Journal of Natural History, 2015
Vol. 49, Nos. 9–10, 509–526, http://dx.doi.org/10.1080/00222933.2014.953224

Two new nematodes, *Pseudelzalia longiseta* gen. nov., sp. nov. and *Paramonohystera sinica* sp. nov. (Monhysterida: Xyalidae), from sediment in the East China Sea

Tingting Yu[a,b] and Kuidong Xu[a]*

[a]*Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China;* [b]*College of Earth Science, Graduate University of Chinese Academy of Sciences, Beijing, China*

(*Received 9 July 2013; accepted 6 August 2014; first published online 10 November 2014*)

Pseudelzalia longiseta gen. nov, sp. nov. and *Paramonohystera sinica* sp. nov. from subtidal sediment in the East China Sea are described. *Pseudelzalia* is characterized by 6 labial papillae and 10 cephalic setae, cylindrical buccal cavity, elongate (>2 anal body diameter) spicules, and conico-cylindrical tail devoid of terminal setae. It differs from *Elzalia* by the absence of terminal setae. *Pseudelzalia longiseta* sp. nov. is 647–853 μm long, has 7–8 μm long cervical setae, 11–14 μm long caudal setae, 25–41 μm long spicules about 2.1–2.7 anal diameter, and pointed tail-tip. *Paramonohystera sinica* possesses 12 cephalic setae, a character found in four congeners: *Paramonohystera buetschlii* (Bresslau and Schuurmans Stekhoven in Schuurmans Stekhoven, 1935, *Paramonohystera pilosa* Boucher, 1971, *Paramonohystera concinna* Lorenzen, 1977 and *Paramonohystera halerba* Fadeeva and Belogurov, 1987. It differs from *P. buetschlii* by shorter body (933–1023 μm versus 2000–2200 μm); from *P. pilosa* by the much shorter spicules (79–88 μm versus 167 μm) and narrower head (13–16 μm versus 32 μm); from *P.concinna* by smooth cephalic setae (versus segmented); and from *P. halerba* by the absence of two rows of setae on the ventral side of the tail (versus present). Based on the evaluation of nominal species, we recognize 14 valid species and provide an emended diagnosis and a tabular key for *Paramonohystera*.

http://www.zoobank.org/urn:lsid:zoobank.org:pub:474B8F17-AED7-4078-8176-DFC499B78526

Keywords: *Pseudelzalia longiseta*; *Paramonohystera sinica*; new genus; new species; marine nematodes; taxonomy

Introduction

Marine free-living nematodes are highly diverse and usually comprise 70–90% meiobenthic metazoans (Miljutin et al. 2010). Our preliminary investigation on nematode diversity in the East China Sea revealed about 40 taxa per 100 individuals in one sediment core. Data indicate that nematode diversity is high and most nematodes are rare species comprising only one or two individuals. Description of new nematode taxa is in progress but, because of taxonomic problems, the number of new species described from the seas of China so far represents only about 1/100 of known species in the world oceans (Tchesunov 2006; Zhang and Zhang 2006; Huang and Wu 2011; Huang and Xu 2013). In this paper we describe one new genus and two new species from the subtidal sediment in the East China Sea: *Pseudelzalia longiseta* gen. nov., sp. nov. and *Paramonohystera sinica* sp. nov.

*Corresponding author. Email: kxu@qdio.ac.cn

Material and methods

Sediment samples were collected from the East China Sea in July 2012, using a 0.1-m^2 Gray–Ohara box corer, from which the samples used for meiofaunal analysis were taken using a modified syringe tube and preserved with formalin (5% final concentration) onboard. In the laboratory, the fixed samples were stained with 0.1% Rose Bengal for 12 h, washed on a 500-μm sieve to remove large particles and a 31-μm sieve to retain meiofauna. To avoid the loss of nematodes on the 500-μm sieve, we checked the sieve and retrieved the nematodes retained on it. Ludox HS 40 was used to extract meiofauna from the remaining sediments by centrifugation. The extracted samples were sorted under a dissecting microscope. Nematodes were transferred into a 9 : 1 (volume/volume) solution of 50% alcohol–glycerol in a cavity block to slowly evaporate to pure glycerol, and then mounted onto permanent slides.

The descriptions were made from glycerine mounts (Platt and Warwick 1983) using a differential interference contrast microscope (Nikon E80i). Line drawings were made with the aid of a camera lucida. Morphological data are presented using the modification of Filipjev's standard formula described by Platt (1973). Type specimens have been deposited in the Marine Biological Museum, Institute of Oceanology at Qingdao, Chinese Academy of Sciences. All measurements are in μm, and all curved structures are measured along the arc.

