

Two new species records of the class Chromadorea Inglis, 1983 (Nematoda) from Korea

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Two known species of the free-living nematodes were collected from marine sediments in the sublittoral zone of Korea and were described and illustrated. *Actinonema pachydermatum* Cobb, 1920, which was originally described from the Key West, Florida, USA, was reported for the first time in the South Sea of Korea. It shows slight difference in body length and thickness (817–850 µm vs. 830–900 µm; 33–35 µm vs. 27–30 µm). *Sphaerolaimus gracilis* de Man, 1876, which was considered the cosmopolitan species of nematodes spread widely from the North Sea, Spitsbergen, East Sea. The present specimen differs from the redescription by Fadeeva from the East Sea in body length and body thickness (1365–1520 µm vs. 1300–1700 µm; 65–78 µm vs. 60–83 µm); the spicules length and the apophysis length of gubernaculum (55–70 µm vs. 45–55 µm, 15–20 µm vs. 13–14 µm). Studies on previously unrecorded species enhance our understanding of nematode species diversity in Korean waters.

Keywords: *Actinonema*, free-living nematodes, *Sphaerolaimus*



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INTRODUCTION

Throughout “Marine Biological Resources Survey Project”, focusing on marine nematodes in Korea from 2022 to 2023, we reported more than 80 species of free-living nematodes include two unrecorded species belonging to the genus *Actinonema* and *Sphaerolaimus* from Korea. The genus *Actinonema* is distinguished by its heterogeneous cuticle with lateral differentiation, six outer labial setae, and four setaceous cephalic setae arranged in a single circle. It also features a conspicuous, transversely oval amphidial fovea with a double contour and simple, curved spicules accompanied by an L-shaped telamon. (Cobb, 1920; Tchesunov, 2014). The genus *Actinonema* was established by Cobb in 1920, with *A. pachydermatum* Cobb, 1920 designated as the type species. To date, 12

species of *Actinonema* have been described (Chu et al., 2023; Nemys eds., 2024; WoRMS Editorial Board, 2024). Currently, 39 species are recognized within the genus *Sphaerolaimus* Bastian, 1865 (Nemys eds., 2024; WoRMS Editorial Board, 2024). *Sphaerolaimus hirsutus* Bastian, 1865 was designated as the type species of the genus *Sphaerolaimus*. The genus *Sphaerolaimus* is primarily characterized by the presence of four setiform cephalic setae and eight groups of subcephalic setae, along with somatic setae that are usually present. It features a large, barrel-shaped buccal cavity, where the anterior section has longitudinal ridges, and the posterior section is heavily sclerotized and surrounded by pharyngeal muscles. Additionally, the genus has a circular amphidial fovea located at variable positions relative to the anterior end. The pharynx is cylindrical with a cuticularized inner lining. Males typi-

cally possess two testes, curved spicules accompanied by a gubernaculum, and a tail that is generally conical or conico-cylindrical, ending with two or three terminal setae (Fonseca and Bezerra, 2014; Zograf *et al.*, 2020; Tchesunov *et al.*, 2024). This paper describes two known species belonging to these two genera, collected from Korean waters.

