Journal of Species Research 5(3):264-271, 2016

First record of *Heteromastus filiformis* (Polychaeta: Capitellidae) from Korean waters, with a taxonomic note on the genus

Hyun Ki Choi[1] and Seong Myeong Yoon[2,*]

[1]*National Marine Biodiversity Institute of Korea, Seocheon, Chungcheongnam-do 33662, Republic of Korea*
[2]*Department of Biology, Chosun University, Gwangju 61452, Republic of Korea*

**Correspondent: smyun@chosun.ac.kr*

A capitellid species, *Heteromastus filiformis* (Claparède, 1864) is newly reported from Korean waters with the description and illustrations. Korean materials of the present study show several characteristics generally agreed well with the previous descriptions of *H. filiformis* as follows: the thorax is composed of the first achaetigerous peristomium and following 11 thoracic chaetigers; the capillary chaetae are present on the thoracic chaetigers 1-5 and narrowly bilimbate; the thoracic hooded hooks are appeared on the chaetigers 6-11 and have indistinct nodes on the shaft and several teeth above the main fang; the abdominal hooded hooks possess distinct nodes on the shaft and a few teeth above the main fang; the branchiae appearing on the posterior abdominal segments are the broadly-based and rounded lamellae projecting posteriorly. The authors reviewed the taxonomy of *Heteromastus* with a comparison of morphological characteristics among worldwide species, and provided a key of them.

Keywords: Capitellidae, *Heteromastus filiformis*, Korea, Polychaeta, taxonomy

© 2016 National Institute of Biological Resources
DOI:10.12651/JSR.2016.5.3.264

Introduction

The family Capitellidae Grube, 1862 is one of the typical inhabitants of marine soft bottom sediments and important in the energy budgets of benthic environments because of usually high abundances and their feeding habits as the non-selective deposit feeders (Dean, 2001; García-Garza and León-González, 2011). This family is divided into several genera based on the number of the thoracic segments and the arrangement of capillary chaetae and hooded hooks (Fauchald, 1977; Amaral, 1980; Hutchings and Rainer, 1982; Warren *et al*., 1994; Green, 2002). Currently, 44 genera have been classified and about 170 species are known worldwide in this family (Fauchald, 1977; Yabe and Mawatari, 1998; Green, 2002).

Because of their high abundance and ecological importance in marine benthic environments, many species of capitellid polychaetes have been included in various ecological studies as the major components of macrobenthic faunal community (Dean, 2001; García-Garza and León-González, 2011). Among them, *Heteromastus filiformis* (Claparède, 1864), the type species of the genus, is known as a cosmopolitan one bearing wide variety of the habitats and has been referred to in many ecological studies (Hutchings and Rainer, 1982).

In Korean waters, only three capitellid species each assigned in different genera, *Capitella capitata* Eisig, 1887, *Notomastus latericeus* Sars, 1851, and *Dasybranchus cauducus* Grube, 1846, are taxonomically recorded (Paik, 1978; 1979; 1980; 1982; 1989). Besides to these, two capitellid species, *Heteromastus filiformis* (Claparède, 1864) and *Mediomastus californiensis* Hartman, 1944, have been reported as one of the members of benthic macroinvertebrate community through many ecological studies without any taxonomical consideration (Hong *et al*., 2000; Choi *et al*., 2003; Shin *et al*., 2004; Seo *et al*., 2009; Jung *et al*., 2014, etc.). Although *Heteromastus filiformis* is one of the capitellid species that has been most frequently reported from Korean waters by such ecological studies (Jung *et al*., 1997; 2012; Hong *et al*., 2000; Choi *et al*., 2003; Shin *et al*., 2004, etc.), its taxonomical reality has not yet been examined in Korean waters. The authors collected the specimens of *H. filiformis* during the study on the polychaete fauna from Korea, and carefully examined them with the consideration of taxonomy of the genus.

In the present study, the authors dealt with the genus

Heteromastus Eisig, 1887 newly recorded from Korean waters. It is known that the species of this genus have 12 chaetigers of thorax composed of first five thoracic chaetigers with capillary chaetae and following chaetigers with hooded hooks (Eisig, 1887; Fauchald, 1977; Hutchings and Rainer, 1982). Presently, a total of seven species, *H. caudatus* (Hartman, 1976), *H. filobranchus* Berkeley and Berkeley, 1932, *H. filiformis* (Claparède, 1864), *H. giganteus* Zachs, 1933, *H. hutchingsae* Green, 2002, *H. similis* Southern, 1921, and *H. tohbaiensis* Yabe and Mawatari, 1998, is known in this genus. Despite of the long taxonomical studies on the *Heteromastus* species, the taxonomic review of them has not been fully accomplished yet.

