

New Record of Two Opheliid Polychaetes (Annelida: Polychaeta) from Korea

Hyun Ki Choi, Tae Won Jung¹ and Seong Myeong Yoon^{2,*}

Department of Biotechnology, Chosun University, Gwangju 501-759, Korea

¹National Science Museum, Daejeon 305-705, Korea

²Department of Biology, Chosun University, Gwangju 501-759, Korea

Abstract - Two newly recorded opheliid polychaetes, *Armandia amakusaensis* Saito, Tamaki and Imajima, 2000 and *Polyopthalmus qingdaoensis* Purschke, Ding and Müller, 1995, from Korean waters are reported with the descriptions and illustrations. *Armandia amakusaensis* can be clearly distinguished from its congeners by the following characteristics: the prostomium has 2 or 3 subdermal eyespots; total number of setigers are 29; the branchiae are present on the setigers from the setiger 2 to the second or third from the last setiger; the lateral eyespots beginning from the setiger 7 are composed of 11 pairs; the anal funnel has 8~11 papillae and a long cirrus. *Polyopthalmus qingdaoensis* has the distinguishable characteristics from its relatives as follows: the prostomium has a brain bearing dark pigment-spots; the lateral eyespots are distinct; the body has only dark pigment-streaks on dorsal side. We also provide the keys for distinguishing the species of the genera *Armandia* and *Polyopthalmus* from Korean waters.

Key words: *Armandia amakusaensis*, *Polyopthalmus qingdaoensis*, Polychaeta, Opheliidae, Korea

INTRODUCTION

The opheliid polychaetes can be found in the sand or mud flats as well as hard bottoms from the intertidal to abyssal depth (Rouse and Pleijel 2001; Neave and Glasby 2013). They can be largely divided into three groups based on the body shape as follows: short and thick grub-shaped (e.g. *Travisia* Johnston, 1840), slender and smooth torpedo-shaped (e.g. *Armandia* Filippi, 1861), and anteriorly inflated and posteriorly cylindrical or narrow (e.g. *Euzonus* Grube, 1866) (Fauchald 1977; Rouse and Pleijel 2001). To date, 11 genera of the family Opheliidae have been classified (Silva 2007).

Among them, the genus *Armandia* includes the species

bearing the ventral groove, the lateral eyespots, the parapodial branchiae, the long unpaired cirrus on anal funnel, and the simply capillary setae (Fauchald 1977; Blake 2000). This genus comprises currently 22 valid species described worldwide (Saito *et al.* 2000). It has been relatively well studied in East Asia, including total seven reported species; three species, *A. exigua* Kükenthal, 1887, *A. intermedia* Fauvel, 1902, and *A. leptocirris* (Grube, 1878), have been recorded from Chinese waters, and four species, *A. amakusaensis* Saito, Tamaki and Imajima, 2000, *A. brevis* (Moore, 1906), *A. lanceolata* Willey, 1905, and *A. simodaensis* Takahashi, 1938, from Japanese waters (Kükenthal 1887; Annenkova 1938; Okuda 1938; Takahashi 1938; Imajima and Hartman 1964; Yang and Sun 1988; Paxton and Chou 2000; Saito *et al.* 2000). Among these, two species, *A. lanceolata* and *A. simodaensis*, are also known from Korean waters (Paik 1975, 1982, 1989).

The diagnostic features of genus *Polyopthalmus* are most

* Corresponding author: Seong Myeong Yoon, Tel. 062-230-7018, Fax. 062-230-7018, E-mail. smyun@chosun.ac.kr

similar to those of *Armandia*, but *Polyophthalmus* doesn't have the parapodial branchiae and the long unpaired cirrus on anal funnel (Fauchad 1977; Blake 2000). Until now, 15 species of *Polyophthalmus* have been described but only four species of them are regarded to be valid (Purschke *et al.* 1995). In East Asia, two *Polyophthalmus* species are recorded. *P. pictus* (Dujardin, 1839), which is known as cosmopolitan species, has been widely reported in this region (Okuda 1938; Imajima and Hartman 1964; Imajima and Gamo 1970; Paik 1982, 1989; Paxton and Chou 2000), and *P. qingdaoensis* Purschke, Ding and Müller, 1995 was additionally recorded from Chinese waters (Purschke *et al.* 1995).