MATERIALS AND METHODS

While conducting a survey of the meiofauna community along the Korean coastline, *Actinonema* specimens were collected along the coast of Samsan-myeon, Goseong-gun, Gyeongsangnam-do (34°56'2.1"N, 128°15'20.6"E, at a depth of 25 m, in the clay sediment) on 2nd May 2023 and *Sphaerolaimus* specimens were collected along the coast of Ilgwang-myeon, Gijang-gun, Busan (35°16'0.0"N, 129°16'50.0"E, at a depth of 16 m, in the clay sediment) on 30th April 2023. Sediment samples were collected using a Smith-McIntyre grab with an area of 0.1 m², while meiofauna samples were obtained using a hand-held corer that has a surface area of 10 cm² and a depth of 5 cm. All samples were promptly fixed in 4% neutral buffered formalin at room temperature. In the laboratory, meiofauna were extracted according to the protocol established by Burgess (2001) and nematodes were classified using a grid-patterned Petri dish while observing them under a stereoscopic microscope (S APO; Leica, Wetzlar, Germany). Sorted nematodes were subsequently placed in Seinhorst solution for dehydration and infiltration with glycerin, utilizing the glycerin-ethanol method (Seinhorst, 1959). Nematode specimens were then prepared on glass slides using anhydrous glycerin and glass beads (the size of the beads was chosen based on the diameter of the specimens) using a standard waxring technique (Hooper, 1986). For morphological analysis, nematode specimens were observed using a 100× oil immersion objective combined with Nomarski Differential Interference Contrast (DIC) illumination. Drawings were created using an optical microscope with a camera lucida (BX-51; Olympus, Tokyo, Japan). All morphometric measurements were acquired from the figures utilizing a digital map-measurer and Leica Application Suite Version 4.12.0 (Leica, Wetzlar, Germany). The classification follows that given in de Ley and Blaxter (2004). Abbreviations used are as follows: a - the ratio of body length to maximum body diameter; abd - anal body diameter (μm); AL - distance from anterior apex to anterior edge of amphids (μm); amp - diameter of amphidial fovea (μm); amp cbd - corresponding body diameter at the level of amphidial fovea (μm); b - body length in relation to the pharynx length; BL - buccal cavity length (μm); bcd - buccal cavity diameter (μm); c - body length divided by tail length; c' - tail length

divided by anal body diameter; car - length of cardia (μm); cbd - corresponding body diameter (μm); cs - length of cephalic setae (μm); EPL - distance of ventral excretory pore from anterior end of body (μm); gub - length of gubernacular apophyses (μm); hd - diameter at the level of cephalic setae (μm); L - total body length (μm); mbd - maximum body diameter (μm); N% - nerve ring distance from the anterior apex as percentage of pharynx length; N cbd - corresponding body diameter at nerve ring (μm); NL - nerve ring from anterior apex of body (μm); P cbd - corresponding body length at cardia (μm); (μm); s - spicule length as arc length divided by anal body width; spia - spicule length as arc (μm); TEL - length of telamon (μm); TL - tail length (μm); V% - vulva distance from anterior end as percentage of total body length.

RESULTS AND DISCUSSION

Class Chromadorea Inglis, 1983
Subclass Chromadoria Pearse, 1942
Order Chromadorida Chitwood, 1933
Family Chromadoridae Filipjev, 1917
Genus *Actinonema* Cobb, 1920

Actinonema pachydermatum Cobb, 1920

Original description (Cobb, 1920: 338–339, fig. 117a–b, Florida, USA)

Other descriptions (Wieser, 1954: 81, fig. 142a–d, Chile. Lorenzen, 1971: 290, fig. 5a–d, North Sea)

Synonymised names [*Actinonema amphidiscatum* (Schuurmans Stekhoven & Adam, 1931) Wieser, 1954; *Actinonema fragile* (Allgén, 1929) Wieser, 1954; *Adeuchromadora megamphida* Boucher & Bovée, 1972; *Euchromadora fragilis* Allgén, 1933; *Pareuchromadora amphidiscata* Allgén, 1940; *Pareuchromadora amphidiscata* Schuurmans Stekhoven & Adam, 1931; *Pareuchromadora fragilis* (Allgén, 1934); *Spiliphora fragilis* Allgén, 1929]

Locality. The coast of Samsan-myeon, Goseong-gun, Gyeongsangnam-do: sub-tidal Eastern part of South Sea, Korea (34°56'2.1"N, 128°15'20.6"E), at a depth of 25 m, in the clay sediment.

Material. Three males (MABIK NA00158042, MABIK NA00158708–MABIK NA00158709) and One female (MABIK NA00158710) collected by Jung-Ho Hong at the coast of Goseong on 2nd May 2023, from Research Vessel Haeyanghwnangkyung 2.

Measurements. Check Table 1 for detailed measurements and morphometric ratios.

