

Three Free-living Marine Nematodes from Sagami Bay, Japan, with a Description of *Wiesoncholaimus jambio* sp. nov. (Nematoda: Oncholaimidae)

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We describe three free-living marine nematode species from Sagami Bay, Japan. *Wiesoncholaimus jambio* sp. nov. is the second species of this genus. It differs from the type species, *Wiesoncholaimus mawsonae* Inglis, 1966, by its dorsal tooth, which is as long as the other two teeth; its conico-cylindrical tail, which is as long as 4.6–4.8 cloacal body diameters; and the absence of the gubernaculum. *Thalassironus* cf. *britannicus* de Man, 1889 agrees well with a redescription of *Thalassironus britannicus* de Man, 1889 based on specimens collected near the type locality. However, as it is possible that *T. britannicus* sensu lato includes two or more species, our species may not be conspecific to *T. britannicus* sensu stricto. *Vasostoma* cf. *longispicula* Huang and Wu, 2010 closely resembles *Vasostoma longispicula* Huang and Wu, 2010 originally described from China, but minor differentiations are observed in body diameter, body cuticle thickness, and type of precloacal supplements.

Key words: invertebrates, JAMBIO, meiofauna, new species, North Pacific

INTRODUCTION

During the 12th Japanese Association for Marine Biology (JAMBIO) Coastal Organism Joint Survey in Sagami Bay, North Pacific Ocean, free-living nematodes were collected using biological dredge sampling. Among these nematodes, three species of Phanodermatidae, namely, *Crenopharynx caudata* (Filipjev, 1927), *Micoletzkyia nakanoi* Shimada and Kakui, 2019, and *Phanodermopsis kohtsukai* Shimada and Kakui, 2019, were described in a previous report (Shimada and Kakui, 2019). In the present report, another three species, belonging to *Wiesoncholaimus* Inglis, 1966, *Thalassironus* de Man, 1889, and *Vasostoma* Wieser, 1954, are described.

The genus *Wiesoncholaimus* only contains the type species *Wiesoncholaimus mawsonae* Inglis, 1966 and differs from the other five genera that have equal right and left subventral teeth in Oncholaimidae Filipjev, 1916, as follows: from *Pontonema* Leidy, 1855, *Filoncholaimus* Filipjev, 1927, and *Meyersia* Hopper, 1967, by a monodelphic female reproductive system (didelphic in the three genera listed); from *Krampia* Ditlevsen, 1921 by the presence of the Demanian system (absent in *Krampia*); and from *Metaparoncholaimus* De Coninck and Schuurmans Stekhoven, 1933 by the spicules longer than 3.0 cloacal body diameters (shorter than 2.0 cloacal body diameters in *Metaparoncholaimus*).

The genus *Thalassironus* contains 12 valid species (Nasira et al., 2006; Huang et al., 2019). Although Jeong et al. (2019) treated *Thalassironus multidentatus* Bussau, 1993 as an invalid name, it is currently considered valid (Holovachov, 2020). This genus is distinguished from the other eight genera in Ironidae de Man, 1876 by the following characteristics: papilliform inner labial sensilla; setiform outer labial and cephalic sensilla; short, paired spicules; and presence of the caudal glands (cf. Platonova and Mokievsky, 1994; Smol et al., 2014).

The genus *Vasostoma* contains eight valid species (Rosli et al., 2014). The genus name is neuter in gender but has sometimes been mistakenly treated as a feminine noun. Rosli et al. (2014) corrected *Vasostoma articulata* Huang and Wu, 2010 and *Vasostoma aurata* Leduc et al., 2012 to *Vasostoma articulatum* and *Vasostoma auratum*, respectively. However, *Vasostoma longicaudata* Huang and Wu, 2011 and *Vasostoma vietnamica* Nguyen et al., 2008 should also be corrected to *Vasostoma longicaudatum* and *Vasostoma vietnamicum*. In addition, as corrected by Jensen (1979) and Rosli et al. (2014), *Vasostoma spiratus* Wieser, 1954 must not be spelled *Vasostoma spiratum* (or *Vasostoma spirata*) because the specific name "*spiratus*" seems to be derived from a Latin noun meaning "breathing." This genus differs from the other 19 genera in Comesomatidae Filipjev, 1918 by having a buccal cavity with a cylindrical posterior portion, possessing teeth, and lacking lateral differentiation (cf. Fonseca and Bezerra, 2014).

MATERIALS AND METHODS

Specimens were collected on 15 February 2017 from off the coast of Jogashima, Miura, Kanagawa Prefecture, Japan, in Sagami

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Bay in the North Pacific Ocean. A biological dredge onboard the research vessel *Rinkai-Maru* (Misaki Marine Biological Station, the University of Tokyo) was used to collect the specimens during the 12th JAMBIO Coastal Organism Joint Survey. The methods used for sorting, fixation, and preparation for differential interference contrast microscopy were previously described by Shimada and Kakui (2019), and the methods used for taking photomicrographs and measurements were previously described by Shimada et al. (2021). All examined specimens were deposited in the Invertebrate Collection of Hokkaido University Museum (ICHUM), Sapporo, Japan.

De Man's ratios (Hooper, 1986): a, ratio of body length to maximum body diameter; b, ratio of body length to pharynx length; c, ratio of body length to tail length; V, position of the vulva from the anterior body end expressed as a percentage of the body length.

RESULTS AND DISCUSSION

In total, 47 nematodes belonging to 17 morphospecies were collected (Table 1).

Order **Enoplida** Filipjev, 1929
Family **Oncholaimidae** Filipjev, 1916
Genus ***Wiesoncholaimus*** Inglis, 1966
Wiesoncholaimus jambio sp. nov.
(Figs. 1–3; Table 2)

Table 1. Nematodes collected during the 12th JAMBIO Coastal Organism Joint Survey.

