

Two new free-living nematode species of *Setosabatieria* (Comesomatidea) from the East China Sea and the Chukchi Sea

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Two new free-living marine nematode species of the genus *Setosabatieria* from the sandy intertidal zone of Xiamen, in the East China Sea and a shallow water area in the Chukchi Sea, Arctic Ocean are described and illustrated. *Setosabatieria longiapophysis* sp. nov. is characterized by four longitudinal files with 7–9 cervical setae per file, 15–16 minute papillate precloacal supplements and relatively long straight apophyses of gubernaculum. *Setosabatieria major* sp. nov. is identified by its relatively large body of 2701–3144 µm, the number (10–11) of cervical setae per file, 26–28 minute papillate precloacal supplements and spicules with a central septum at both the proximal and distal end. A pictorial identification key to all known species of *Setosabatieria* is provided.

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Keywords: *Setosabatieria longiapophysis* sp. nov.; *Setosabatieria major* sp. nov.; pictorial key

Introduction

Setosabatieria was first erected by Platt (1985) to accommodate two *Sabatieria* species possessing synapomorphic features warranting recognition as a separate genus, namely the lack of cuticular punctations and the presence of four sublateral files of numerous long cervical setae (Platt 1985). To date, eight species of *Setosabatieria* with distinct differentiating morphology have been reported from oceans worldwide (Gagarin 2013). Leduc et al. (2012) provided a dichotomous key to the genus based on tail shape, spicule shape, and the number of windings of amphidial fovea and precloacal supplements. Two new *Setosabatieria* species from the sandy intertidal zone of Xiamen in the East China Sea and a shallow water area in the Chukchi Sea, Arctic Ocean are described and illustrated in this paper.

Methods

Nematode samples from Xiamen, East China Sea were collected in October 2011 from the sandy intertidal zone at Guliang Island. Sediments from the Chukchi Sea, Arctic Ocean were collected using a multicorer during the Fourth Chinese National Arctic Research Expedition from July to September, 2010. The samples were fixed

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with 5% formalin in seawater. In the laboratory, the samples were stained with rose Bengal for more than 24 h. Nematodes were extracted from the sediment by decantation and/or Ludox centrifugation (Warwick et al. 1998). Each extracted sample was washed into a lined Petri dish and the meiofauna were sorted under a stereoscopic microscope to higher taxonomic levels. Nematodes were transferred into an embryo glass dish containing by volume 5% glycerine, 5% pure ethanol, 90% freshwater, and left in a desiccator for a few days. This allows the ethanol and water to evaporate slowly leaving the nematodes in pure glycerol. The descriptions have been made from glycerine mounts using interference contrast microscopy (NIKON 80i, Shizuoka, Japan). Drawings were made with the aid of a camera lucida. Type specimens are deposited in the Institute of Oceanology, Chinese Academy of Sciences.

Measurements are in μm . Abbreviations are as follows: *a*, total body length divided by maximum body diameter; *b*, total body length divided by pharynx length; *c*, total body length divided by tail length; a.b.d., anal body diameter; *c'*, tail length divided by a.b.d.; Spic, spicule length as chord; TL, total body length; Hd, head diameter as percentage of body diameter at level posterior pharynx; A%, amphid diameter as percentage of corresponding body diameter; At, number of turns of amphidial fovea; R3, cephalic setae length as percentage of head diameter; Cs, number of cervical setae in each sublateral row; Ps, number of precloacal supplements; V%, position of vulva from anterior as percentage of total body length.

Description

Family COMESOMATIDAE Filipjev, 1918

Genus *Setosabatieria* Platt, 1985

Setosabatieria longiapophysis sp. nov. (Figures 1, 2 and Table 1)

Type material

Five males and two females were collected from station XMGLY L2. Holotype: ♂1 on slide number XMGLY20111016 L206.

Paratypes: ♂2 and ♀2 on slide number XMGLY20111016 L205, ♂3 on XMGLY20111016 L210, ♂4 on XMGLY20111016 L218, ♂5 and ♀1 on XMGLY20111016 L213.