Description. Males (Fig. 1, Table 1). Body cylindrical, uniform in thickness, gradually narrowing toward both ends; anterior apex blunt. Cuticle heterogeneous and com-

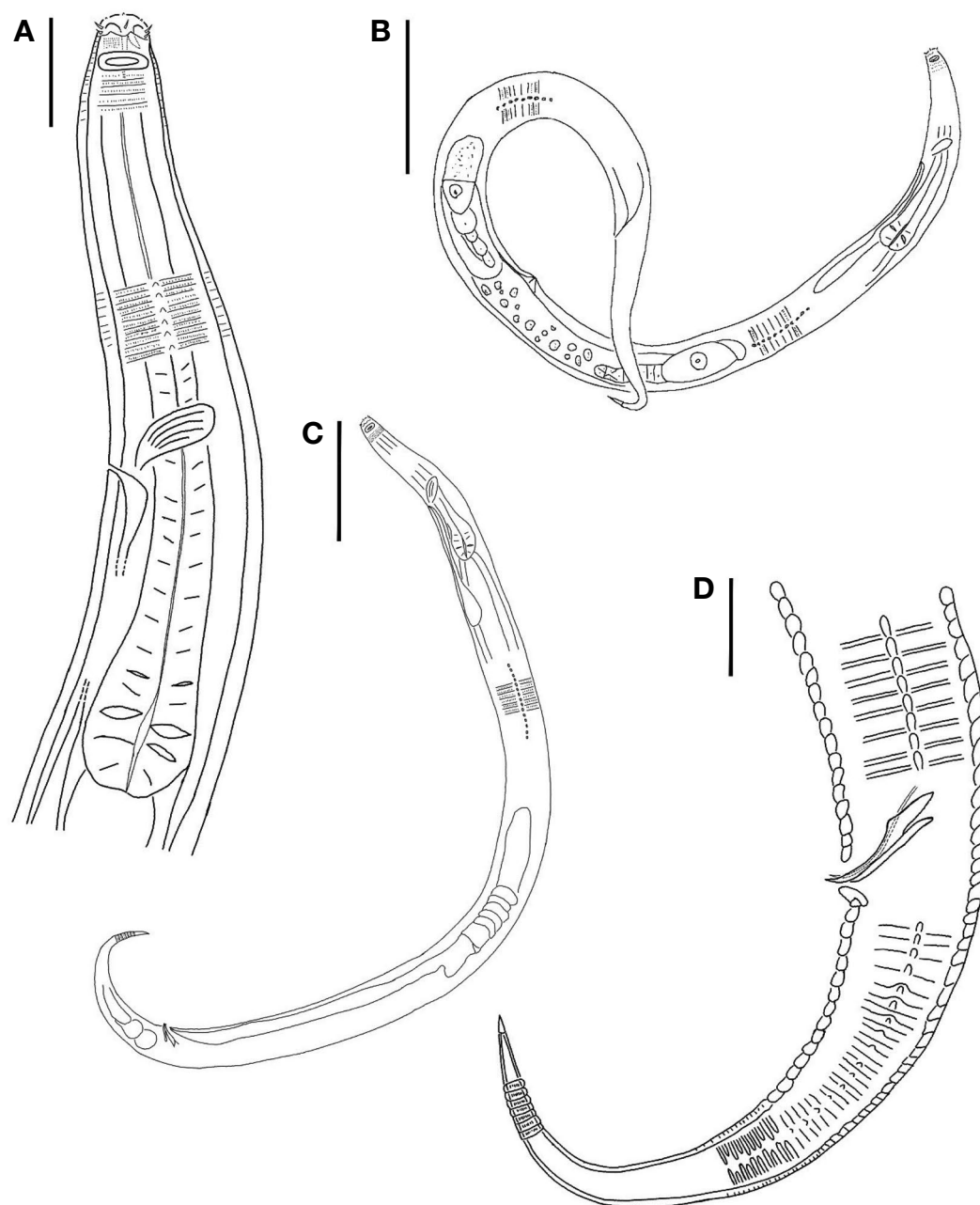


Fig. 1. *Actinonema pachydermatum* Cobb, 1920 from the South Sea, Korea: A, Male pharynx; B, Male habitus; C, Female habitus; D, Male tail. Scale bars: 20 μ m (A, D) and 100 μ m (B, C).