Species	Number of specimen		
	Male	Female	Juvenile
Enoplida			
Anticonidae			
Anticoma sp.	1		
Leptosomatidae			
Leptosomatum aff. *keiense*	1		
Phanodermatidae			
Crenopharynx caudata	1	1	1
Micoletzkyia nakanoi	1	1	
Micoletzkyia sp. 1		4	1
Micoletzkyia sp. 2		4	
Phanodermopsis kohtsukai	2		
Phanodermatidae sp.		3	
Enoplidae			
Enoplus sp.			1
Thoracostomopsidae			
Epacanthion sp.	3	8	4
Thoracostomopsidae sp.			1
Ironidae			
Thalassironus cf. *britannicus*	1		
Oncholaimidae			
Metoncholaimus sp.		1	
Wiesoncholaimus jambio sp. nov.	2	1	
Oncholaimidae sp.			1
Araeolaimida			
Comesomatidae			
Vasostoma cf. *longispicula*	2		
Sabatieria sp.	1		

Diagnosis. *Wiesoncholaimus jambio* sp. nov. is characterized by three equal-sized teeth, a long (4.6–4.8 cloacal body diameters) conico-cylindrical tail, and the absence of the gubernaculum.

Material examined. Holotype: male (ICHUM 5886), DESS-fixed (Yoder et al., 2006), whole mount in glycerin, off Misaki, Miura, Kanagawa, Japan (35°06.807′N 139°33.777′E–35°06.644′N 139°33.739′E), depth 297–365 m, 15 February 2017. Paratypes: one male (ICHUM 5887) and one female (ICHUM 5888), DESS-fixed, whole mount in glycerin, same collection data as those of holotype.

Etymology. The specific name *jambio* is derived from the expedition name, the 12th JAMBIO Coastal Organism Joint Survey; thus it is treated as indeclinable.

Description of males. Cuticle smooth, without striation. Somatic setae sparse, mainly present in cervical and caudal regions. Head rounded, constricted at level of amphids, as wide as 0.3–0.4 maximum body diameters at level of cephalic setae. Six lips with six inner labial papillae. Six outer labial and four cephalic setae 8–10 μm or 0.2–0.3 cephalic diameters long, arranged in single circle. Amphids with slit-like aperture and cup-shaped fovea, 14–16 μm or 0.35 corresponding body diameters wide, located at 0.5–0.6 cephalic diameters from anterior end. Buccal cavity barrel-shaped with sclerotized walls, as long as 1.5–1.6 cephalic diameters, as wide as 0.50–0.55 cephalic diameters, length/width = 2.7–3.2. Three teeth well-developed, almost equal in size and shape. Tip of teeth located at 0.30–0.35 buccal cavity lengths from anterior end. Pharynx gradually widened toward posterior end, as long as 0.09–0.10 body lengths. Cardia surrounded by intestine. Nerve ring located at 0.42–0.43 pharyngeal lengths from anterior end. Pore of secretory-excretory system located at 2.4–2.5 cephalic diameters or 1.5–1.7 buccal cavity lengths from anterior end. Renette cell not observed. Tail conico-cylindrical, conical in anterior fifth, as long as 4.6–4.8 cloacal body diameters, slightly widened at end, with spinneret and pair of terminal setae (4–6 μm). Tail width at posterior end of conical portion 0.3 cloacal body diameters, at narrowest point of cylindrical portion 0.15 cloacal body diameters, at widened tip 0.2 cloacal body diameters. Caudal glands not observed. One pair of ventromedian papillae located just anterior to cloacal opening. Circumcloacal setae arranged in single circle, 13–14 pairs in total: six pairs precloacal, 5–8 μm long; four or five pairs in conical portion at even intervals, 2–3 μm long; remaining pairs located at posterior end of conical portion, 4–6 μm long. Row of subdorsal setae located in conical portion. Four or five setae present on both sides of cylindrical portion.

Spicules slender, as long as 3.4–3.6 cloacal body diameters or 0.7–0.8 tail lengths, proximally with capitulum, distally bending, and slightly widened with acute tip. Gubernaculum absent. Reproductive system diorchic. Two telogonic testes opposed and outstretched, both situated on right side of intestine, each containing distal germinal zone with two or more rows of small cells and following growth zone with single row of larger cells. Anterior testis as long as 17% of body length, blind end located at 32–36% of body length from anterior end. Posterior testis as long as 20–21% of body length, blind end located at 56–57% of body length from anterior end. Single seminal vesicle between two testes, including globular sperms. Vas deferens on right sub-