Type locality and habitat

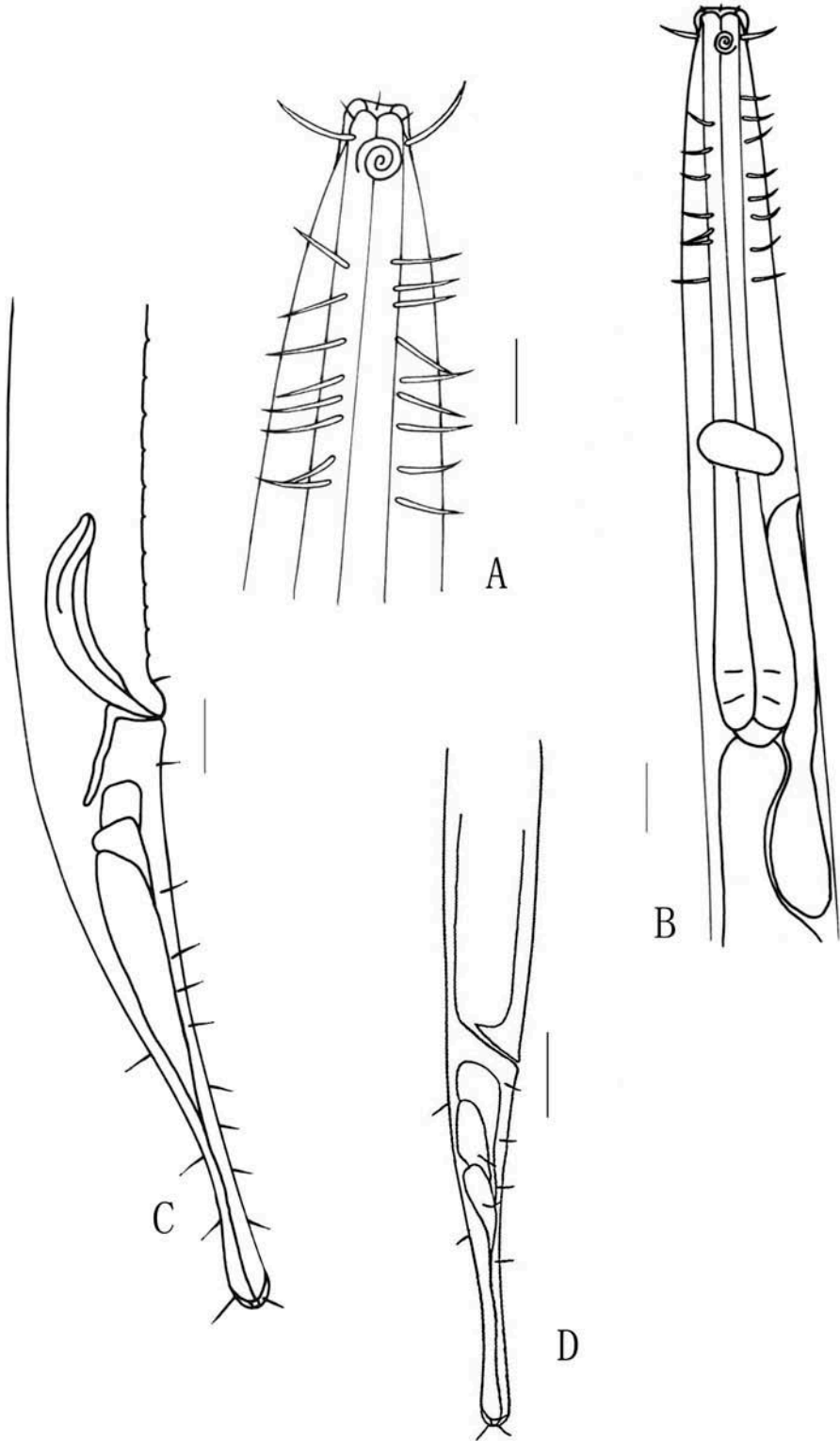
Intertidal sandy sediment at Gulang Island, Xiamen, the East China Sea. Latitude: 118.0666°E, longitude: 24.4333°N.