plex, with irregular minute dots beginning at the anterior border of amphids. Transverse dots present in the anterior part of the pharynx; lateral differentiation starts anterior to the nerve ring (~50–60 μ m from the anterior apex) with a reversed 'V' shape. Double reversed 'V' shaped lateral differentiation present from mid-body to anus, transitioning to irregular differentiation from near the anus to the posterior tail. Lateral differentiation diminishes in the distal two-thirds of the tail. Somatic setae inconspicuous,

minute, and scattered. Labial region with six inner labial papillae and six outer labial setae (~3 μ m) in a single circle, accompanied by four cephalic setae (~2 μ m). Six solid cones surround the labial region. Stoma conical, bearing a sharply pointed dorsal tooth. Amphideal fovea conspicuous, transversely oval with a double contour, 10–11 μ m wide (75–80% of cbd), located posterior to the cephalic setae circle. Pharynx cylindrical, 130–135 μ m long, with a distinct posterior bulb. Cardia inconspic-

Table 1. Morphometrics of *Actinonema pachydermatum* Cobb, 1920 from South Sea, Korea and *A. pachydermatum* Cobb, 1920 from Florida and Chile.

Characters	<i>A. pachydermatum</i> from South Sea, Korea		<i>A. pachydermatum</i> from Florida ^a	<i>A. pachydermatum</i> from Chile ^b
	♂; n = 3	♀; n = 1	♂; n = ?, ♀; n = ?	♂; n = 1, ♀; n = 3
L	820–850	817	830–900	610–790
mbd	33–35	34	27–30	27–30
hd	9–10	9	n/a	11.5
cs	2–3	2	n/a	n/a
amp	9–10	9	n/a	9–10
amp cbd	12–13	12	n/a	12–13
amp%	75–80	75	n/a	70
NL	50–60	60	n/a	n/a
N cbd	27–30	28	n/a	n/a
EPL	55–68	65	n/a	n/a
PL	130–145	155	142–147	132
P cbd	33–34	33	n/a	n/a
V%	n/a	51.5	n/a	50.6–50.7
abd	25–27	30	n/a	n/a
spia	25–30	n/a	n/a	21
s	1.0–1.2	n/a	n/a	n/a
TEL	27–31	n/a	n/a	n/a
gub	20–23	n/a	n/a	n/a
TL	135–140	145	134–156	112–124
a	24–25	24	24–34	15–29
b	5.9–6.3	5.2	6.3	5.1–5.9
c	6.0–6.3	5.6	5.3–6.7	5.9–7.0
c'	5.2–5.4	4.8	n/a	n/a

All measurements in μm unless otherwise stated, except ratio a, b, c, c', s. n/a: not applicable. ?: unknown. Literature sources: ^aCobb, 1920; ^bWieser, 1954.

uous. Excretory pore located just posterior to the nerve ring, 80–85 μm from the anterior body end. Reproductive system monorchic; single testis situated on the left side of the intestine. Spicules thin, curved, measuring 25–30 μm ; talamons 27–31 μm long. Gubernaculum 20–23 μm , without apophyses. Precloacal supplements absent. Tail conical, tapering to a pointed tip, with three caudal glands and a well-developed spinneret.

Females (Fig. 1, Table 1). Overall features similar to males. Reproductive system amphidelphic. Ovaries located to the left of the intestine, reflexed. Vulva slightly posterior to mid-body, positioned at 51.5% of body length.

Remarks. To date, the genus *Actinonema* Cobb, 1920 contains 12 valid species: *A. celtica* Boucher, 1976, *A. diplobulba* Chu, Hao and Huang, 2023, *A. dolichurum* Gagarin and Long, 2017, *A. falciforme* Shi, Yu and Xu, 2018, *A. fidatum* Vitiello, 1970, *A. grafi* Jensen, 1991, *A. longicaudatoides* Gagarin, 2015, *A. longicaudatum* (Steiner, 1918) Wieser, 1954, *A. pachydermatum* Cobb, 1920, *A. paraceltica* Muthumbi and Vincx, 1998, *A. parvum* Gagarin, 2015 and *A. smolae* Muthumbi and Vincx, 1998

(WoRMS Editorial Board, 2024; Nemys eds., 2024). Specimens from the eastern part of the South Sea, Korea, generally match the original description by Cobb (1920), with the exception of differences in body width (33–35 μm vs. 27–30 μm) and slight variation in body length (817–850 μm vs. 830–900 μm). These differences are considered intraspecific variations.

