This material agree well with the previous descriptions (Rota and Healy, 1994; Torii, 2012), expect for the body size in fixed specimen. The body length of our specimen has shorter than the species of Japan (Torii, 2012).

**World distribution.** Austria, China, Czechoslovakia, Denmark, Finland, France, Germany, Great Britain, Italy, Ireland, Japan, Lebanon, Northern Africa, Poland, Romania, Spain, Sweden, Switzerland.

## Acknowledgements

This work was supported by a grant from the National Institute of Biological Resources (NIBR), funded by the Ministry of Environment (MOE) of the Republic of Korea (NIBR 2013-02-001).

## References

An, Y.J. and C.Y. Yang. 2009. *Fridericia peregrinabunda* (Enchytraeidae) as a new test species for soil toxicity assessment. Chemosphere 77(3):325-329.

Bretscher, K. 1899. Beitrag zur Kenntnis der Oligochaeten Fauna der Schweiz. Revue Suisse de Zoologie 6:369-426.

Černosvitov, L. 1928. Die Oligochaetenfauna der Karpathen. Zoologische Jahrbuecher Abteilung für Systematik, Geographie und Biologie der Tiere 55:1-28.

Černosvitov, L. 1937. Zur Kenntnis der Enchytraeiden. III. Revision der FRIEND'schen Enchytraeidentypen. - Zoologischer Anzeiger. Germany: Leipzig 117:191-205.

Černosvitov, L. 1942. Oligochæte from Various Parts of the World. In Proceedings of the Zoological Society of London 111(3-4):197-236. Blackwell Publishing Ltd.

Chen, J. and Z. Xie. 2008. *Fridericia dianchiensis* sp. nov. (Enchytraeidae, Oligochaeta) from Yunnan Province, China. Proceedings of the Biological Society of Washington 121(2):283-288.

Christensen, B. and K. Dózsa-Farkas. 2012. A new genus *Globulidrilus* and three new enchytraeid species (Oligochaeta: Enchytraeidae) from Seoraksan National Park (Korea). Journal of Natural History 46(45-46):2769-2785.

Didden, W.A.M. 1993. Ecology of terrestrial Enchytraeidae. Pedobiologia 37:2-29.

Dózsa-Farkas, K. and Y. Hong. 2010. Three new Hemienchytraeus species (Enchytraeidae, Oligochaeta, Annelida) from Korea, with first records of other enchytraeids and terrestrial polychaetes (Annelida). Zootaxa 2406:29-56.

Dózsa-Farkas, K., T. Felföldi and Y. Hong. 2014. New enchytraeid species (Enchytraeidae, Oligochaeta) from Korea. Zootaxa 4006(1):171-197.

Erséus, C. 2005. Phylogeny of oligochaetous Clitellata. Hydrobiologia 535(536):357-372.

Erséus, C. and B. Healy. 1994. Oligochaeta. Taxonomic atlas of the benthic fauna of the Santa Maria Basin and Western Santa Barbara Channel 4:5-38.

Friend, H. 1912. Annelid hunting in Notts. - Report of the Nottinghamshire Naturalists Society for 1910-1911 59: 30-44.

Friend, H. 1913. British enchytraeids. V. Species new to science. - Journal of the Royal Microscopical Society. London. pp. 255-271.

Giani, N. 1976. Les oligochètes aquatiques du Sud-Ouest de la France. In Annales de Limnologie 12(2):107-125.

Giani, N. 1979. Les oligochètes aquatiques du sud-ouest de la France (2e note). - Bulletin de la Société d'histoire naturelle de Toulouse 115:347-358.

Graefe, U. 1993. Die Gliederung von Zersetzergesellschaften für die standortsökologische Ansprache. Mitteilungen der Deutschen Bodenkundlichen Gesellschaft 69:95-98.

Graefe, U. and R.M. Schmelz. 1999. Indicator values, strategy types and life forms of terrestrial Enchytraeidae and other microannelids. Newsletter on Enchytraeidae 6:59-67.

Kasprzak, K. 1972. Materiały do znajomości skąposzczetów (Oligochaeta) Wielkopolski. Fragmenta Faunistica 18(6): 99-119.