Characteristics of surface sediment: Silt + clay 0.07%, salinity 20–22‰, total organic matter 0.0192%.

Etymology

This species is named for the long straight apophyses of gubernaculum.

Figure 1. *Setosabatieria longiapophysis* sp. nov. (A) lateral view of male head end; (B) lateral view of female anterior region; (C) lateral view of male tail region and copulatory apparatus; (D) lateral view of female tail region. Scale bars: A = 20 μm ; B, C = 25 μm ; D = 50 μm .



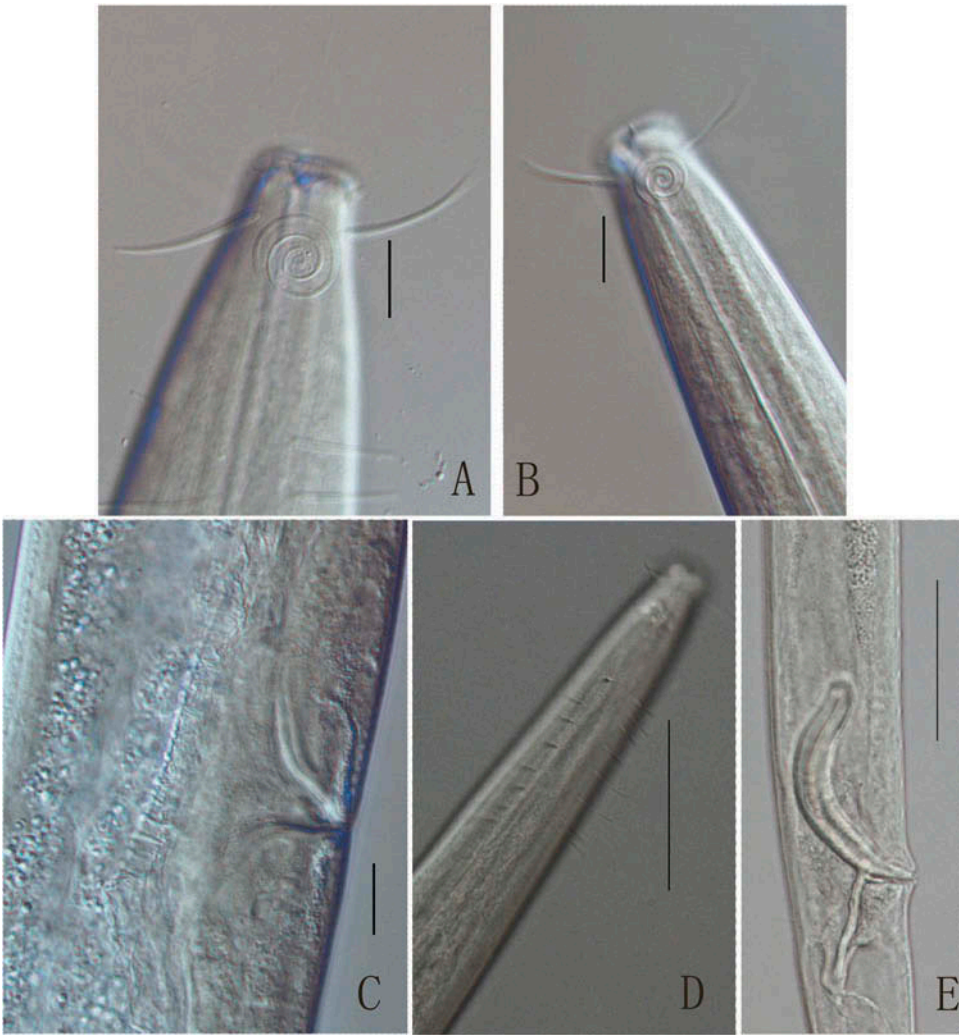


Figure 2. *Setosabatieria longiapophysis* sp. nov. (A) lateral view of male head end, showing amphidial fovea and cephalic setae; (B) lateral view of female head end; (C) lateral view of female vulva region; (D) lateral view of male head end, showing cervical setae; (E) lateral view of male spicule, gubernaculum and precloacal supplements. Scale bars: A–C = 10 μ m, D, E = 50 μ m.