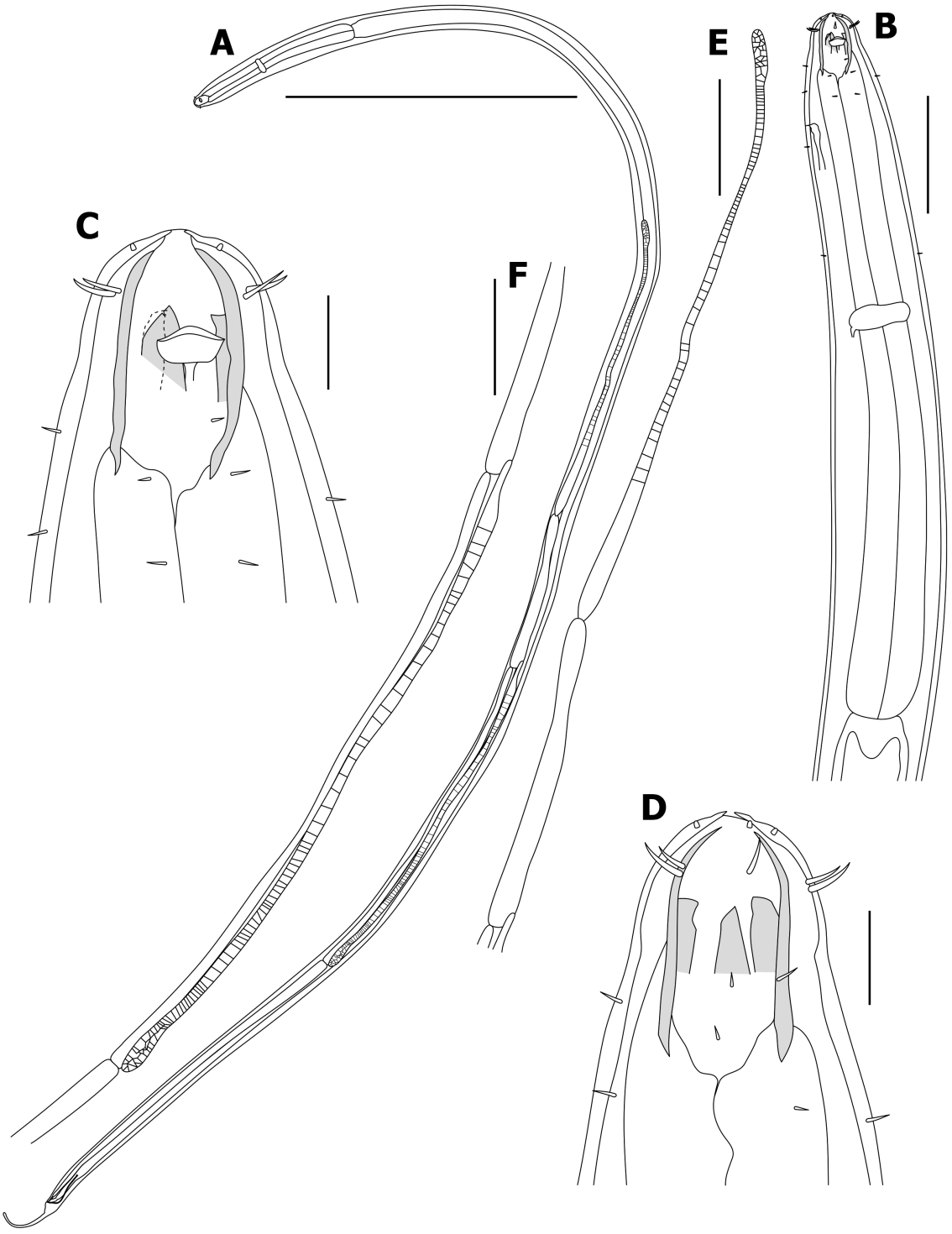

Fig. 1. *Wiesoncholaimus jambio* sp. nov. **(A–C, E, F)** Holotype and **(D)** paratype female. **(A)** Male body. **(B)** Male anterior region. **(C)** Male head. **(D)** Female head. **(E)** Anterior testis and seminal vesicle. **(F)** Posterior testis and vas deferens. Scale bars: **(A)** 1 mm; **(B)** 100 μm; **(C, D)** 20 μm; and **(E, F)** 200 μm.

ventral side of intestine, connecting to muscular ejaculatory duct at level of blind end of posterior testis. Cloaca as long as rectum, expanded at end.

Description of female. Similar to males except as follows. Outer labial and cephalic setae, 8–11 μm or 0.2–0.3 cephalic diameters long. Amphids located at 0.47 cephalic diameters from anterior end. Buccal cavity as long as 1.6 cephalic diameters, as wide as 0.65 cephalic diameters, length/width = 2.5. Nerve ring located at 0.40 pharyngeal lengths from anterior end. Pore of secretory-excretory system located at 2.7 cephalic diameters or 1.7 buccal cavity lengths from anterior end. Tail conico-cylindrical, more grad-

