ASED http://e-ASED.org
Animal Systematics, Evolution and Diversity

Anim. Syst. Evol. Divers. Vol. 37, No. 2: 171-176, April 2021
https://doi.org/10.5635/ASED.2021.37.2.002

Short communication

The First Record of Marine Oligochaete, *Marionina coatesae* (Annelida; Oligochaeta; Enchytreaidae) from Korean Waters

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

[1]Interdisciplinary Program of Ecocreative, Ewha Womans University, Seoul 03760, Korea
[2]Department of Science Education, Ewha Womans University, Seoul 03760, Korea

ABSTRACT

Marionina Michaelsen, 1889, is distributed worldwide and inhabits marine, terrestrial, and limnic environments. *Marionina coatesae* Erséus, 1990 of the present study is characterized by two characteristics: two chaetae per segment all over the body except in segment XII and round or oval-shaped spermathecal ampullae with sperm rings irregularly scattered on the walls. Korean specimens of the species were obtained from the intertidal sand beach of the East Sea in Korea. Here, *M. coatesae* is reported for the first time in Korean fauna as the first marine oligochaete, microdriles, species.

Keywords: Clitellata, Enchytraeidae, marine Oligochaeta, microdrile, *Marionina coatesae*, Korea

INTRODUCTION

Marine oligochaetes are distributed worldwide, with approximately 600 described species from various habitats, including intertidal and subtidal sands, deep-sea sediments, and brackish water. Most of them have been reported in Europe (Brinkhurst, 1982; Erséus, 1990, 2005; Diaz and Erséus, 1994; Healy and Coates, 1999; Wang and Erséus, 2001; Hartzell et al., 2005; Prantoni et al., 2014b). Several studies on marine oligochaetes in East Asian waters have been ongoing for over 30 years, and about 100 marine species and 16 brackish-water species have been recorded in China and Japan, respectively (Erséus, 1984, 1990, 1997; Erséus and Sang, 1985; Ohtaka, 1987; Erséus et al., 1990; Takashima and Mawatari, 1996, 1998; Erséus and Diaz, 1997; Hallett et al., 1997; Takashima, 2000, 2001; Huang, 2001; Cai and Lin, 2006; Torii et al., 2016; Chen et al., 2017).

Marionina Michaelsen, 1889 is widely distributed in terrestrial (moist to wet), marine, and aquatic habitats, and the marine species have been reported throughout the seas worldwide, from warmer areas to across the Arctic and the Antarctic regions (Giere, 1975; Erséus, 1978; Coates, 1989; Rota and Healy, 1994; Coates and Healy, 2003; Rota, 2013). *Marionina* species are hardly distinguishable from each other based on external features (Schmelz and Collado, 2010; Matamoros, 2011). The identification of them is based on almost internal characteristics, including the type of coelomocytes, the shapes of the brain and spermathecal ampulla with glands, two straight chaetae per bundle or absent chaetae, well-developed penial bulbs, etc. (Coates, 1983; Chalupský, 1991; Schmelz et al., 2008; Prantoni et al., 2014a). These internal organ characteristics can be observed during maturity (Brinkhurst and Jamieson, 1971).

Currently, about 67 *Marionina* species have been reported in marine habitats. Among them, four species - *M. coatesae* Erséus, 1990, *Marionina levitheca* Erséus, 1990, *Marionina nevisensis* Righi and Kanner, 1979 and *Marionina vancouverensis* Coates, 1980 were reported in China (Wang and Cui, 2007), and two species, *M. coatesae* and *M. nevisensis*, were reported in Japan (Torii, 2012).

In Korean fauna, seven *Marionina* species, *Marionina argentea*, *Marionina clavate*, *Marionina communis*, *Marionina righiana*, *Marionina seminuda*, *Marionina riparia*, have been recognized as earthworms or semi-aquatic oligochaetes (Dózsa-Farkas et al., 2015; Lee and Jung, 2016; Hong and Dózsa-Farkas, 2018). By comparison, marine oligochaete species has been reported only one marine oligochaete species, as megadrile, *Pontodrilus litoralis* (Grube, 1855) from Jeju Island,

*To whom correspondence should be addressed
Tel: 82-2-3277-2616, Fax: 82-2-6937-0733
E-mail: jongwoo@ewha.ac.kr

eISSN 2234-8190

Korea without detailed taxonomic description and illustration on the species. In this study, we report a *Marionina* species, microdriles, for the first time from Korean waters with a detailed description of the species.