The purpose of this study is to describe the two new records of *Armandia* and *Polyophthalmus* species from Korean waters along with the descriptions and illustrations. We also provide the keys to *Armandia* and *Polyophthalmus* species from Korean waters.

MATERIALS AND METHODS

Samples were collected from the soft and rocky bottoms of intertidal zone 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. Drawings were made by the stereomicroscope and light microscope (LABOPHOT-2; Nikon, Tokyo, Japan) with the aids of drawing tubes. The examined materials are deposited in Chosun University and the National Institute of Biological Resources (NIBR) in Korea.

RESULTS AND DISCUSSION

Class Polychaeta Grube, 1850 다모 강
 Order Opheliida Malmgren, 1867 요정갯지렁이 목
 Family Opheliidae Malmgren, 1867 요정갯지렁이 과

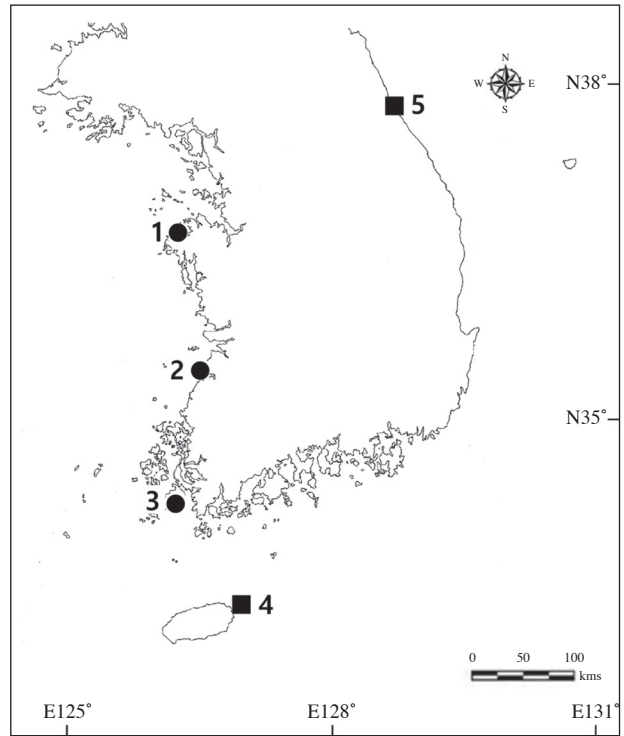


Fig. 1. A map showing the distributions of *Armandia amakusaensis* (●) and *Polyophthalmus qingdaoensis* (■) from Korean waters in the present study. 1, Taean-gun, Gwan-ri; 2, Buan-gun, Docheong-ri; 3, Jindo-gun, Ganggye-ri; 4, Jeju-si, Yeonpyeong-ri; 5, Gangneung-si, Hyangho-ri.

Genus *Armandia* Filippi, 1861 보석요정갯지렁이 속

1. *Armandia amakusaensis* Saito, Tamaki and Imajima, 2000 아가미보석요정갯지렁이 (신칭) (Fig. 2)

Synonyms: *Armandia amakusaensis* Saito *et al.*, 2000: 2032, Figs. 2, 3.

Material examined: Korea, 8 specimens, Chungcheongnam-do, Taean-gun, Iwon-myeon, Gwan-ri (36°53'05"N, 126°14'19"E), 23 May 2012, Choi HK; 11 specimens, Jeollabuk-do, Buan-gun, Byeonsan-myeon, Docheong-ri (35°35'24"N, 126°28'51"E), 14 Aug 2014, Choi HK; 10 specimens, Jeollanam-do, Jindo-gun, Imhoe-myeon, Ganggye-ri (34°23'30"N, 126°15'16"E), 09 Apr 2013, Choi HK.