The purpose of this study is to describe a new record of *Heteromastus* species from Korean waters with detailed description and illustrations. We also presented a taxonomic review of worldwide *Heteromastus* species with a key based on the literatures (Claparède, 1864; Southern, 1921; Fauvel, 1927; Berkeley and Berkeley, 1932; Zachs, 1933; Hartman, 1947; Uschakov, 1965; Day, 1967; Hartman, 1976; Hutchings and Rainer, 1982; Warren *et al*., 1994; Yabe and Mawatari, 1998; Blake, 2000; Dean, 2001; Green, 2002).

Materials and Methods

Samples were collected from mud of the tidal flat in Korean waters. The specimens were sorted by using sieves with a pore size of 0.5 mm, fixed initially with 5% formaldehyde-seawater solution, and transferred to 85% ethyl alcohol after sorting in the laboratory. The characteristics of the whole body were observed and the appendages were dissected in a petri dish by using dissection forceps or surgical knives and needles under stereomicroscope (SMZ1500; Olympus, Tokyo, Japan). Dissected specimens were mounted on temporary slides using glycerol or permanent slides using polyvinyl lactophenol solution. Methyl green staining was performed based on the work of Warren *et al*. (1994). Drawings were made by the stereomicroscope and light microscope (LABOPHOT-2; Nikon, Tokyo, Japan) with the aids of drawing tubes. Photographs were captured by using an image system (LAS V4.7, Leica Microsystems, Heerbrugg, Switzerland). The examined materials are deposited in Chosun University and the National Institute of Biological Resources (NIBR) in Korea.

Systematic Accounts

Family Capitellidae Grube, 1862
Genus *Heteromastus* Eisig, 1887
고리버들갯지렁이속(신칭)

***Heteromastus filiformis* (Claparède, 1864)**
고리버들갯지렁이(신칭)
Capitella filiformis Claparède, 1864: 509, pl. 4, fig. 10.
Heteromastus filiformis Fauvel, 1927: 150, fig. 53a-l; Hartman, 1947: 427, pl. 52, figs. 1-4; Uschakov, 1965: 304; Day, 1967: 601, fig. 28.3a-d; Hutchings and Rainer, 1981: 374; Blake, 2000: 69, fig. 4.8; Dean, 2001: 75, figs. 10-12; García-Garza and León-González, 2011: 27.

Material examined. Korea, 25 specimens, Jeollabuk-do, Buan-gun, Byeonsan-myeon, Daehang-ri (126°35′02″E, 35°41′44″N), 13 Aug 2014; 14 specimens, Jeollanam-do, Suncheon-si, Byeollyang-myeon, Haksan-ri (127°29′03″E, 34°50′50″N), 24 May 2013.

Description. Body filiform and cylindrical, about 30 to 35 mm long with approximately 130-150 segments, width 0.8-1.0 mm in thoracic segments and about 1.0 mm in abdominal segments.

Prostomium small, conical. Proboscis globular with numerous minute papillae on surface. Peristomium slightly longer than chaetiger 1; single pair of subepidermal eyespots on dorsal surface appeared in immature materials (Fig. 1A, B).

Thorax distinct and biannulate, with weak wrinkles on surface, and composed of achaetigerous peristomium and 11 chaetigers; thoracic chaetigers 1-5 with narrowly bilimbate capillary chaetae composed of 4 or 5 per fascicle in noto- and neuropodia; chaetigers 6-11 with long handled hooded hooks composed of 3-6 per fascicle. Thoracic hooded hooks with indistinct node on shaft and 5 or 6 teeth in 2 transverse rows above main fang. Nephridial and genital pores invisible (Fig. 1A, F, G).