The specimens of this study were collected from the intertidal sand shoal in the East Sea. Marine benthic sediments were dredged into polyethylene vinyl bags using a trowel, kept on ice, and transported to the laboratory. The anesthesia and washing was were done as previously described (Higgins and Thiel, 1988). Next, the anesthetized specimens were sorted under a stereomicroscope (SMZ-168, Motic, Hong Kong). The specimens were fixed in 8% formalin solution or 80–96% ethanol. The fixed worms were mounted on microscope slides followed a description of Erséus (1994). Morphological observation and measurements were performed using a BX41 research microscope fitted with an Olympus DP22 camera system (Olympus, Tokyo, Japan). Images were edited using the image analyzing software InnerViewTM-i series (Innerview Co. Ltd., Seongnam, Korea). Voucher specimens were deposited in the Laboratory of Ecological Genetics of the Interdisciplinary Program of Ecocreative Division, Ewha Womans University, Seoul, and the National Institute of Biological Resources in Korea (NIBR).

SYSTEMATIC ACCOUNTS

Phylum Annelida Linnaeus, 1758
Class Clitellata Linnaeus, 1740
Subclass Oligochaeta Grube, 1850
[1*]Order Enchytreaida Vejdovský, 1879
[2*]Family Enchytreaidae Vejdovský, 1879
Genus *Marionina* Michaelsen, 1889

[3*]*Marionina coatesae* Erséus, 1990 (Fig. 1A–J)

Marionina coatesae Erséus, 1990: 318, fig. 26A–G; Erséus et al., 1990: 117, fig. 6A, B; Coates and Stacey, 1993: 411, fig. 12; Healy and Coates, 1997: 93; Rota et al., 2003: 509; Torii, 2012: 18, figs. 2A, B.

Material examined. Korea: 10 specimens in Gangwon-do, Gangneung-si, Aninjin-ri, and Anin Beach, 37°44′04.79″N, 128°59′25.27″E, 18 Oct 2018, cat on NIBRIV0000862924, JHL20180901–201809012, GenBank accession no. MW800145. Two mature, complete individuals, stained in alcoholic paracarmine and whole-mounted in Canada balsam, and 8 individuals, stored in 80% ethanol. All specimens were collected from a sand beach by JH Lee.

Description. Length 1.8–2.4 mm, width 0.06–0.18 mm at XI, number of segments 30–32 in fixed. Thin, cuticle not rigid. Head pore, mid-dorsal at 0/1. Brain two times as long as wide in I–II (fixed), 72.69–143.71 μm long with strongly concave anteriorly, round posteriorly (Fig. 1A). Pharyngeal pad in III. Pharyngeal glands 3 pairs in V–VII; anterior 2 pair lobes merging dorsal connection in V–VI and third pair elongate and without dorsal connection in VII (Fig. 1A). Oesophagus without diverticula. Oesophageal appendage paired, tubiform in IV dorso-laterally, anteriorly of pharyngeal gland. Ventral blood vessel bifurcation point in III. Chaetae 53.84–126.47 μm long, with almost strongly bent proximally ental hook without nodulus, 2 per bundle throughout body (Fig. 1B). Ventral chaetae of XII absent.