Description: Body about 6.0 to 7.0 mm long with about 29 segments, slender and convex dorsally, and tapering anterior and posterior end; width 0.8 to 1.0 mm; surface smooth and faintly annulated; ventral groove from setiger 2 to last segment.

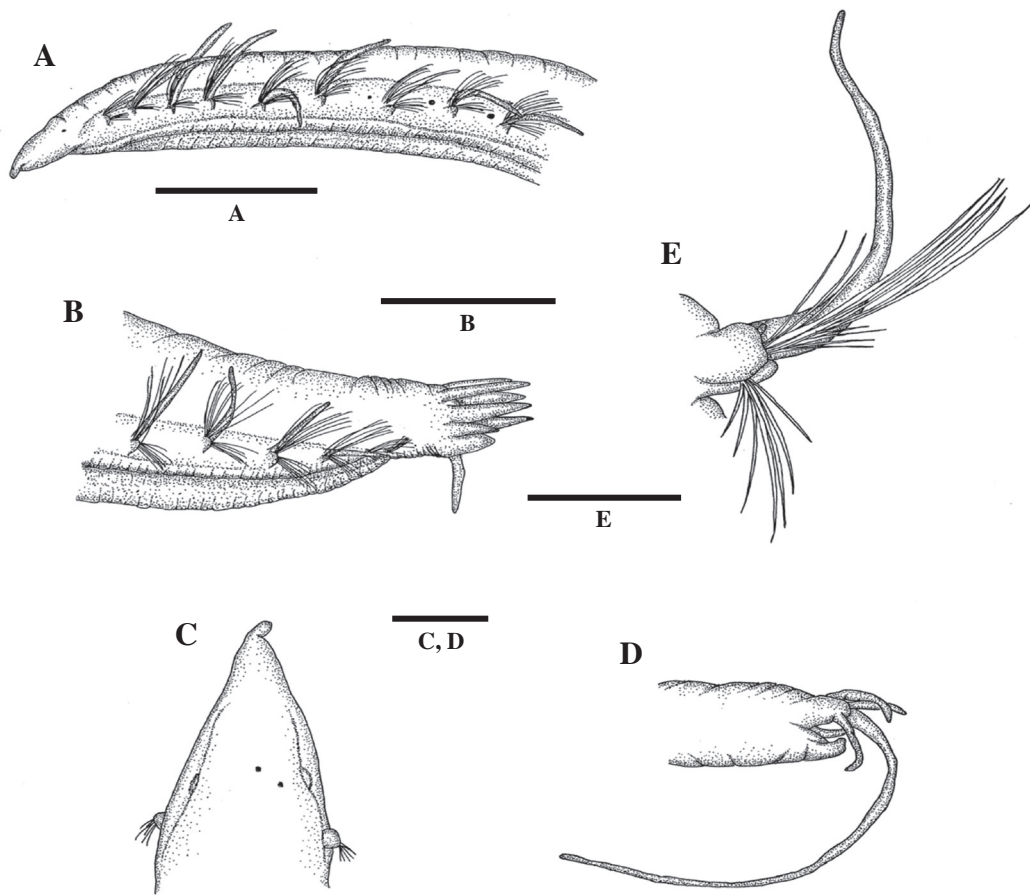


Fig. 2. *Armandia amakusaensis* Saito, Tamaki and Imajima, 2000. A, lateral view of anterior end; B, lateral view of posterior end including anal funnel (omitted long cirrus); C, dorsal view of anterior end; D, dorsal view of posterior end; E, anterior view of parapodium. Scale bars: A = 1.0 mm, B = 0.5 mm, C-E = 0.2 mm.

Prostomium conical shaped, with ball-shaped palpode distally; 2 or 3 subepidermal eyespots on dorsal side; nuchal organs visible on base of prostomium (Fig. 2A, C).

Branchiae filament-shaped, present on setigers from setiger 2 to second or third from last setiger (Fig. 2A, B).

Lateral eyespots beginning from setiger 7, composed of 11 pairs; anterior eyespots slightly larger than posterior ones (Fig. 2A).