Class Chromadorea Inglis, 1983
Subclass Chromadoria Pearse, 1942
Order Monhysterida Filipjev, 1929
Family Sphaerolaimidae Filipjev, 1918
Genus *Sphaerolaimus* Bastian, 1865

***Sphaerolaimus gracilis* de Man, 1876**

Original description (de Man, 1876: 179–181, fig. 47a–d, North Sea)

Other descriptions (de Man, 1922: 235–236, fig. 23a–b, North Sea. Stekhoven, 1935: 148, fig. 325a–c, North Sea. Stekhoven, 1942: 228, fig. 10a–c, Mediterranean Sea. Gerlarch, 1957: 172, fig. 1211–m, Brazil. Loof,

Table 2. Morphometrics of *Sphaerolaimus gracilis* de Man, 1876 from the East Sea, Korea, and comparisons with populations from Spitsbergen, the North Sea, the Baltic Sea, and the East Sea.

Characters	<i>S. gracilis</i> from East Sea, Korea	<i>S. gracilis</i> from Spitsbergen ^a	<i>S. gracilis</i> from North Sea, Group 1 ^b	<i>S. gracilis</i> from North Sea, Group 2 ^b	<i>S. gracilis</i> from North Sea, Group 3 ^b	<i>S. gracilis</i> from East Sea ^c	<i>S. gracilis</i> from Baltic Sea ^d
	♂: n=3, ♀: n=0	♂: n=1, ♀: n=0	♂: n=2, ♀: n=1	♂: n=2, ♀: n=1	♂: n=1, ♀: n=2	♂: n=5, ♀: n=0	♂: n=14, ♀: n=22
L	1365–1520	1559	725–800	1105–1360	870–940	1300–1700	972–1668
mbd	65–78	54	34	44–57	48	60–83	34–76
hd	24–26	23	17	24	20	13–25	16–24
cs	4–5	8.5	4–8	6–8	4–8	4–5	5.5–6.5
sub cep	15–20	17–21	10–12	10–15	17–21	19–20	15–16
AL	23–33	36	25	44	30	25–38	25–38
amp	8–11	10	8	8	9	8–11	6–8
amp cbd	33–39	33	25	40	33	25–38	30–36
BL	19–24	23	25	25	23	18–23	n/a
NL	140–181	n/a	n/a	n/a	n/a	138–175	n/a
N cbd	48–60	n/a	n/a	n/a	n/a	35–63	n/a
EPL	160–185	164	n/a	n/a	n/a	150–178	152–190
PL	280–335	353	150	225–330	215	261–368	192–340
P cbd	55–62	50	50	43–57	45	40–68	32–72
V%	n/a	n/a	63	68	69–70	n/a	64–72
abd	45–65	44	28	39–51	39	45–50	27–55
spia	55–70	55	29–40	56–83	47	45–55	47–64
s	1.0–1.2	1.3	1.0–1.4	1.4–1.5	1.2	0.9–1.1	1.1–1.7
gub	15–20	26	13	20	25	13–14	13–14
TL	190–215	167	100	150–155	115	145–177	120–185
a	17–23	29	21–27	17–25	18–20	17–21	18–32
b	4.5–4.9	4.4	4.5–4.8	3.2–4.9	3.9–4.0	4.4–6.3	4.2–5.1
c	7.0–8.0	9.3	7.0–7.6	7.2–8.0	7.5–8.2	7.8–10.4	7.1–9.1
c'	3.3–4.2	3.7	3.7	3.0–3.8	2.9	2.9–3.9	2.9–3.9

All measurements in μm unless otherwise stated, except ratio a, b, c, c', s. n/a: not applicable. Literature sources: ^aGerlach, 1965; ^bLorenzen, 1969; ^cFadeeva, 1983; ^dTurpeenniemi, 1997.