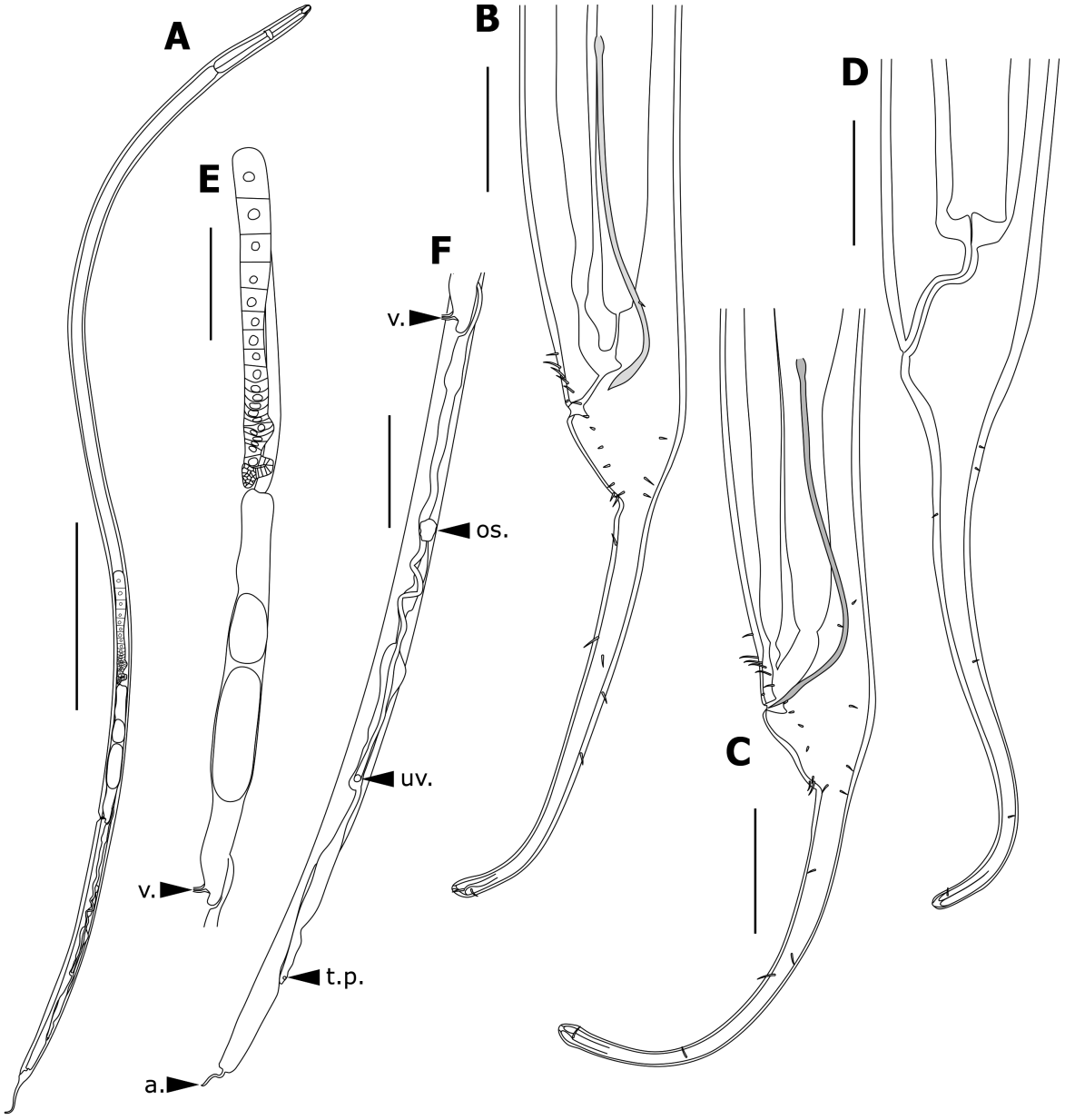

Fig. 2. *Wiesoncholaimus jambio* sp. nov. **(A, D–F)** Paratype female; **(B)** paratype male; and **(C)** holotype. **(A)** Female body. **(B, C)** Male posterior region. **(D)** Female posterior region. **(E)** Ovary and uterus. **(F)** Demanian system. Abbreviations: a., anus; os., osmosium; t.p., terminal pore; uv., uvette; and v., vulva. Scale bars: **(A)** 1 mm; **(B–D)** 50 μm; and **(E, F)** 200 μm.

ually tapering than that of males, as long as 4.6 anal body diameters. No setae observed in circumanal region. Five setae present in both sides of cylindrical portion.

Reproductive system monodelphic and prodelphic. Telogonic ovary antidromously reflexed, situated on left side of intestine, as long as 9% of body length, blind end located at 54% of body length from anterior end, containing three zones: germinal zone with small cells not arranged in rows; growth zone with gradually growing cells arranged in two right and left rows, curving in proximal part; ripening zone with grown oocytes arranged in single row, occupying anterior half of ovary. One mature egg (233 × 78 μm) and another smaller egg (123 × 69 μm) present in uterus. Vulva located at 74.3% of body length from anterior end. Vagina sclerotized, 25 μm long. Demanian system present, situated on right side of intestine. Ductus uterinus connected to dorsal side of uterus anterior to vulva. Uvette simple pore-like, located at 0.84 mm posterior to vulva. Osmosium complexed, located between vulva and uvette. Terminal pore opening on right subdorsal side of body surface, not observed on left side, located anterior to anus, near posterior end of main duct.

Remarks. *Wiesoncholaimus jambio* sp. nov. clearly differs from the only other species of this genus, *W. mawsonae*, by a dorsal tooth equal in size to the other teeth (shorter in *W. mawsonae*), the conico-cylindrical tail (conical in *W. mawsonae*) as long as 4.6–4.8 cloacal body diameters (3.2–3.6 in *W. mawsonae*), and the absence of the gubernaculum