Anal funnel with V-shaped incision on both dorsal and ventral sides, fringed with 8 to 10 short cirri and long unpaired cirrus originated mid-ventrally from inside of anal funnel; ventral length slightly shorter than dorsal length (Fig. 2D).

Parapodia biramous, with presetal lobes and ventral cirrus; presetal lobes semi-circular shaped, with minute projection (Fig. 2E).

Notosetae and neurosetae simple capillary in bundles; no-

tosetae longer than neurosetae (Fig. 2E).

Remarks: *Armandia amakusaensis* was originally described from western Kyushu in Japan by Saito *et al.* (2000). They indicated that *A. amakusaensis* resembled *A. leptocirris* and *A. intermedia* in the total number of setigers, the number of branchiae on the setigers, the distribution of lateral eyespots, and the number of anal funnel papillae (Saito *et al.* 2000). However, *A. amakusaensis* is distinguished from these species by the following characteristics: *A. amakusaensis* and *A. intermedia* possess the lateral eyespots beginning from the setiger 7, while *A. leptocirris* has the lateral eyespots beginning from the setiger 5; the branchiae are present on the setigers from the setiger 2 to the second or third from the last setiger in *A. amakusaensis*, while those of *A. leptocirris* are present on the setigers from the setiger 2 to the last setiger and those of *A. intermedia* are present on the setigers from the setiger 2 to the fourth from the last setiger (Saito *et al.*

2000).

Korean materials of the present study show several characteristics which are generally agreed well with the original description of *A. amakusaensis* as follows: the prostomium has two or three subdermal eyespots; total number of setigers are 29 (27~34 in the original description of *A. amakusaensis*); the branchiae are present on the setigers from the setiger 2 to the second or third from the last setiger; the lateral eyespots beginning from the setiger 7 are composed of 11 pairs; the anal funnel has 8~11 short cirri and a long cirrus. However, *A. amakusaensis* of the present study has a minor difference such that its long cirrus on anal funnel is smooth, while that of Japanese materials has constrictions at intervals (Saito *et al.* 2000).

Armandia amakusaensis resembles *A. lenceolata* previously reported by Paik (1989) from Korean waters in which the anal funnel is fringed, the lateral eyespots are composed of 11 pairs, and the body has about 29 setigers. However, these species are clearly distinguishable from each other by the following characteristics: *A. amakusaensis* has two or three subepidermal eyespots on the prostomium, while *A. lenceolata* has the prostomium without eyespots; *A. amakusaensis* possesses one or two abranchiate setigers posteriorly, while *A. lenceolata* has more than two; the anal funnel bears 8~11 short cirri in *A. amakusaensis*, while that of *A. lenceolata* has 14~18 short cirri (Willey 1905; Imajima and Hartman 1964; Paik 1989).

Habitat: This species collected from the soft bottoms of intertidal zone in the Yellow Sea of Korean waters.

World distribution: Korea, Japan.

Deposition: NIBRIV0000307837.

Identifiers: Hyun Ki Choi, Seong Myeong Yoon.

2. *Armandia lenceolata* Willey, 1905

침보석요정갯지렁이

Synonyms: *Armandia lanceolata* Willey, 1905: 288, pl. 5, Fig. 120; Imajima and Hartman, 1964: 306; Tampi and Rangarajan, 1964: 115; Paik, 1975: 422; 1982: 815; 1989: 502-503, Fig. 199.

3. *Armandia simodaensis* Takahashi, 1938

등근보석요정갯지렁이

Synonyms: *Armandia simodaensis* Takahashi, 1938: 152, 3 textfigs; Imajima and Hartman, 1964: 306; Paik, 1982:

815; 1989: 503.