Transition between thorax and abdomen distinct. Abdomen biannulate, smooth on anterior segments but with many wrinkle on posterior segments, composed of about 120-140 segments; parapodia located at slightly posterior of segment; length between noto- and neuropodia longer than thoracic segments; anterior abdominal segments slightly longer and wider than posterior, gradually tapered toward end; posterior abdominal segments with parapodial lobes projecting posteriorly; abdominal chaetigers with short handled hooded hooks composed of 4-7 per fascicle. Abdominal hooded hooks with distinct node on shaft and 3 or 4 teeth above main fang (Fig. 1A, C, D, H).

Pygidium with single digitate caudal cirrus (Fig. 1E).

Branchiae short, broadly-based and rounded lamellae projecting posteriorly over adjacent segment, and well developed in about 100-120 segments (Fig. 1D).

Methyl green staining pattern. Korean materials of *H. filiformis* usually have the following patterns: the tho-

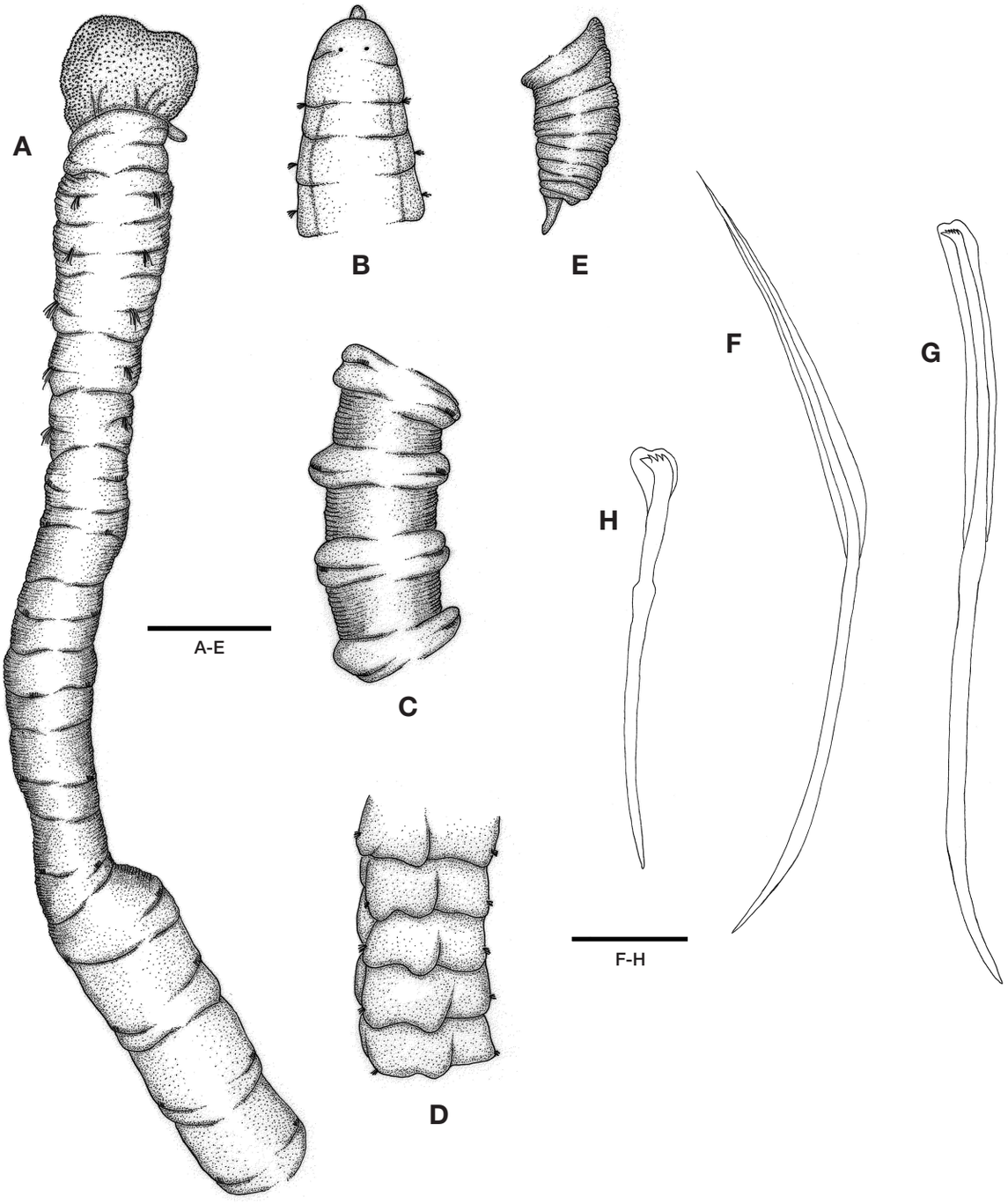

Fig. 1. *Heteromastus filiformis* (Claparède, 1864). A, anterior lateral view including thoracic segments; B, anterior dorsal view of specimens with subepidermal eyespots in immature state; C, lateral view of posterior abdominal segments; D, lateral view of posterior abdominal segments with branchiae; E, pygidium; F, notopodial capillary chaeta; G, thoracic notopodial hooded hook; H, abdominal notopodial hooded hook. Scale bars: A-E = 0.5 mm, F-H = 0.025 mm.

racic segments are weakly stained with faintly speckled bands, one of them is on the chaetiger 1 and others are on the chaetigers 3-11 (Fig. 2A); the abdominal segments are intensely stained with two longitudinal bands on the mid-ventral side (Fig. 2B).

Remarks. Korean materials of the present study show

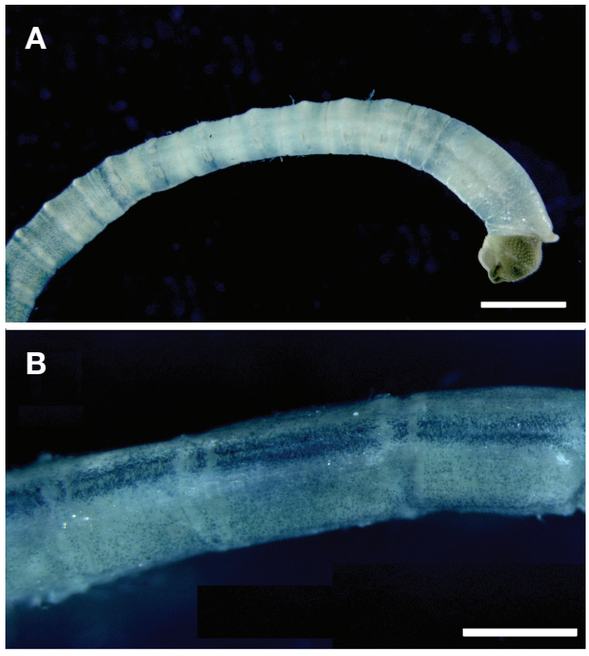

Fig. 2. Photograph of *Heteromastus filiformis* (Claparède, 1864) showing methyl green staining patterns. A, anterior lateral view of thoracic segments; B, mid-ventral view of abdominal segments. Scale bars: A = 1.0 mm, B = 0.5 mm.