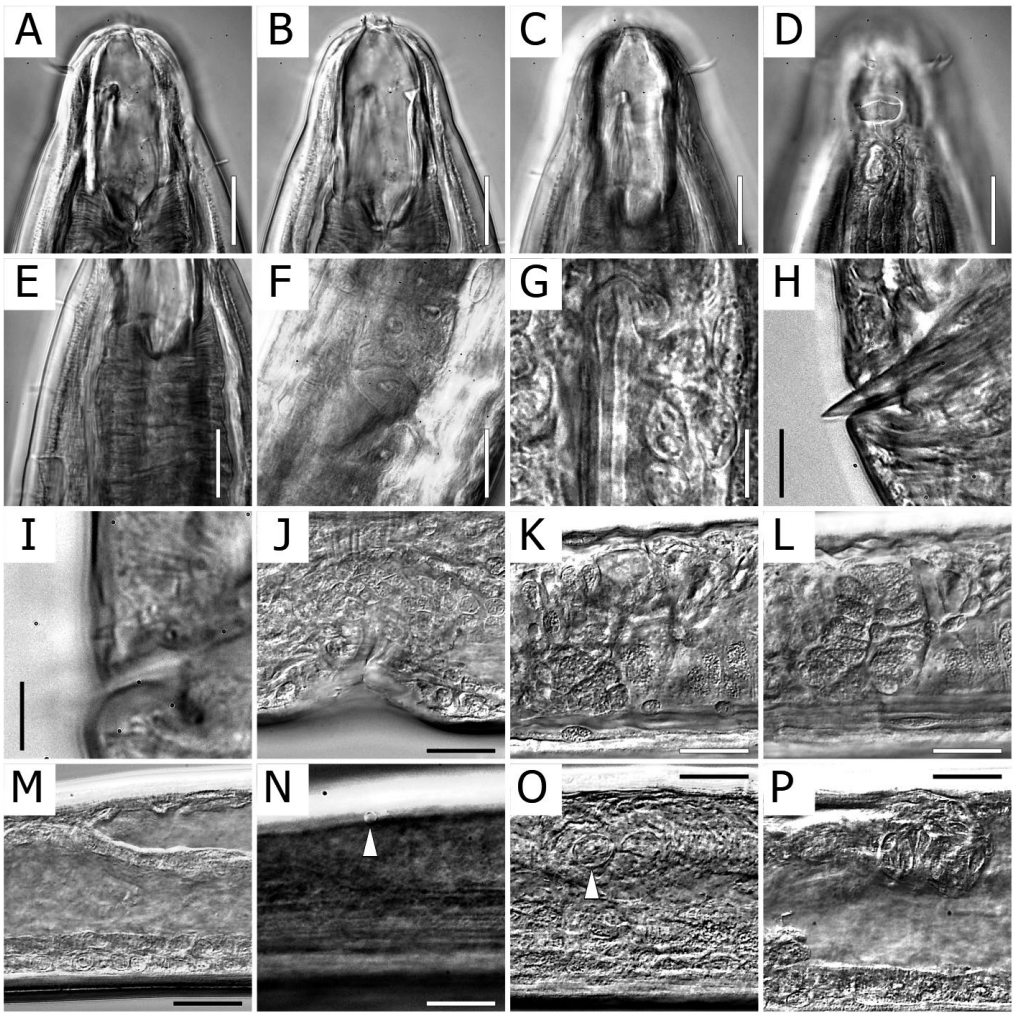

Fig. 3. *Wiesoncholaimus jambio* sp. nov., differential interference contrast micrographs. **(A–I)** Paratype male and **(J–P)** paratype female. **(A)** Head with left subventral tooth. **(B)** Dorsal tooth. **(C)** Right subventral tooth. **(D)** Amphid. **(E)** Pore of secretory-excretory system. **(F)** Sperms. **(G)** Proximal end of spicule. **(H)** Distal end of spicule. **(I)** Precloacal papilla. **(J)** Vulva. **(K)** Germinal zone of ovary. **(L)** Growth zone, in the same visual field as that in **(K)**. **(M)** Main duct of Demanian system. **(N)** Terminal pore, in the same visual field as that in **(M)**. **(O)** Uvette. **(P)** Osmosium. Scale bars: **(A–F)** 20 μm; **(G, H)** 10 μm; **(I)** 5 μm; and **(J–P)** 25 μm.

(conspicuous in *W. mawsonae*).

Family **Ironidae** de Man, 1876
Genus ***Thalassironus*** de Man, 1889
Thalassironus* cf. *britannicus de Man, 1889
(Fig. 4; Table 2)

Material examined. One male with immature testes (ICHUM 5891), DESS-fixed, whole mount in glycerin, same collection data as those for *W. jambio* sp. nov.

Description of male. Cuticle finely annulated. Somatic sensilla papilliform, arranged in eight longitudinal rows, present from cervical to caudal regions. Head truncated, slightly constricted just posterior to cephalic setae, as wide as 0.4 maximum body diameters at level of cephalic setae. Three lips distinct, each with two inner labial papillae. Six outer labial setae 20–30 μm or 0.6–0.8 cephalic diameters long. Four cephalic setae 10–15 μm or 0.3–0.4 cephalic diameters long, located at same level of outer labial setae. Eight pairs of cervical setae present: three on each lateral side, one on ventral side, and one on dorsal side. Few single cervical setae also present in anterior part of cervical region. Amphid pocket-like, located just posterior to cephalic setae. Buccal cavity divided into two portions, as long as 2.8 cephalic diameters: anterior portion (= cheilostome) movable, not sclerotized; posterior portion (= pharyngostome) cylindrical, strongly sclerotized, surrounded by pharyngeal tissue. Three solid teeth in anterior portion of buccal cavity: dorsal tooth double-tipped; subventral teeth single. Several minute denticles present at level of teeth. Pharynx gradually widened toward posterior end, as long as 0.10 body lengths. Cardia surrounded by intestine. Nerve ring located at 0.3 pharyngeal lengths from anterior end. Secretory-excretory system not observed. Tail conical, as long as 2.5 cloacal body diameters, widened at tip with spinneret and pair of terminal setae (7–8 μm). Three caudal glands postcloacal. One pair of short subventral setae present just anterior to tail tip.

Spicules stout and arcuate, as long as 1.1 cloacal body diameters or 0.45 tail lengths, proximally with capitulum and

Table 2. Morphometrics of *Wiesoncholaimus jambio* sp. nov., *Thalassironus* cf. *britannicus*, and *Vasostoma* cf. *longispicula* (in µm except de Man's ratios). *Distance from the anterior body end. **Tail tip was broken.