Key to the species of the Genus *Armandia* from Korea

- 1. Anal funnel fringed 2
- Anal funnel not fringed
..... *A. simodaensis* Takahashi, 1938
- 2. Abranchiaete setigers on posterior region 1 or 2; anal funnel bearing 8~11 papillae
..... *A. amakusaensis* Saito, Tamaki and Imajima, 2000
- Abranchiaete setigers on posterior region more than 2; anal funnel bearing 14~18 papillae
..... *A. lenceolata* Willey, 1905

Genus *Polyophthalmus* Quatrefages, 1850

무늬요정갯지렁이 속

4. *Polyophthalmus pictus* (Dujardin, 1839)

무늬요정갯지렁이

Synonyms: *Polyophthalmus pictus* Southern, 1914: 133; Fauvel, 1927: 137, Fig. 481-n; Imajima and Hartman, 1964: 309; Day, 1967: 579, Fig. 25.2k-m; Imajima and Gamo, 1970: 16, Figs. 66, 67; Paik, 1982: 815; 1989: 500, Fig. 198.

5. *Polyophthalmus qingdaoensis* Purschke, Ding and Müller, 1995

안점무늬요정갯지렁이 (신칭) (Fig. 3)

Synonyms: *Polyophthalmus qingdaoensis* Purschke *et al.*, 1995: 239, Fig. 7.

Material examined: Korea, 6 specimens, Jeju-do, Jeju-si, Udo-myeon, Yeonpyeong-ri (33°30'08"N, 126°56'34"E), 24 Jun 2014, Choi HK; 2 specimens, Gangwon-do, Gangneung-si, Jumunjin-eup, Hyangho-ri (33°12'19"N, 126°21'58"E), 15 Sep 2014, Choi HK.

Description: Body slender, about 12.0 to 17.0 mm long with 27 setigerous segments and width 0.8 to 1.2 mm; body color brightly white in alcohol; separations of segments indistinct; ventral groove from setiger 2 to last segment.

Prostomium rounded, with 2 or 3 subepidermal eyespots; 4 or 5 dark pigment-spots on prostomial brain; pair of nuchal organ distinct, formed cylindrical projection, and positioned between prostomium and setiger 1 (Fig. 3A).

Lateral groove present on both sides, from setiger 3 to 24; reduced parapodia and lateral eyespots within lateral groove