Measurements

Measurements are given in Table 1.

Holotype ♂1:	–252 W 2273	2480 μ m; a = 50.6, b = 9.8, c = 12.0, Spic = 66.0 μ m
	16 41 49 39	
Paratype ♀1:	–270 V 2312	2540 μ m; a = 49.8, b = 9.4, c = 11.2, V% = 50.0%
	16 41 51 38	

Table 1. Individual measurements of *Setosabatieria longiapophysis* sp. nov. (in μm).

Characters	Holotype	Paratypes					
	♂1	♂2	♂3	♂4	♂5	♀1	♀2
Total body length	2480	2435	2590	2380	2800	2540	2810
Head diameter	16	16	15	15	17	16	17
Amphids diameter	11	10	10	10	10	7.8	9.2
Body width level amphid	16	15	15	15	17	16	17
Length of cephalic setae	18	19	17	18	17	16	18
Nerve ring from the anterior end	169	163	164	161	164	166	175
Body width level nerve ring	38	36	38	35	38	37	39
Pharynx length	252	262	270	259	261	270	271
Body width level pharynx end	41	41	43	40	43	41	44
Maximum body diameter	49	42	48	53	54	51	58
Spicule length as chord (Spic)	66	65	64	67	66	—	—
Spicule length as arc	80	80	78	77	78	—	—
Length of gubernaculum apophysis	36	35	37	31	33	—	—
Anal diameter	39	38	40	40	41	38	41
Tail length	206	227	217	223	222	227	237
Tail length/anal body diameter	5.3	6.0	5.4	5.6	5.4	6.0	5.8
Vulva from anterior end	—	—	—	—	—	1270	1370
Body width level vulva	—	—	—	—	—	49	52
V%	—	—	—	—	—	50	49
a	50.6	57.9	53.9	44.9	51.8	49.8	48.5
b	9.8	9.3	9.6	9.2	10.7	9.4	10.4
c	12.0	10.7	11.9	10.7	12.6	11.2	11.9

Description

Body cylindrical, tapering towards both extremities, maximum body diameter 42–58 μm . Cuticle not punctate but with faint transverse striations visible throughout body. Head narrower than rest of body due to constriction at level of amphidial fovea. Buccal cavity cup-shaped. Inner labial sensilla not visible, outer labial sensilla setiform, 2 μm long. Four cephalic setae 16–19 μm long (100–120% of head diameter). Cervical setae, similar to cephalic setae length, arranged in four longitudinal files of seven to nine setae. Amphidial fovea spiral, with 2.75–3 turns, 15–17 μm in diameter, occupying 49–69% of corresponding body diameter. Pharynx gradually enlarging posteriorly but without true terminal bulb. Nerve ring at 61–65% of pharynx length from anterior end. Cardia small, muscular, surrounded by intestinal tissue. Excretory pore posterior to nerve ring. Tail conico-cylindrical,

5.3–6.0 times anal body diameter, with numerous caudal setae. Tail tip enlarged with three terminal setae 12 µm long. Caudal glands and spinneret well developed.

Males. Testes opposite and outstretched. Anterior testis situated to left of intestine, posterior testis to right. Spicules paired, equal, arcuate, with slightly marked capitulum and a central cuticularized septum at the proximal end. Gubernaculum with 31–37 µm long straight dorsocaudal directed apophyses. Fifteen or 16 poorly developed small precloacal papillate supplements, posterior supplements with closer spacing.

Females. Similar to male in general characteristics, but amphid diameter smaller; vulva at 49–50% of total body length but developed reproductive system not found.

Differential diagnosis

Setosabatieria longiapophysis sp. nov. is similar to *Setosabatieria triangularis* Riera et al. 2006 in that they both have longer cephalic setae than in the other species, and a similar number of cervical setae in each sublateral row and precloacal supplements (Table 3). However, *Setosabatieria longiapophysis* sp. nov. has spicules with straight apophyses 31–37 µm long in contrast to the triangular apophyses of *S. triangularis*.