Abbreviations are as follows: a, body length divided by maximum body diameter; b, body length divided by pharynx length; c, body length divided by tail length; a.b.d., anal body diameter; c.b.d., corresponding body diameter; V, distance of vulva from the anterior body end; V%, position of vulva from anterior end expressed as a percentage of total body length.

Order **MONHYSTERIDA** Filipjev, 1929
Family **XYALIDAE** Chitwood, 1951
Genus ***Pseudelzalia*** gen. nov.

Diagnosis

Xyalidae with six labial papillae and 10 cephalic setae, cylindrical buccal cavity, elongate (>2 a.b.d.) spicules, and conico-cylindrical tail devoid of terminal setae.

Etymology

Composition of the Greek prefix *pseudo-* (false) and the generic name *Elzalia*, referring to the similarity of the genus to *Elzalia*. Feminine gender.

Type species

Pseudelzalia longiseta gen. nov., sp. nov.

Familial assignment and comparison with related genera and species

The new species *Pseudelzalia longiseta* sp. nov. described below is obviously a member of the family Xyalidae characterized by transversely striated cuticle, usually

10 cephalic setae, and a single anteriorly outstretched ovary to the left of the intestine. Within the family Xyalidae, *Pseudelzalia longiseta* sp. nov. is very similar to members of *Elzalia* Gerlach, 1957 in having the labial papillae, large cylindrical buccal cavity and elongate spicules. However, the new species possesses a character clearly different from all known species of *Elzalia*, namely, the tail devoid of terminal setae versus with three terminal setae in *Elzalia* (Figure 1A, E). The structure of the tail is a significant character at the genus level within the family Xyalidae, in which the two largest genera, *Daptonema* Cobb, 1920 and *Theristus* Bastian, 1865, are separated only by the tail morphology (conico-cylindrical with terminal setae versus conical without terminal setae) (Warwick et al. 1998). *Pseudelzalia longiseta* sp. nov. is also similar to the monotypic genus *Parelzalia* Tchesunov, 1990 which, however, has a conical buccal cavity with domed anterior end, shorter spicules of about 1 a.b.d. and in particular the presence of terminal setae (Tchesunov 1990). Accordingly, we propose *Pseudelzalia* as a new genus. Except for the tail morphology, *Pseudelzalia* differs from *Daptonema* and *Theristus* also by the cylindrical buccal cavity (versus conical) and elongate spicules (>2 a.b.d. versus <2 a.b.d.).

The presence of long caudal setae in the new species *Pseudelzalia longiseta* is another striking character that is absent in the genera *Elzalia*, *Daptonema* and *Theristus*. However, only one species is described for the new genus and such a character has never been regarded as a generic character within the family Xyalidae. Hence, we consider it a specific character for *Pseudelzalia* at the current state of knowledge.

Pseudelzalia longiseta sp. nov.
(Figures 1A–D, 3A–D, Table 1)

Diagnosis

Body length about 647–853 μm. Buccal cavity cuticularized, occupying about half of head diameter. Ten cephalic setae, 2–4 μm long. Amphids circular, 3–6 μm across. Cervical setae 7–8 μm long and caudal setae 11–14 μm long. Spicules 25–41 μm long and 2.1–2.7 a.b.d. Tail conico-cylindrical with pointed tip, about 96–121 μm long and 7.7–9.7 a.b.d.

Type material

Four males and two females were available for measurement and description.

Holotype. One male on slide CJ-4-24.

Paratypes. Three males on slides DH1-8-02, DH2-7-07 and DH2-7-11. Two females on slide DH2-7-08.

Type locality and habitats

Muddy sediments at Stations CJ-4 (32°11' N, 123°59' E) and DH1-8 (32°00' N, 125° 59' E) DH2-7 (31°01' N, 126°00' E) in the East China Sea. Station CJ-4, water depth 42 m, water temperature at the sediment–water interface 20.9°C, salinity 31.3, median