	W. jambio sp. nov.			*T.* cf. *britannicus*	*V.* cf. *longispicula*	
	Male		Female	Male	Male	
	Holotype	Paratype	Paratype			
ICHUM	5886	5887	5888	5891	5889	5890
Body length	6390	5935	6595	8151	2362	2653**
a	63.9	52.5	60.0	84.0	16.9	21.2**
b	10.7	9.7	10.8	9.7	6.1	6.6**
c	29.0	26.3	27.4	42.9	9.4	12.5**
V	–	–	74.3	–	–	–
Cephalic diamter	39	37	36	38	19	17
Maximum diameter	100	113	110	97	140	125
Vulval diameter	–	–	95	–	–	–
Cloacal/anal diameter	46	49	52	77	79	81
Amphid*	20	21	17	19	10	8.5
End of Buccal cavity*	57	60	58	106	41	36
Excretory pore*	95	91	97	–	235	224
Nerve ring*	258	256	246	263	197	191
End of pharynx*	600	610	612	841	389	405
Tail length on arc	220	226	241	190	252	212**
Spicule length on arc	157, 157	167, 177	–	84, 87	168, 168	176, 185
Gubernaculum length	–	–	–	39, 40	48	54
Apophysis length	–	–	–	–	43	46
Anterior gonad*	2038	2120	4180	–	752	785
End of posterior gonad*	4870	4570	–	–	1245	1418
Vulva*	–	–	4900	–	–	–
Osmosium*	–	–	5274	–	–	–
Uvette*	–	–	5740	–	–	–
Terminal pore*	–	–	6131	–	–	–

central lamella, distally with another central lamella and without projection. Gubernacula paired, as long as 0.50 cloacal body diameters or 0.45 spicule lengths, distally widened and cup-shaped. Single precloacal supplement setiform (5 µm), located just anterior to cloacal opening. Eight pairs of papilliform postcloacal supplements present apart from somatic papillae. Reproductive system immature, without obvious outlines and contents. Vas deferens observed only in posterior body region.

Remarks. Our species closely resembles *T. britannicus* and *Thalassironus qatarensis* Nasira et al., 2006, by possessing one double-tipped tooth and two single teeth, the arrangement of the eight pairs of cervical setae, the conical (sometimes regarded as short conico-cylindrical) tail as long as 2–3 cloacal body diameters, the stout spicules as long as the cloacal body diameter, the gubernacula with their cup-shaped distal ends, and the presence of the precloacal and postcloacal supplements. *Thalassironus britannicus* was originally described from the United Kingdom by de Man (1889) but was redescribed based on the type specimens by Chitwood (1960), and redescribed from near the type locality by Warwick (1977), from the Gulf of Mexico by Keppner (1987), and from Japan by Yoshimura (1980). *Thalassironus qatarensis* was described only from Qatar by Nasira et al. (2006). Our species is most similar to *T. britannicus* sensu Warwick based on the body length (6–8 mm) and number of postcloacal supplements (eight or nine). *Thalassironus britannicus* sensu Keppner and *T. qatarensis* are much smaller than *T. britannicus* sensu de Man (3.1–3.4 mm in *T. britannicus* sensu Keppner and 3.4–4.3 mm in *T. qatarensis*; 7.2 mm in *T. britannicus* sensu de Man). The numbers of postcloacal supplements of *T. britannicus* sensu de Man and sensu Yoshimura are unknown. Chitwood (1960) reported a lack of postcloacal supplements in the type specimen, but the specimen was damaged and supplements might therefore have been overlooked. In *T. britannicus* sensu Keppner, fewer postcloacal supplements are existent than are found in *T. britannicus* sensu Warwick (four or five in *T. britannicus* sensu Keppner). *Thalassironus qatarensis* has seven or eight postcloacal supplements. Therefore, it is possible that *T. britannicus* sensu lato includes two or more biological species, or that *T. qatarensis* is a junior synonym of *T. britannicus*.

Order **Araeolaimida** De Coninck and Schuurmans Stekhoven, 1933
Family **Comesomatidae** Filipjev, 1918
Genus ***Vasostoma*** Wieser, 1954
Vasostoma* cf. *longispicula Huang and Wu, 2010
(Fig. 5; Table 2)

Material examined. Two males in bad condition (ICHUM 5889 and 5890), DESS-fixed, whole mount in glycerin, same collection data as those for *W. jambio* sp. nov.

Description of male. Cuticle about 10 µm thick. Exocuticle with transversely arranged minute dots, without lateral differentiation. Epicuticle finely annulated. Epidermal chords distinct, comprising one row of transversely elongated cells. Somatic sensilla papilliform or short setiform, arranged in eight longitudinal rows, mainly present in cervical and caudal regions. Head truncated, slightly constricted at level of cephalic setae, as wide as 0.15 maximum body diameters. Six lips with six inner labial setae (about 2 µm). Six outer labial setae as long as inner labial setae. Four cephalic setae 3–4 µm or 0.2 cephalic diameters long, located just posterior to outer labial setae. Amphids with 2.5 turns,