Setosabatieria major sp. nov. (Figures 3, 4 and Table 2)

Type material

Five males, one female and one juvenile from station CC4. Holotype: ♂1 on slide number Chukchi20100720 CC42401.

Paratypes: ♂2 on slide number Chukchi20100720 CC42401, ♂3 on Chukchi20100720 CC42403, ♂4 on Chukchi20100720 CC42404, ♂5 on Chukchi20100720 CC42405, ♀1 on Chukchi20100720 CC42406, juvenile on Chukchi20100720 CC42407.

Type locality and habitat

Sublittoral zone in the Chukchi Sea (the Arctic Ocean). Latitude: 68.1336°N, longitude: 167.8633°W.

Environmental parameters: water depth 52 m, surface water temperature 2.2°C, salinity at 52 m depth 32.13‰.

Etymology

This species is named for the large body.

Figure 3. *Setosabatieria major* sp. nov. (A) lateral view of male head end; (B) lateral view of female anterior region; (C) lateral view of male tail and copulatory apparatus; (D) spicule and gubernaculum; (E) lateral view of female tail region. Scale bars: A, D = 20 µm; B, C, E = 50 µm.

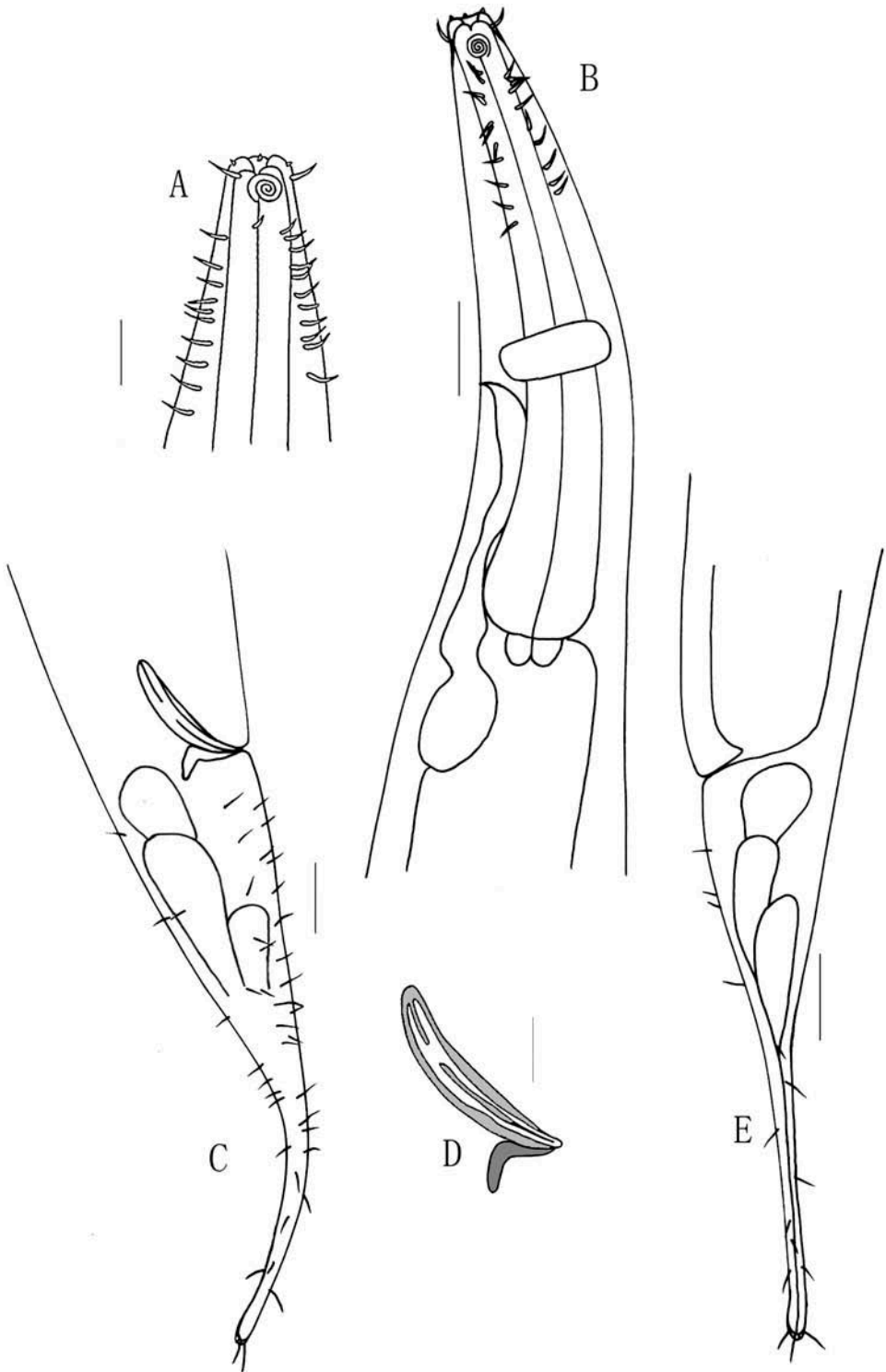




Figure 4. *Setosabatieria major* sp. nov. (A) lateral view of male head end, showing cervical setae; (B) lateral view of female head end, showing female amphidial fovea; (C) lateral view of female vulva region, showing vulva and eggs; (D) lateral view of male tail region. Scale bars: A = 25 μ m; B = 10 μ m; C, D = 50 μ m.

Table 2. Individual measurements of *Setosabatieria major* sp. nov. (in μm).

Characters	Holotype	Paratypes					
	♂1	♂2	♂3	♂4	♂ 5	♀1	Juvenile
Total body length	3130	2720	3075	2930	2700	3145	1730
Head diameter	21	20	22	24	19	23	17
Amphids diameter	12	10	13	14	12	12	8.5
Body width level amphid	22	20	24	26	21	26	9
Length of cephalic setae (R3)	9	11	11	10	9	11	13
Nerve ring from the anterior end	206	172	199	200	154	188	115
Body width level nerve ring	96	79	76	62	61	75	55
Pharynx length	366	292	327	327	282	332	231