the several characteristics that are generally agreed well with several previous works including the original description of *H. filiformis* as follows: the thoracic hooded hooks have indistinct nodes on the shaft and several teeth above the main fang; the abdominal hooded hooks possess distinct nodes on the shaft and a few teeth above the main fang; the branchiae appearing in posterior abdominal segments are broadly-based and rounded lamellae projecting posteriorly (Claparède, 1864; Fauvel, 1927; Hartman, 1947; Day, 1967; Hutchings and Rainer, 1982; Blake, 2000; Dean, 2001).

Korean materials of *H. filiformis* have a minor difference in the morphology of teeth on the abdominal hooded hooks from the neotype materials of Hutchings and Rainer (1982): the abdominal hooded hooks have 11-15 teeth above the main fang in the description of Hutchings and Rainer (1982), but those of our materials have only 3-4 teeth above the main fang. However, it is known that the number of teeth on the hooded hooks is a doubtful feature because it can vary depending on the orientation of the hooks under a light microscope (Yabe and Mawatari, 1998), and the real structure of them is unclear in the original description (Claparède, 1864). Therefore, the taxonomic validity of this difference is still in need of further study.

In the methyl green staining patterns, our materials are slightly different from the materials of Blake (2000) collected from California, North America in having weakly staining thorax with faintly speckled bands on the chaetiger 1 and chaetigers 3-11. Blake (2000) described that his materials have the thoracic segments staining solidly green with distinct bands on the chaetigers 5-9. In this respect, the materials of Blake (2000) could be a distinct species from Korean materials. However, the methyl green staining patterns have been poorly described in the most previous reports of *H. filiformis* except for Blake (2000), so the further study is required to verify the taxonomic value of these patterns.