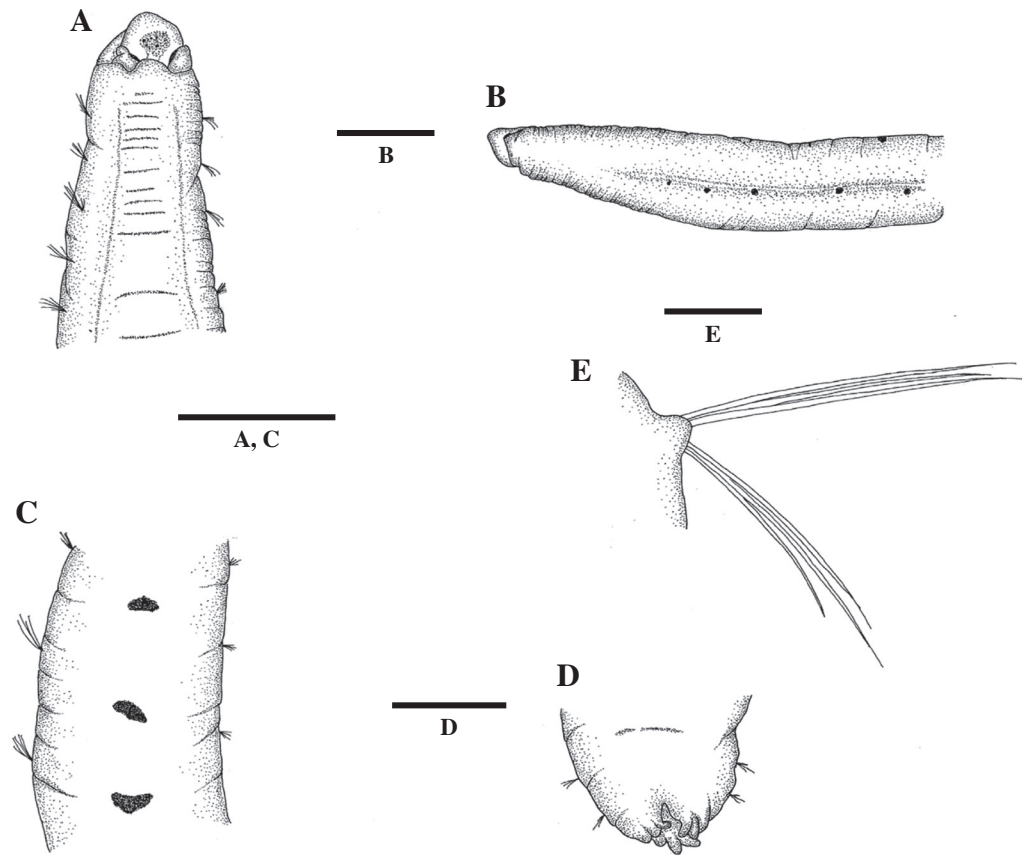


Fig. 3. *Polyophtalmus qingdaoensis* Purschke, Ding and Müller, 1995. A, dorsal view of anterior end; B, lateral view of anterior end (omitted setae); C, pigmented streaks on dorsal side of mid-body; D, dorsal view of posterior end; E, anterior view of parapodium. Scale bars: A-C = 1.0 mm, D = 0.05 mm, E = 0.025 mm.

(Fig. 3B).

Dorsum convex, with short and dark pigment-streaks composed of numerous spots appeared on surface in most segments (Fig. 3C).

Lateral eyespots distinct, circular and with heavily dark pigmentation, beginning from setiger 7, and composed of 12 pairs; median eyespots larger than anterior and posterior ones (Fig. 3B).

Anal funnel with single median notch on dorsal side and 8~10 small cirri on posterior margin; dorsal papillae smaller than ventral (Fig. 3D).

Parapodia without dorsal and ventral cirri, with only subglobular parapodial lobe and 2~5 capillary setae per bundle; setae from parapodial lobe, and grouped into notopodial and neuropodial setae. Branchiae absent (Fig. 3E).

Remarks. *Polyophtalmus qingdaoensis*, which was first described by Purschke *et al.* (1995) from Qingdao in China,

has a unique feature such as the prostomial brain bearing dark pigment-spots. The authors could find out the presence of this feature from the Korean materials of *Polyophtalmus* species in the present study. They generally agree well with the original description of *P. qingdaoensis* as the following characteristics: the body is slightly translucent and poorly pigmented, and has only short and dark pigment-streaks on the dorsal side; the lateral eyespots beginning from the setiger 7 are composed of 12 pairs (Purschke *et al.* 1995). However, there are some minor differences between Korean materials and Chinese materials of the original description: Korean materials possess the prostomial brain with 4 or 5 pigment-spots, while Chinese materials has the brain with 10 pigment-spots; the anal funnel bears 8~10 small cirri in Korean materials, but that in Chinese materials has only 6 small cirri (Purschke *et al.* 1995).

Polyophtalmus qingdaoensis is distinguished from *P. pic-*

tus, which is widely known from East Asia, by the following characteristics: *P. qingdaoensis* has distinct prostomial brain bearing the dark pigment-spots, while *P. pictus* possesses indistinct prostomial brain; *P. qingdaoensis* bears the distinct lateral eyespots, but *P. pictus* has faintly small lateral eyespots; the body possesses only dark pigment-streaks on the dorsal side in *P. qingdaoensis*, whereas that of *P. pictus* bears brown streaks and variable spots (Fauvel 1927; Imajima and Hartman 1964; Day 1967; Imajima and Gamo 1970; Paik 1982, 1989; Purschke *et al.* 1995).

Habitat: This species collected from algae on the rocky bottoms of intertidal zone in Jeju Is. and the East Sea of Korea.

World distribution: Korea, China.

Deposition: NIBRIV0000307838.

Identifiers: Hyun Ki Choi, Seong Myeong Yoon.

Key to the species of the Genus *Polyopthalmus* from Korea

1. Prostomium with brain bearing dark pigment-spots; lateral eyespots distinct
..... *P. qingdaoensis* Purschke, Ding and Müller, 1995
- Prostomium without brain; lateral eyespots faintly small
..... *P. pictus* (Dujardin, 1839)

ACKNOWLEDGEMENT

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 NO. 2014-02-001).