Body width level pharynx end	117	97	103	93	74	104	70
Maximum body diameter	168	122	136	122	106	176	78
Spicule length as chord (Spic)	69	—	69	78	70	—	—
Spicule length as arc	74	—	73	87	73	—	—
Length of gubernaculum apophysis	17	—	23	18	23	—	—
Anal diameter	82	76	72	68	64	80	46
Tail length	323	290	325	296	241	316	206
Tail length/a.b.d.	4.0	3.8	4.5	4.4	3.7	4.0	4.5
Vulva from anterior end	—	—	—	—	—	1390	—
Body width level vulva	—	—	—	—	—	164	—
V%	—	—	—	—	—	44	—
a	18.6	22.3	22.7	24.0	25.4	17.9	22.2
b	8.6	9.3	9.4	8.9	9.6	9.5	7.5
c	9.7	9.4	9.5	9.9	11.2	10.0	8.4

Measurements

Measurements are given in [Table 2](#).

Holotype ♂1:	—366 W 2806	3130 μm ; a = 18.6, b = 8.6, c = 9.7, Spic = 69 μm
	21 117 168 82	
Paratype ♀1:	—332 V 2828	3145 μm ; a = 17.9, b = 9.5, c = 8.0, V% = 44.1%
	23 104 176 80	

Description

Body rather large cylindrical, tapering towards both extremities. Cuticle not punctated but with transverse striation most obvious at anterior and posterior

extremities. Buccal cavity small cup-shaped, surrounded by six short outer labial, 1.5–2 μm long and four cephalic setae, 9–13 μm long. Amphidial fovea spiral, with 3.25–3.75 turns and occupying 47–57% of corresponding body diameter. Four sublateral rows of 10–11 cervical setae 8–10 μm long. Pharynx gradually swollen posteriorly, not forming a true bulb. Cardia small, muscular, surrounded by intestinal tissue. Ventral gland situated posterior to pharynx and excretory pore about level nerve ring. Nerve ring at 55–61% of pharynx length from anterior end. Tail slender, with rather broad, conical anterior portion and rather narrow cylindrical posterior portion. Tail 3.7–4.5 times of the anal body diameter with numerous short setae. Tail tip not enlarged, with 15 μm long three terminal setae. Caudal glands not always visible and spinneret well developed.