In East Asia, *H. filiformis* is readily differentiated from *H. tohbaiensis* Yabe and Mawatari, 1998, which was recorded from Hokkaido in northern Japan, by following characteristics: the thoracic hooded hooks of *H. filiformis* have indistinct nodes on the shaft, while those of *H. tohbaiensis* have distinct nodes on the shaft; the branchiae on posterior abdominal segments are composed of broadly-based and rounded lamellae projecting posteriorly in *H. filiformis*, but those are absent in *H. tohbaiensis* (Yabe and Mawatari, 1998) (Table 1).

Habitat. The materials of present study were collected from mud or muddy sand of intertidal zone. Dean (2001) suggested that this species is widely distributed in all type sediments, and mainly found in the muds of intertidal zone.

Distribution. Italy (Eisig, 1887), France (Fauvel, 1927), the Mediterranean Sea (Claparède, 1864), Southern Africa (Day, 1967), Australia (Hutchings and Rainer, 1982), Costa Rica (Dean, 2001), Mexico (García-Garza and León-González, 2011), North America (California) (Hartman, 1947; Blake, 2000), Thailand (Green, 2002), Japan (Uschakov, 1965), Korea (present study).

Discussion. It is known that the thoracic and abdominal hooded hooks have indistinct or distinct nodes on shaft, while having been regarded as a minor character of the genus by many previous works of *Heteromastus* species (Hartman, 1947; Day, 1967; Fauchald, 1977; Hutchings and Rainer, 1982; Green, 2002). However, Yabe and Mawatari (1998) described *H. tohbaiensis* as a new species, and pointed out that indistinct or distinct nodes on thoracic and abdominal hooded hooks are the significant characteristic features in the genus.

Heteromastus species have been confused with the genus *Mediomastus* Hartman, 1944 because they have similar diagnostic characteristics such as the presence of achaetigerous peristomium and hooded hooks in the thoracic segments (Fauchald, 1977; Warren *et al*., 1994). However, this two genera are clearly distinguished from each other by the following characteristics: the thorax of *Heteromastus* has 11 chaetigers, while that of *Mediomastus* has usually 10 chaetigers; *Heteromastus* possesses the capillary chaetae on chaetigers 1-5 and the thoracic hooded hooks on chaetigers 6-11, but *Mediomastus* possesses

Table 1. Comparison of morphological character states among the worldwide species belonging to the genus *Heteromastus*.

Species	Type locality	Body size	Eyespots	Thoracic capillary chaetae	Thoracic hooded hooks	Abdominal hooded hooks	Branchiae	Additional information
H. caudatus (Hartman, 1976)	Indian Ocean	length 20.0 mm width 0.5-0.7 mm	absent	chaetigers 1-5	chaetigers 6-11 with indistinct node	with more than 2 teeth and distinct node	absent	conspicuously projecting uncinial spines on posterior segments
H. filiformis (Claparède, 1864)	Mediterranean Sea	length 30-100 mm width 0.6-1.0 mm	sometimes present (immature state)	chaetigers 1-5	chaetigers 6-11 with several teeth and indistinct node	with a few teeth and distinct node	broadly-based and rounded lamellae projecting posteriorly	
H. filobranchus Berkeley and Berkeley, 1932	Northeast Pacific	length 100-150 mm width 1.0-2.0 mm	absent	chaetigers 1-5	chaetigers 6-11 with 3 teeth and indistinct node	with 3 teeth and distinct node	palmately arranged filamentous branchiae	
H. giganteus Zachs, 1933	North Japanese Sea	length 5.0 mm, width 0.7 mm (incomplete)	unknown	chaetigers 1-6	chaetigers 7-11	unknown	unknown	
H. hutchingsae Green, 2002	Andaman Sea, Thailand	length 24.0 mm, width 0.6 mm (incomplete)	absent	chaetigers 1-5	chaetigers 6-11 with about 3 teeth and indistinct node	with 7-8 teeth and distinct node	triangular-shaped with hooded hooks	
H. similis Southern, 1921	Chika lake, Indian Ocean	length 55 mm width unknown	absent	chaetigers 1-5	chaetigers 6-11 with a few teeth and indistinct node	with a few teeth and distinct node	triangular-shaped with hooded hooks	abdominal hooded hooks with node located posterior to middle of shaft
H. tohbaiensis Yabe and Mawatari, 1998	North Japanese Sea	length 21.5 mm width 0.4 mm	present	chaetigers 1-5	chaetigers 6-11 with more than 10 teeth and distinct node	with 9-10 teeth and distinct node	absent	