1961: 198–199, fig. 10a–b, North Sea, reexamination of type specimen. Gerlach, 1965: 170, fig. 44a–c. Lorenzen, 1969: 209, fig. 10a–d, North Sea. Fadeeva, 1983: 1324–1326, fig. 2a–d, East Sea. Turpeenniemi, 1997: 72–81, fig. 4a–h, Baltic Sea)
Synonymised names (*Sphaerolaimus buetschlii* Schulz, 1932; *Sphaerolaimus demani* Filipjev, 1922; *Sphaerolaimus setosus* Paramonov, 1927)

Locality. The coast of Ilgwang-myeon, Gijang-gun, Busan: sub-tidal zone Southern part of East Sea, Korea (35°16' 0.0"N, 129°16'50.0"E), at a depth of 16 m, in the clay sediment.

Material. Three males (MABIK NA00158050, MABIK NA00158715–MABIK NA00158716) collected by Jung-Ho Hong at the coast of Gijang on 30th April 2023, from Research Vessel Haeyanghwnangkyung 3.

Measurements. See Table 2 for detailed measurements and morphometric ratios.

Description. Males (Fig. 2, Table 2). Body cylindrical, gradually tapering towards the tail end, about 1365–1520 μm long and 65–78 μm wide at the maximum body diameter. The cuticle finely striated with lateral alae measuring 10–15 μm in width, starting from the cervical region and extending to the base of the tail. Somatic setae in eight longitudinal rows, about 6–12 μm long in the cervical region, 5–7 μm long in the mid and tail part. The anterior end rounded with six small lips encircle the oral opening. Lip region rounded with six inner labial papillae. Six outer labial papillae and four cephalic setae (4–5 μm long) in one circle, anterior to buccal cavity. Subcephalic setae in eight groups situated, 2–3 setae (14–20 μm long) in each group. A series of longitudinal ridges located just in front of the buccal cavity. Buccal cavity barrel-shaped,