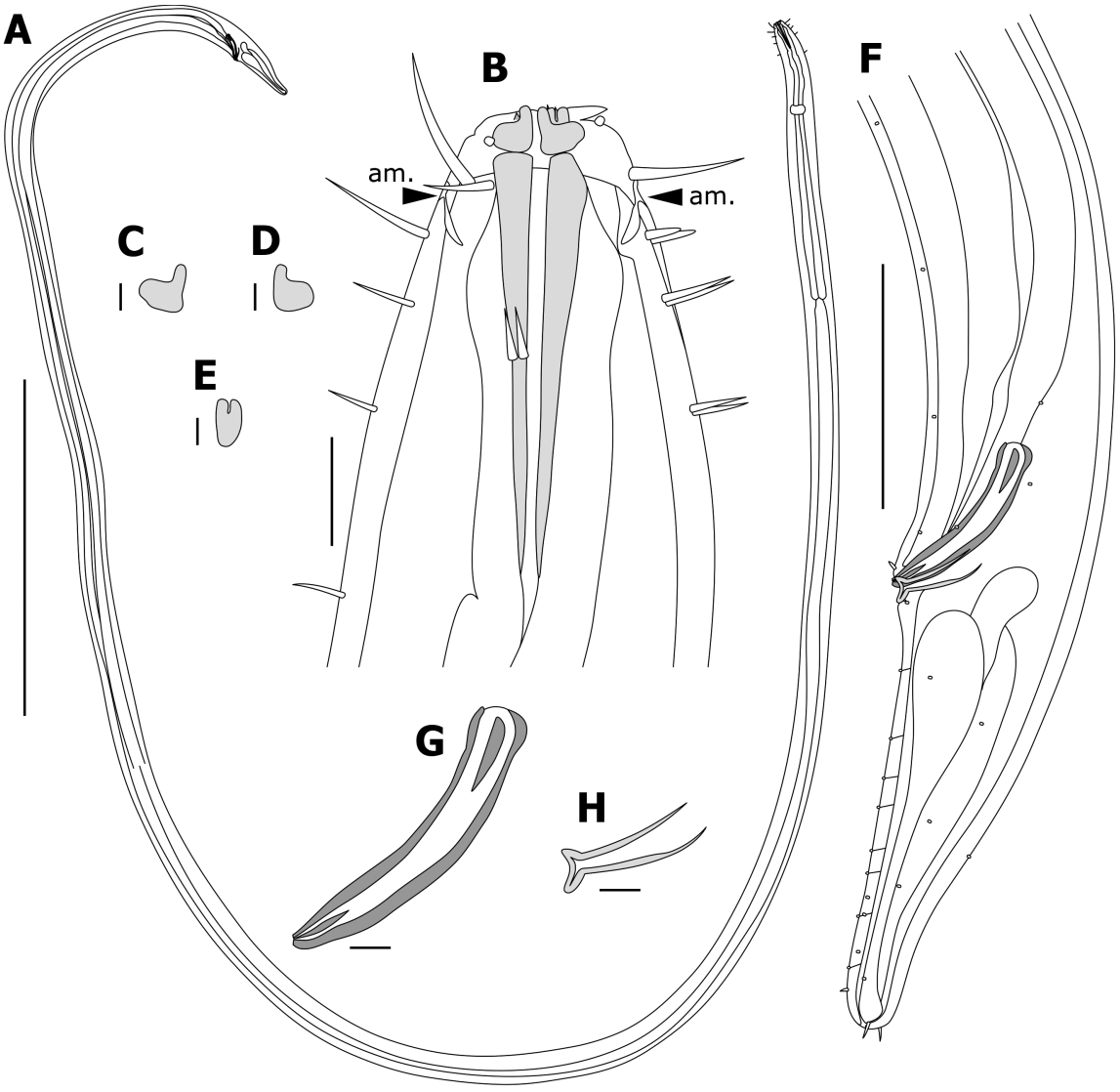

Fig. 4. *Thalassironus* cf. *britannicus*. **(A)** Male body. **(B)** Male head, ventral view. **(C)** Left subventral tooth. **(D)** Right subventral tooth. **(E)** Dorsal tooth. **(F)** Male posterior region. **(G)** Spicule. **(H)** Gubernaculum. Abbreviation: am., amphid. Scale bars: **(A)** 1 mm; **(B)** 20 μm; **(C–E)** 5 μm; **(F)** 100 μm; and **(G, H)** 10 μm.

almost equal in length and width (11–13 μm), 0.7 cephalic diameters or 0.5 corresponding body diameters wide, located at 0.5 cephalic diameters or 0.25 buccal cavity lengths from anterior end. Buccal cavity composed of cup-shaped anterior portion and cylindrical posterior portion with sclerotized walls, as long as 2.1 cephalic diameters, length/width = 4.0–5.0. Three solid teeth in anterior portion of buccal cavity. Pharynx gradually widened toward posterior end, not forming terminal bulb, as long as 0.15 body lengths. Cardia surrounded by intestine. Nerve ring located at 0.47–0.51 pharyngeal lengths from anterior end. Pore of secretory-excretory system located posterior to nerve ring at 0.55–0.60 pharyngeal lengths. Renette cell located at level of cardia, as wide as 0.15–0.20 corresponding body diameters. Tail conico-cylindrical, conical in anterior two-thirds, as long as 3.2 cloacal body diameters, slightly widened at tip, with spinneret and a pair of terminal setae (about 5 μm). Three (possibly more) caudal glands postcloacal. Somatic setae present only in conical portion.

Spicules slender, as long as 2.1–2.3 cloacal body diameters or 0.7 tail lengths, proximally with elongated capitulum and central lamella, distally bending and acute at tip. Gubernaculum as long as 0.6–0.7 cloacal body diameters or 0.3 spicule lengths, ventrally with one tooth-like projection, dorsally with pair of caudal apophyses as long as main body of gubernaculum. Well-developed cloacal glands surrounding gubernaculum and distal part of spicules. One pair of precloacal setae just anterior to cloacal opening. Papilliform precloacal supplements 18–19 in total. Reproductive system diorchic. Two telogonic testes opposed and outstretched. Each testis containing germinal zone with numerous small cells not arranged in rows and growth zone with two or three rows of larger cells, connecting with individual seminal vesicles. Anterior testis on left side of intestine, as long as 4–6% of body length, blind end located at 30–32% of body length from anterior end. Posterior testis on right side of intestine,