the capillary chaetae on chaetigers 1-4 and the thoracic hooded hooks on chaetigers 5-10; the branchiae are usually present in *Heteromastus*, while those are absent in *Mediomastus* (Hartman, 1947; Day, 1967; Fauchald, 1977; Hutchings and Rainer, 1982; Warren *et al*., 1994; Green, 2002).

Because having high similarities between *Heteromastus* and *Mediomastus*, some species belonging to these genera have been newly combined (Warren *et al*., 1994). The species previously known as *Heteromastus deductus* Pillai, 1961 is now treated as a species belonging to *Mediomastus* because its original description shows a significant characteristic of *Mediomastus* species such as chaetiger 5 with hooded hooks instead of capillary chaetae (Pillai, 1961; Warren *et al*., 1994). On the contrary, *Mediomastus caudatus* Hartman, 1976 was emended as a *Heteromastus* species, *H. caudatus* (Hartman, 1976), because it has the capillary chaetae on thoracic chaetigers 1-5, which is one of the key characteristics of *Heteromastus* species (Hartman, 1976; Warren *et al*., 1994). *H. caudatus* is discriminated from its congeners by having the uncinial spines conspicuously projected on the posterior segments (Warren *et al*., 1994) (Table 1).

The morphology of branchiae is considered as a very important character in the taxonomy of *Heteromastus* (Southern, 1921; Berkeley and Berkeley, 1932; Hartman, 1947; Hartman, 1976; Yabe and Mawatari, 1998; Blake, 2000; Green, 2002). *H. similis* Southern, 1921 from Chika lake in India and *H. hutchingsae* Green, 2002 from Andaman Sea in Thailand, both have the posterior abdominal segments with triangular-shaped branchiae carrying abdominal hooded hooks, are distinguishable from *H. filiformis* by this characteristic branchiae (Southern, 1921; Green, 2002). *H. filobranchus* Berkeley and Berkeley, 1932 from Northeast Pacific also can be readily discriminated from its congeners by having the palmately arranged filamentous branchiae (Berkeley and Berkeley, 1932; Hartman, 1947; Blake, 2000). On the other hands, the original description of *H. tohbaiensis* and *H. caudatus* show that the species has the abdominal segments without branchiae (Hartman, 1976; Yabe and Mawatari, 1998) (Table 1).

Heteromastus species also show several taxonomic features in the development of abdominal segments and chaetal structures (Southern, 1921; Yabe and Mawatari, 1998; Green, 2002). *H. similis* differs from *H. filiformis* in that the length of anterior abdominal segment is similar to that of thoracic segment, and has a unique feature such that the node is located posterior to the middle of the shaft in the abdominal hooded hooks (Southern, 1921; Green, 2002). On the other hands, *H. hutchingsae* is distinguished from *H. similis* by having the node situated anterior to the middle of the shaft and the hood covering half of the length from crest to node in the abdominal hooded hooks (Green, 2002). *H. tohbaiensis* is differentiated from its congeners by a unique feature of thoracic hooded hooks bearing distinct nodes (Yabe and Mawatari, 1998) (Table 1).

Among the species described as *Heteromastus* ones, it is known that *Heteromastus giganteus* Zachs, 1933 from North Japanese Sea has also the thorax composed of the first achaetigerous peristomium and following 11 thoracic chaetigers (Zachs, 1933; Uschakov, 1965). However, this species differs from *Heteromastus* species by having six anterior thoracic segments bearing capillary chaetae (Zachs, 1933; Uschakov, 1965). This characteristic feature of *H. giganteus* is regarded as one of the diagnostic features of other genus, *Barantolla* Southern, 1921 (Fauchald, 1977). Therefore, *H. giganteus* is needed to further study with the type materials for its definite affiliation as a member of *Heteromastus* species.

Conclusively, we suggested six valid species of *Heteromastus* according to the morphologies of branchiae, abdominal segment, and chaetae including capillary chaetae and hooded hooks. In the present study, a comparison of the characteristic features among worldwide *Heteromastus* species is provided with a key.