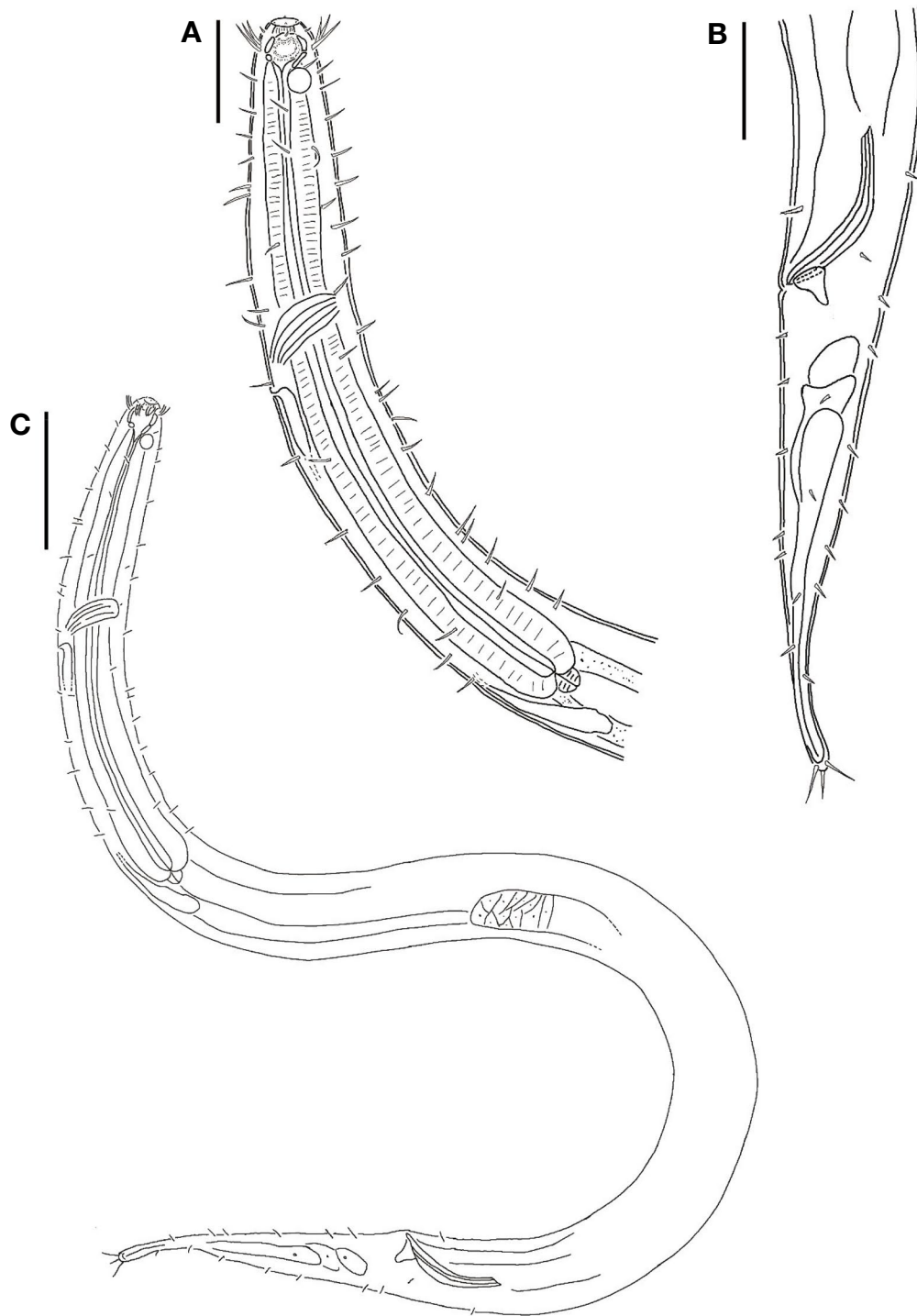


Fig. 2. *Sphaerolaimus gracilis* de Man, 1876 from the East Sea, Korea: A, Male pharynx; B, Male tail; C, Male habitus. Scale bars: 50 μ m (A, B) and 100 μ m (C).

23–32 μ m long, 20–25 μ m wide composed in two parts, thick-walled anterior part and a sclerotized, thin-walled posterior part. Amphideal fovea circular, 8–11 μ m in diameter or 24–28% of corresponding body diameter, located 23–33 μ m from anterior apex. Pharynx nearly cylindrical,

gradually expanding towards to the cardia, strongly muscular throughout its entire length. Cardia small, rounded-conoid, surrounded by intestinal tissue. Nerve ring at 50–54% of the pharynx length (140–181 μ m long). Renette cell slightly behind the base of the pharynx, small oval

shape, lateral to the intestine. Excretory pore near posterior to the nerve ring. Testes paired. Vas deferens well-developed. Spicules curved, 60–85 μm long along arch. Gubernaculum with dorsal-caudally directed apophysis 20–25 μm long. Precloacal supplements absent. Tail length 190–215 μm , conical anteriorly and cylindrical posteriorly, pointed terminal end with three terminal setae (12–15 μm long). Three caudal glands open to the spinneret.

Remarks. *Sphaerolaimus gracilis* de Man, 1876 is characterized by the position of the amphid posterior to the buccal cavity; the length of spicules shorter than twice of anal body diameter; spicules not double jointed; spicules with consistent thickness; gubernaculum present; gubernaculum with straight dorsal apophyses (Zograf *et al.*, 2020). Based on the original description by de Man in 1876 from the brackish water of Walcheren Island, Netherlands, other descriptions made by many authors in the North Sea, Spitsbergen, the East Sea, and so on. Our specimens from the East Sea, Korea are similar to the description by Fadeeva in 1983 from the East Sea, but slightly smaller in body width (65–75 μm vs. 60–83 μm) and body length (1365–1520 μm vs. 1300–1700 μm). There is also a slight difference in spicules length (55–70 μm vs. 45–55 μm) and the apophysis length of the gubernaculum (15–20 μm vs. 13–14 μm).

CONFLICTS OF INTEREST

The authors of this paper have no affiliation with any interests and is solely responsible for the paper.

ACKNOWLEDGEMENTS

This work was supported by the National Marine Biodiversity Institute Research Program (2024M00200).

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Submitted: November 27, 2024

Revised: December 27, 2024

Accepted: January 2, 2025