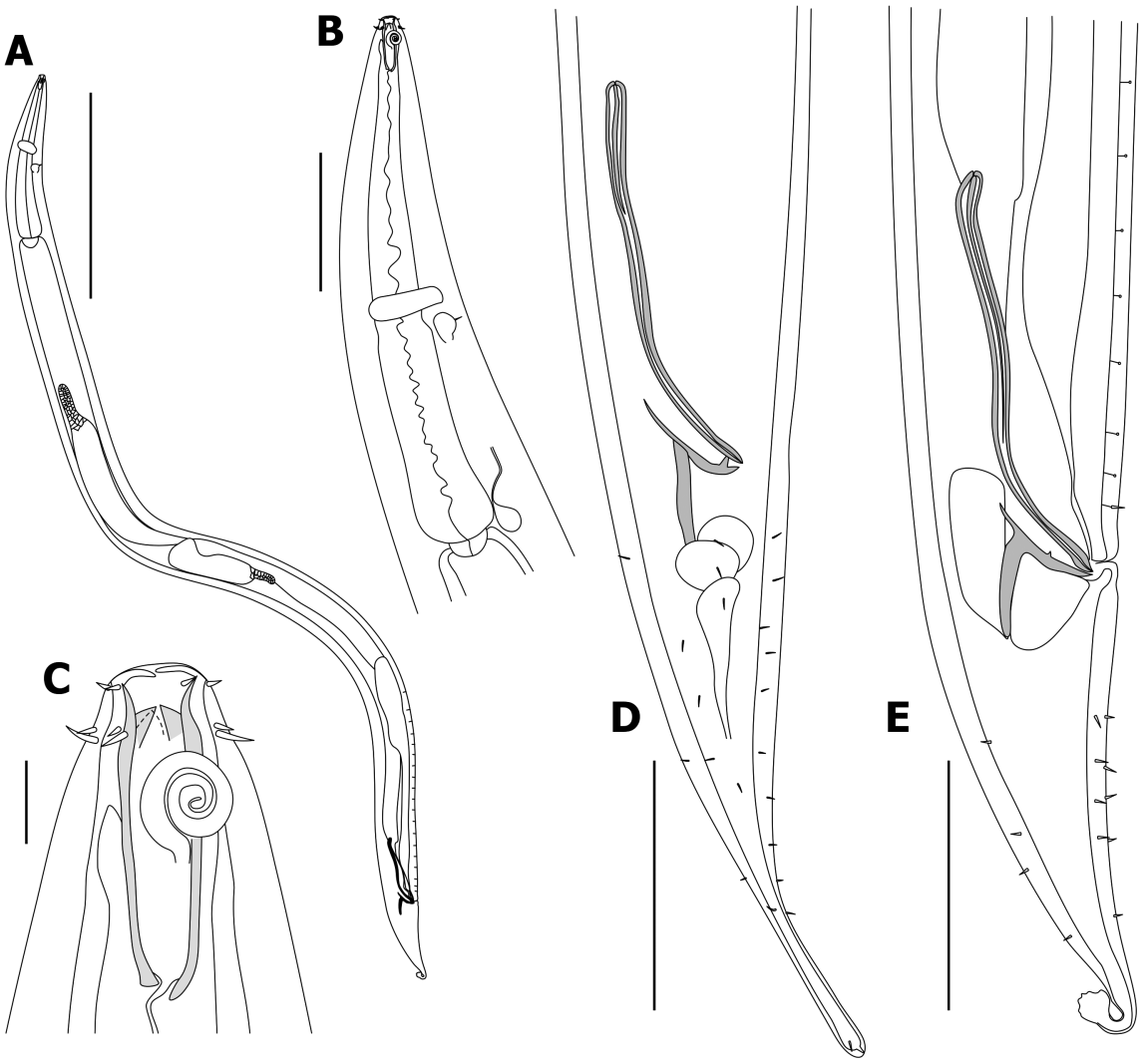

Fig. 5. *Vasostoma* cf. *longispicula*. **(A, E)** ICHUM 5890 and **(B–D)** ICHUM 5889. **(A)** Male body. **(B)** Male anterior region. **(C)** Male head. **(D)** Male posterior region, ventrosublateral view. **(E)** Male posterior region, lateral view. Scale bars: **(A)** 500 μm; **(B, D, E)** 100 μm; and **(C)** 10 μm.

as long as 2–3% of body length, blind end located at 55–56% of body length from anterior end. Seminal vesicles much larger than testes, filled with globular sperms (5–25 μm in diameter).

Remarks. Our species closely resembles *Vasostoma longispicula* in terms of body length (about 2.5 mm), pharyngeal length (b = 6–8), amphids with 2.5 turns, possession of three teeth, the absence of two bands of irregular cell bodies in the epidermal chords (cf. Leduc et al., 2012), the absence of the pharyngeal bulb, tail length (3–4 cloacal body diameters, c ≈ 10), unjointed spicules as long as 2.1–2.4 cloacal body diameters, and the 15–19 precloacal supplements. However, our species differs from the type series of *V. longispicula* in terms of maximum body diameter (125–140 μm, a = 16.9–21.2 in our species; 76–84 μm, a = 30.3–34.2 in *V. longispicula*) and the thickness of the body cuticle (about 10 μm in our species; < 5 μm in *V. longispicula*). Although our species differs from *V. longispicula* in having papilliform precloacal supplements (tubular in *V. longispicula*), the intracuticular canals of papilliform supplements (Fig. 5E) and the structure called tubular supplements by Huang and Wu (2010: figs 1, 2) are similar in appearance. Therefore, we could not conclude that they are different structures.

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COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

DS conceived and designed the study, made morphological observations, and drafted the manuscript. KK collected and processed the samples. Both authors read and approved the final manuscript.

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