Key to worldwide species of the genus *Heteromastus*

1. Thoracic hooded hooks with indistinct node on shaft ‥ ····· 2
− Thoracic hooded hooks with distinct node on shaft ···· ····· *H. tohbaiensis* Yabe and Mawatari, 1998
2. Posterior abdominal segment with conspicuously projecting uncinial spines ···· *H. caudatus* (Hartman, 1976)
− Posterior abdominal segment without conspicuously projecting uncinial spines ····· 3
3. Abdominal segment with palmately arranged filamentous branchiae ····· ····· *H. filobranchus* Berkeley and Berkeley, 1932
− Abdominal segment with simple branchiae ····· 4
4. Branchiae broadly-based and rounded lamellae projecting posteriorly ····· *H. filiformis* (Claparède, 1864)
− Branchiae triangular-shaped and carrying abdominal hooded hooks ····· 5
5. Abdominal hooded hooks with node situated anterior to middle of shaft ····· *H. hutchingsae* Green, 2002
− Abdominal hooded hooks with node located posterior to middle of shaft ····· *H. similis* Southern, 1921

Acknowledgements

This work was supported by the research funds from Chosun University (2015) and the National Institute of Biological Resources (NIBR), funded by the Ministry of Environment (MOE) of the Republic of Korea (NIBR 201401201), and partly supported by the National Ma-

rine Biodiversity Institute of Korea as a part of the 'Basic Research for Systematic Management of Marine Bioresources (2016M00300)'.

References

Amaral, A.C.Z. 1980. Breve caracterização dos gêneros da familia Capitellidae Grube (Annelida, Polychaeta) e descrição de Nonatus longilineus gen. sp. nov. Bol. Inst. Oceanogr. 29:99-106.

Berkeley, E. and C. Berkeley. 1932. Some Capitellidae (Polychaeta) from the northeast Pacific with a description of a new genus. Proc. Zool. Soc. Lond. 1932:669-675.

Blake, J.A. 2000. Family Capitellidae Grube, 1862. In: J.A. Blake, B. Hilbig, and P.V. Scott (eds.), Taxonomic atlas of the benthic fauna of the Santa Maria Basin and Western Santa Barbara, Part 4. Santa Barbara Museum of Natural History, Santa Barbara, California. pp. 47-96.

Choi, J.W., O.H. Yu and W.J. Lee. 2003. The summer spatial distributional pattern of macrobenthic fauna in Gwangyang Bay, southern coast of Korea. The Sea, Journal of the Korean Society of Oceanography 8:14-28.

Claparède, É. 1864. Glanures zootomiques parmi les annélides de Port-Vendres (Pyrénées Orientales). Mémoires de la Société de Physique et d'Histoire Naturelle de Genève 17:463-600.

Day, J.H. 1967. A monograph on the Polychaeta of Southeren Africa. Bulletin of the British Museum (Natural History), London.

Dean, H.K. 2001. Capitellidae (Annelida: Polychaeta) from the Pacific Coast of Costa Rica. Rev. Biol. Trop. 2:69-84.

Eisig, H. 1887. Monographie der Capitelliden des Golfes von Neapel und der angrenzenden meeres-abschnitte nebst untersuchungen zur vergleichenden anatomie und physiologie. Fauna und Flora des Golfes von Neapel und der angrenzenden Meeres-Abschnitte, Friedländer, Berlin.

Fauchald, K. 1977. The polychaete worms, definitions and keys to the orders, families and genera. Natn. Mus. Hist. L. A. Sci. ser. 28, Los Angeles.

Fauvel, P. 1927. Polychètes sédentaires. Faune de France, Lechevalier, Paris.

García-Garza, M.E. and J.A.D. León-González. 2011. Review of the Capitellidae (Annelida, Polychaeta) from the Eastern Tropical Pacific region, with notes on selected species. Zookeys 151:17-52.

Green, K.D. 2002. Capitellidae (Polychaeta) from the Andaman Sea. Phuket Mar. Biol. Cent. Spec. Publ. 24:249-343.

Hartman, O. 1947. Polychaetous annelids. Part 7. Capitellidae. Allan Hancock Pac. Exped. 10:391-481.