Spermathecae paired in V. Spermathecal ampulla round or oval-shaped with irregular lumen and arranged distinct rings scattered in wall, with short ectal ducts slightly covered by small glands (Fig. 1C, D). Clitellum covered with indefinite gland cells, extending over X–XII (Fig. 1E). Seminal vesicle developed, unpaired laterally, extending forward into IX (Fig. 1F). Vas deferens narrowing from glandular part to male pore, tight irregularly coiled in XII. Male pore pair with penial bulb small and compact, 36.23–41.31 μm wide in XII (Fig. 1G, H). Nephridia pairs, distinct from 6/7 to 7/8; anteseptale part larger than postseptale, with funnel containing a few loops of the nephridial canal and parts of nephridial body, and postseptale merging into efferent duct (Fig. 1I). Coelomocytes abundant, with two types; flattened oval with granulated, filled with distinct globular vesicles, and ovoid with nucleate, approximately 13.13–9.40 μm (Fig. 1J). Dorsal blood vessel originating in segment XIII.

Distribution. Australia (Northern Territory, Western coast), China, Hong Kong, Japan, Korea (this study).

Remarks. *Marionina coatesae* was originally recorded from Hong Kong. This species has been recorded in China, Japan, and Australia (Erséus, 1990; Erséus et al., 1990; Coates and Stacey, 1993; Healy and Coates, 1997; Torii, 2009). Among the littoral oligochaetes, the *Marionina* species have two chaetae, dorsal blood vessels originating in segment XIII, and sperms arranged in a ring on the walls of the spermathecal ampullae (Erséus, 1990; Healy and Coates, 1997). *Marionina coatesae* is characterized by the complete absence of chaeta from segment XII, and the sperm rings irregularly scattered on the spermathecal walls during maturation. In this respect, Korean specimens of the present study agree well with its original description (Erséus, 1990).

However, our specimens have some minor differences from that of Japanese in the internal characteristics of coelomocyte. The coelomocyte has a flattened ovoid that is granulated and filled with distinct globular vesicles and a nucleated ovoid.

Korean name: [1*]꼬마지렁이목(신칭), [2*]꼬마지렁이과(신칭), [3*]연안돌애지렁이(신칭)