REFERENCES

- Annenkova NP. 1938. Polychaeta of the North Japan Sea and their horizontal and vertical distribution. Hydrobiol. Exped. U.S.S.R. in 1934 to the Japan Sea. 1:81-230.
- Blake JA. 2000. Family Opheliidae Malmgren, 1867. pp.145-168. In Taxonomic atlas of the benthic fauna of the Santa Maria Basin and Western Santa Barbara, Part 7 (Blake JA, B Hilbig and PV Scott eds.). Santa Barbara Museum of Natural History, Santa Barbara, California.
- Day JH. 1967. A monograph on the Polychaeta of Southern Africa. Trustees of the British Museum (Natural History), London.
- 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.
- Imajima M and O Hartman. 1964. The polychaetous annelids of Japan, Part II. Allan Hancock Found. Occas. Pap. 26:239-452.
- Imajima M and S Gamo. 1970. Polychaetous annelids from the intertidal zone of Manazuru, Kanagawa Prefecture. Sci. Rep. Yokohama Nati. Univ., Ser. Sec. II. 16:1-18.
- Kükenthal W. 1887. Die Opheliaceen der Expedition der Vettore Pisani. Jen. Zeitschr. f. Naturwissenschaft. 21:361-373.
- Neave MJ and CJ Glasby. 2013. New species of *Ophelina* (Annelida: Opheliidae: Ophelininae) from northern Australia. Org. Divers. Evol. 13:331-347.
- Okuda S. 1938. Polychaetous annelids from the vicinity of the Mitsui Institute of Marine Biology. Japan. Jour. Zool. 8:75-105.
- Paik EI. 1975. The polychaetous annelids in Korea (III). Res. Bull. Hyosung Women's Coll. 17:409-438.
- Paik EI. 1982. Taxonomic studies on polychaetous annelids in Korea. Res. Bull. Hyosung Women's Coll. 24:745-913.
- Paik EI, 1989. Illustrated encyclopedia of fauna and flora of Korea. Vol. 32. Polychaeta. Ministry of Education Press, Seoul.
- Paxton H and LM Chou. 2000. Polychaetous annelids from the South China Sea. Raffles Bull. Zool. 8:209-232.
- Purschke G, D Zhihu and MC Müller. 1995. Ultrastructural differences as a taxonomic marker: The segmental ocelli of *Polyopthalmus pictus* and *Polyopthalmus qingdaoensis* sp.n. (Polychaeta, Opheliidae). Zoomorphology 115:229-241.
- Rouse G and F Pleijel. 2001. Polychaetes. Oxford University Press, New York.
- Saito H, A Tamaki and M Imajima. 2000. Description of a new species of *Armandia* (Polychaeta: Opheliidae) from western Kyushu, Japan, with character variations. J. Nat. Hist. 34:2029-2044.
- Silva GS. 2007. Filogenia de opheliidae. PhD thesis. Universidade Federal do Paraná. Programa de Pós-Graduação em Zoologia, Curitiba.
- Southern R. 1914. Clare island survey, archi Annelida and Polychaeta. Proc. Roy. Irish Acad. 31:1-160.
- Takahashi K. 1938. On a new species of polychaetous annelid,

Armandia simodaensis, sp. nov. Zool. Mag. (Dobutsugakusho zasshi). 50:152-154.

Tampi PRS and K Rengarajan. 1964. Some polychaetous annelids from the Andaman waters. J. Mar. Biol. Assoc. India. 6:98-123.

Willey A. 1905. Report on the Polychaeta collected by Professor Herdman, at Ceylon, in 1902. pp.243-324. In Report to the government of Ceylon on the pearl oyster fisheries of the Gulf of Manaar with supplementary reports upon

the marine biology of Ceylon, by other naturalists, Part IV (Herdman WA ed.). Royal Society, London.

Yang D and R Sun. 1988. Polychaetous annelids commonly seen from the Chinese waters. China Agriculture Press, Beijing.

Received: 11 May 2015

Revised: 2 June 2015

Revision accepted: 3 June 2015