Hartman, O. 1976. Polychaetous annelids of the Indian Ocean including an account of species collected by members of the International Indian Ocean Expeditions, 1963-1964 and a catalogue and bibliography of the species from India. J. Mar. Biol. Assoc. India 16:191-252.

Hong, J.S., I.S. Seo, C.G. Lee, S.P. Yoon and R.H. Jung. 2000. An ecological feature of benthic macrofauna during summer 1997 in Namdaechon estuary, Yangyang, Korea. Korean J. Fish. Aquat. Sci. 33:230-237.

Hutchings, P.A. and S. Rainer. 1982. Designation of a neotype of *Capitella filiformis* Claparede, 1864, type species of the genus *Heteromastus* (Polychaeta: Capitellidae). Rec. Aust. Mus. 34:373-380.

Jung, R.E., M.K. Choi, S.P. Yoon, W.C. Lee and H.G. Choi. 2012. Polychaete community structure from inshore and offshore of Lake Shihwa (Korea) in March, 2008. Korean J. Fish. Aquat. Sci. 45:56-64.

Jung, R.H., I.S. Seo, W.C. Lee, H.C. Kim, S.R. Park, J.B. Kim, C.W. Oh and B.M. Choi. 2014. Community structure and health assessment of macrobenthic assemblages at spring and summer in Cheonsu Bay, West Coast of Korea. The Sea, Journal of the Korean Society of Oceanography 19:272-286.

Jung, R.H., J.S. Hong and J.H. Lee. 1997. Spatial and seasonal patterns of polychaete community during the reclamation and dredging activities for the construction of the Pohang Steel Mill Company in Kwangyang Bay, Korea. Korean J. Fish. Aquat. Sci. 30:730-743.

Paik, E.I. 1978. Preliminary survey of the polychaetous annelids from Gogeum Isl. Korea, Res. Bull. Hyosung Women's Coll. 20:1-25.

Paik, E.I. 1979. New records of five polychaetous Annelida species in Korea. Korean J. Fish. Aquat. Sci. 12:35-39.

Paik, E.I. 1980. New records of three benthic polychaetous annelid species in Korea. Korean J. Fish. Aquat. Sci. 13: 89-92.

Paik, E.I. 1982. Taxonomic studies on polychaetous annelids in Korea. Res. Bull. Hyosung Women's Coll. 24:745-913.

Paik, E.I. 1989. Illustrated Encyclopedia of Fauna and Flora of Korea. Vol. 32. Polychaeta. Ministry of Education Press, Seoul.

Pillai, T.G. 1961. Annelida Polychaeta of Tambalagam Lake, Ceylon. Ceylon J. Sci. (Bio. Sci.) 4:1-40.

Seo, I.S., H.T. Moon, B.M. Choi, M.H. Kim, D.I. Kim, J.S. Yun, J.Y. Byun, H.C. Choi and M.H. Son. 2009. Community structure of macrobenthic assemblages around the Wolseong Nuclear Power Plant, East Sea of Korea. Korean J. Environ. Biol. 27:341-352.

Shin, S.H., B.J. Gu and J.G. Je. 2004. Spatial distribution of benthic macrofauna on the tidal flat of Garorilim Bay, West Coast of Korea. J. Kor. Wet. Soc. 6:57-72.

Southern, R. 1921. Polychaeta of the Chilka Lake and also of fresh and brackish waters in other parts of India. Mem. Indian Mus. 5:563-659.

Uschakov, P.V. 1965. Polychaeta of the far eastern seas of the U.S.S.R. Israel Program for Scientific Translations, Jerusalem.

Warren, L.M., P.A. Hutchings and S. Doyle. 1994. A revision of the genus *Mediomastus* Hartman, 1944 (Polychaeta: Capitellidae). Records of the Australian Museum 46:227-256.

Yabe, K. and S.F. Mawatari. 1998. Two new species of Capitellidae (Annelida: Polychaeta) from Hokkaido, Northern Japan. Species Diversity 3:201-209.

Zachs, I. 1933. K. faune kolćhatykh chervi Severo-Yaponskogo morya (Polychaeta). Gosudarstvennyi Gidrologicheskii Institut, Issledovaniia Morei SSSR 14:125-137.

Submitted: November 27, 2015
Revised: July 19, 2016
Accepted: October 13, 2016