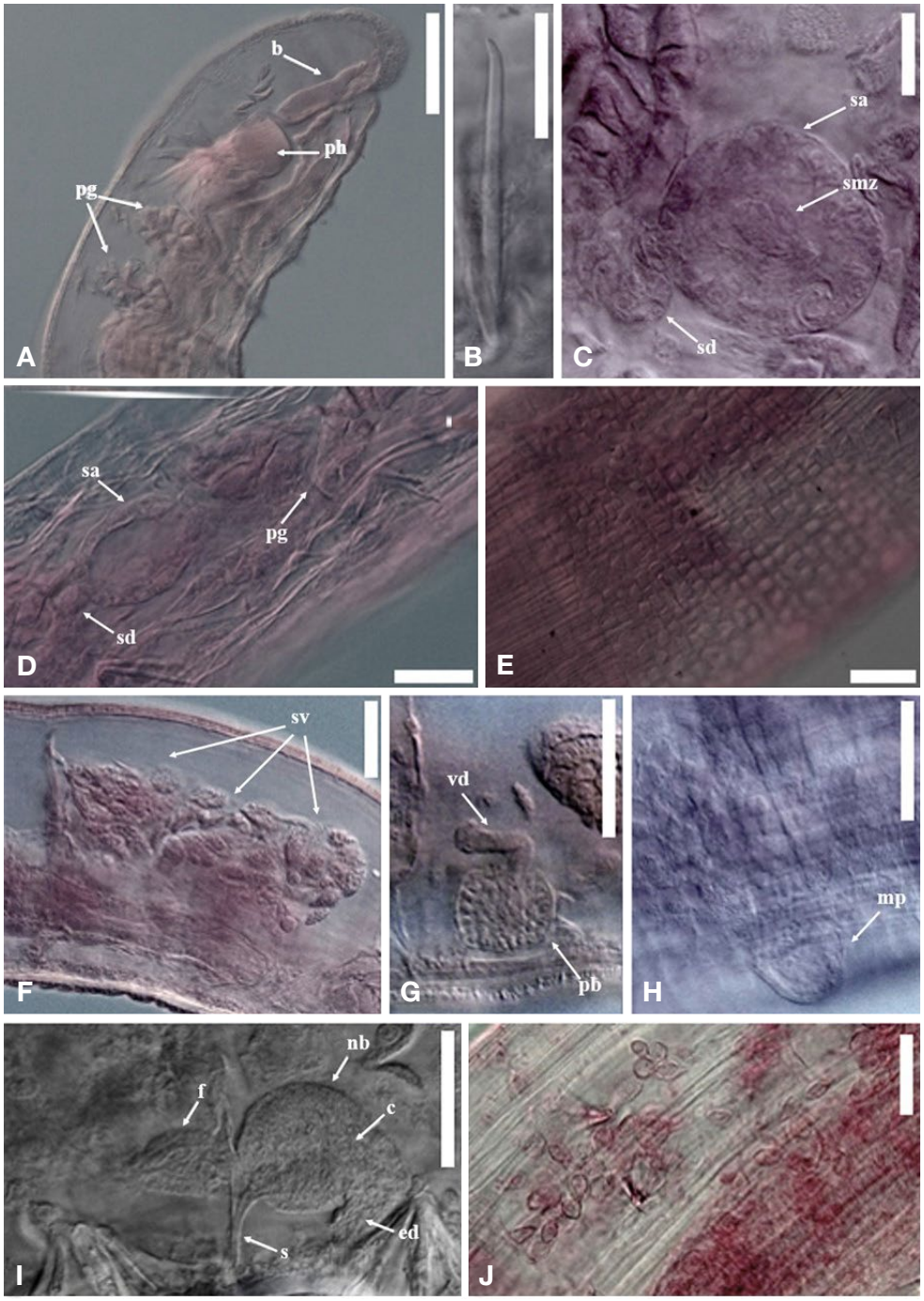

Fig. 1. *Marionina coatesae* Erséus, 1990. A, Anterior part of the specimen; B, Chaetae in V; C, Round-shaped spermatheca; D, Oval-shaped spermatheca; E, Clitellum; F, Seminal vesicles in IX; G, Vas deferens with penial bulb in XII; H, Male pore in XII; I, Nephridia; J, Coelomocytes. b, brain; c, canal; ed, efferent duct; f, funnel; pb, penial bulb; pg, pharyngeal gland; ph, pharyngeal pad; mp, male pore; nb, nephridial body; s, stem of nephridia; sa, spermathecal ampulla; sd, spermathecal ectal duct; smz, spermatozoa; sv, seminal vesicle; vd, vas deferens. Scale bars: A, F = 50 μm, B = 10 μm, C–E, G–J = 20 μm.

Most other features are consistent with the original descriptions. In Japanese specimens, the coelomocyte has a flattened nucleated ovoid only, while the Korean specimens have both flattened nucleated and granulated ovoid types (Torii, 2012). The further study with the taxonomic and ecological considerations for the minor differences is needed. This study uti-

lized mature specimens having visible genital organs (Fig. 1C, D, G, H), showing the two types of coelomocytes (Fig. 1J). Almost all morphological characters of the present specimens corresponded closely to previous studies (Erséus, 1990; Healy and Coates, 1997; Torii, 2012).

To date, *P. litoralis* has been recorded only once in a marine environment in Jeju Island, Korea. This species belongs to the family Megadrilacea Benham, 1890. The large worms in this family are known as megadriles, whereas the small worms, described in this study, *M. coatesae*, are called microdriles. It is noteworthy that *M. coatesae* is the first species reported from Korea in a marine region, and this study is the first to investigate the marine species (microdriles) in the Korean seas.

ORCID

Jeounghee Lee: https://orcid.org/0000-0003-3758-9296
Jongwoo Jung: https://orcid.org/0000-0003-1911-9485

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGMENTS

This study 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 funded by a Discovery of Invertebrate Species from Unexplored Habitats grant (NIBR 201902204) and Ministry of Oceans and Fisheries (MOF) under Development of methods for controlling and managing marine ecological disturbance and harmful organisms (MEDHO) (No. 20190518) of the Republic of Korea.

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Received January 5, 2021
Revised April 8, 2021
Accepted April 14, 2021