Kasprzak, K. 1986. Skaposzczety wodne i glebowe, 2. Rodzina: Wazonkowce (Enchytraeidae). Klucze do Oznaczania Bezkręgowców Polski.

Matamoros, L. 2011. Systematics of Marionina (Annelida: Clitellata: Enchytraeidae) (PhD thesis). University of Gothenburg, Gothenburg.

Michaelsen, W. 1889. Synopsis der Enchytraeiden. - Abhandlungen aus dem Gebiete der Naturwissenschaften herausgegeben vom Naturwissenschaftlichen Verein in Hamburg 11:1-59.

Michaelsen, W. 1900. Das Tierreich Vol. 10: Vermes, Oligochaeta. - Friedländer & Sohn, Berlin: XXIX+575 pp. plus 13 figs.

Nielsen, C.O. and B. Christensen. 1959. The Enchytraeidae. Critical revision and taxonomy of European species (Studies on Enchytraeidae VII). - Natura Jutlandica. Denmark: Aarhus (8-9):1-160.

Park, H.J., T. Timm and Y.J. Bae. 2013. Taxonomy of the Korean freshwater Oligochaeta (Annelida) with eight species new to Korea. Entomological Research Bulletin 29(2):180-188.

Rota, E. 1994. Enchytraeidae (Oligochaeta) of western Anatolia: Taxonomy and faunistics*. Italian Journal of Zoology 61:241-260.

Rota, E. and B. Healy. 1994. The enchytraeid fauna of North Africa. In Aquatic Oligochaete Biology V. Springer Netherlands. pp. 53-66.

Rota, E. and B. Healy. 1999. A taxonomic study of some Swedish Enchytraeidae (Oligochaeta), with description of four nex species and notes on the genus *Fridericia*. Journal of Natural History 33(1):29-64.

Schmelz, R.M. 1996. Species separation and identification in the Enchytraeidae (Oligochaeta, Annelida): combining morphology with general protein data. Hydrobiologia 334(1-3):31-36.

Schmelz, R.M. 2003. Taxonomy of *Fridericia* (Oligochaeta, Enchytraeidae). Revision of species with morphological and biochemical methods. Goecke & Evers, Keltern-weiler, Germany. p. 415.

Schmelz, R.M. and R. Collado. 2010. A guide to European terrestrial and freshwater species of Enchytraeidae (Oligochaeta). Soil Organ 82:1-176.

Schmelz, R.M. and R. Collado. 2015. Checklist of taxa of Enchytraeidae (Oligochaeta): an update. Soil Organisms 87(2):149-152.

Timm, T. 1994. Propappidae and aquatic Enchytraeidae (Oligochaeta) from the farthest southeast of Russia. Hydrobiologia 278(1-3):67-78.

Torii, T. 2012. New records of semiaquatic species *Marionina* (Clitellata, Enchytraeidae) from Japan, with a description of *Marionina biwaensis* sp. nov. Turkish Journal of Zoology 36(1):15-24.

Torii, T. and A. Ohtaka. 2007. Aquatic Oligochaete (Annelida, Clitellata) fauna in the Seto River system, Shizuoka, central Japan. Biology of Inland Waters 22:15-24.

Vejdovský, F. 1879. Beiträge zur vergleichenden Morphologie der Anneliden. I. Monographie der Enchytraeiden. Verlag von Friedrich Tempsky, Prag, 61 pp.

Wang, H.Z. and Y.D. Cui. 2007. On the studies of Microdrile Oligochaeta and Aeolosomatidae (Annelida) in China: brief history and species checklist. Acta Hydrobiologica Sinica 31:87-98.

Yamaguchi, H. 1953. Studies on the Aquatic Oligochaeta of Japan: VI. A Systematic Report, with Some Remarks on the Classification and Phylogeny of the Oligochaeta (With 1 Plate, 5 Tables and 25 Text-figures). 北海道大學理學部紀要=Journal of The Faculty of Science Hokkaido University Series VI. Zoology 11(2):277-342.

*Submitted: September 17, 2016*
*Revised: September 29, 2016*
*Accepted: October 13, 2016*