Males. Reproductive system with two opposite outstretched testes. Spicules paired, equal, slight arcuate, 0.9–1.3 times as long as cloacal body diameter, with central septum appearing in both proximal and distal portions. Gubernaculum with a pair of short dorsocaudal apophyses. There are 26–28 small pre-cloacal papillae supplements, although they are very small and difficult to observe.

Females. Similar to male in general characteristics, but tail with fewer short setae and narrow cylindrical posterior portion longer than anterior conical portion. Reproductive system with two outstretched equally developed ovaries. Vulva at 44% of total body length.

Differential diagnosis

Setosabatieria major sp. nov. is characterized by its rather large body (length 2700–3145 μm ; maximum body diameter 106–176 μm), the number (10–11) of cervical setae per file, 26–28 small papillate precloacal supplements and central septum appearing in both proximal and distal portions of spicules. These characters are obviously different from those of other species in this genus.

Discussion

Setosabatieria longiapophysis sp. nov. was found in the samples from low tidal level where 38% of the specimens were free-living nematodes, It accounted for 1% of the total number of nematodes. *Setosabatieria major* sp. nov. was found in subsurface sediments at 2–4 cm depth. It accounted for 3% of total nematode abundance at the type locality CC4 station (Lin et al. 2014). At present, the three species of *Setosabatieria* found in China are distributed in three distant sea areas: Bohai, the Yellow Sea and the East China Sea. The geographic distributions of other valid species in the genus are given by Gagarin (2013) and Platt (1985). The genus has a worldwide distribution. The dichotomous keys including seven species in this genus were provided by Leduc et al. (2012). Composite differentiating characters of all known male *Setosabatieria* species are provided as an aid to identification (Table 3). Based on Gagarin (2013), the pictorial key of the genus is shown in Figure 5.

Table 3. Differentiating characters of all known male *Setosabatieria* species.

Species	TL	a	Hd	A%	At	R3	Cs	Spic	Ps	c'
<i>S. fibulata</i> (Weiser, 1954)	1400	34	40	90	4.25	90	3–4	1.7	17	3–3.3
<i>S. hilarula</i> (de Man, 1922)	1140–2400	25–38	31–47	48–76	3.25	80–150	3–21	1.3–1.7	11–16	4–6
<i>S. jingtingae</i> Guo and Warwick, 2001	1370–1620	29–34	20–32	69–73	3.5	62–73	5–8	1.0–1.7	9	3.2–5.2
<i>S. triangularis</i> Riera et al., 2006	1700–2371.4	31.7–44.2	43–58	68	2.5	108–158	6–8	1.2–1.7	15	5.2–5.3
<i>S. coomansi</i> Huang and Zhang, 2006	1580–1983	31.5–36.7	33–38	59–71	3.5	63–81	6–8	1.1–1.4	15	3.9–4.8
<i>S. australis</i> Leduc and Gwyther, 2008	1321–1321	33.3–35.3	32–35	67–84	3.5	83–110	2–5	1.5–1.6	7–9	4.5–5.2
<i>S. conicauda</i> Leduc et al., 2012	1094–1640	25–30	42.1–42.5	25–30	4.25–4.5	41–44	1–3	1.5–1.8	7–9	1.8–2.4
<i>S. orientalis</i> Gagarin, 2013	1238–1545	26–39	—	50–55	2.5–3	91	4–6	1.8–2	15–19	5.2–5.6
<i>S. longiapophysis</i> sp. nov.	2380–2810	44.9–57.9	35–40	49–69	2.75–3	100–120	6–9	1.6–1.71	15–16	5.2–6.0
<i>S. major</i> sp. nov.	2700–3130	18.6–25.4	18–26	51–57	3.25–3.75	41–55	10–11	0.9–1.3	26–28	3.7–4.5

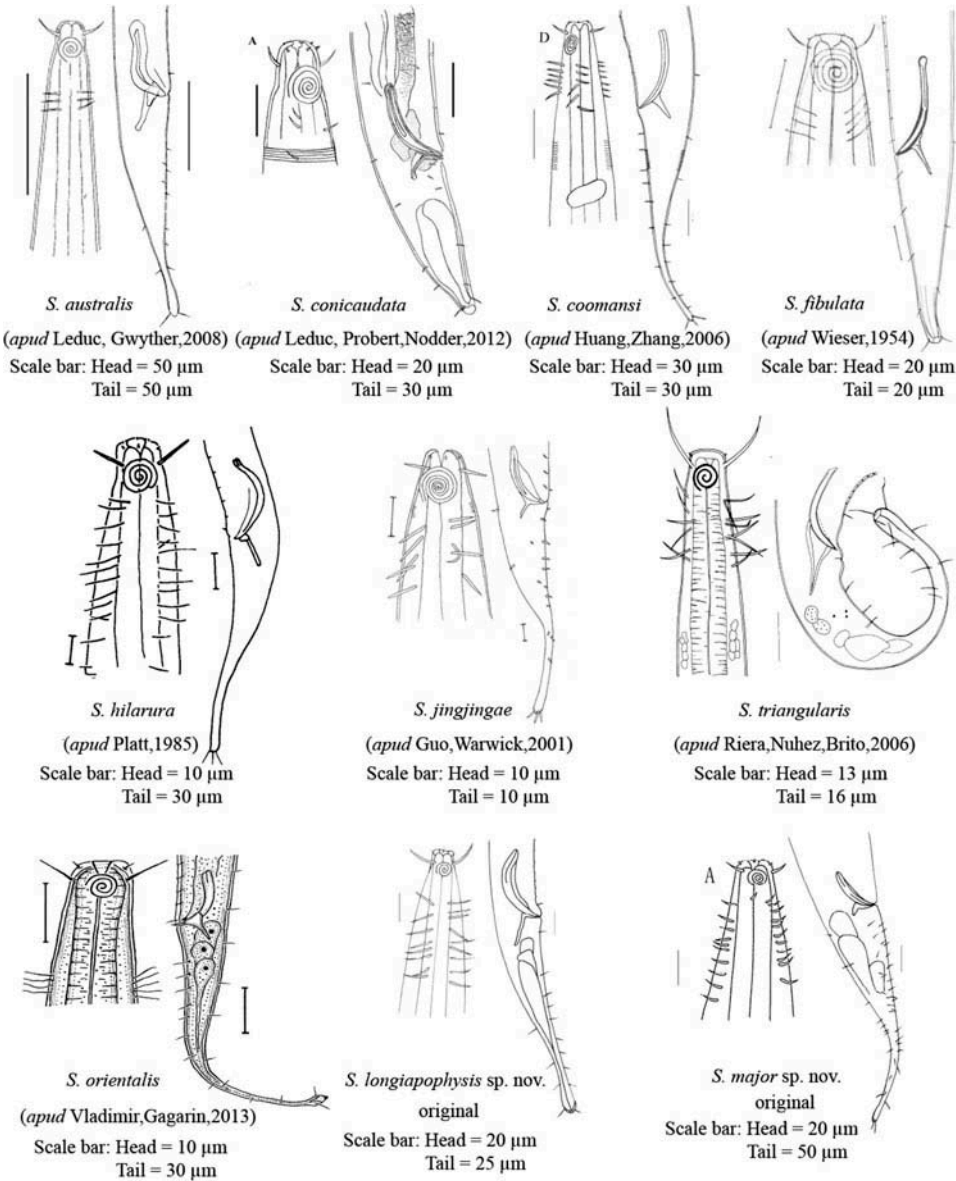


Figure 5. Pictorial key for valid species of genus *Setosabatieria*.

Disclosure statement

No potential conflict of interest was reported by the authors.

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