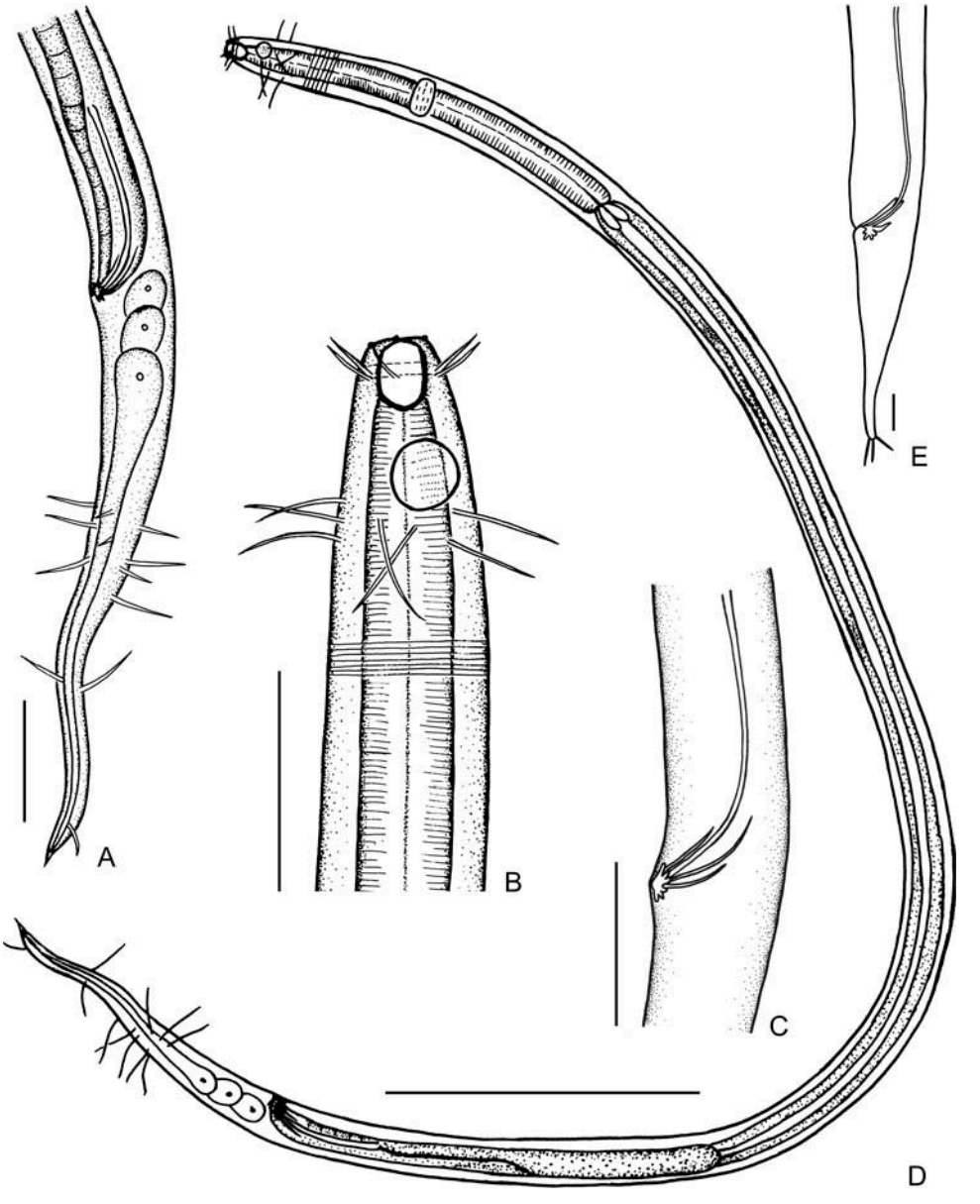

Figure 1. *Pseudelzalia longiseta* gen. nov., sp. nov. (male holotype, A–D) and *Elzalia floresi* (E, type species of *Elzalia*, redrawn from Gerlach 1957). (A, E) Lateral view of tail region. Note the terminal setae are lacking in the genus *Pseudelzalia* (A), while in *Elzalia* there are invariably three terminal setae (E). (B) Lateral view of anterior region showing the cylindrical and cuticularized buccal cavity and the papilliform labial sensilla. (C) Lateral view of cloacal region, showing the elongate spicules and adjacent gubernaculum. (D) Overall view, showing the testis. Scale bars: A–C, E, 20 μm; D, 100 μm.

Table 1. Individual measurements (in μm) and morphometric data on males of *Pseudelzalia longiseta* gen. nov., sp. nov.

Characters	♂ (n = 4)						♀ (n = 2)	
	Holotype	Min	Max	Mean	SD	CV	♀ 1	♀ 2
Body length	853	733	853	790.8	66.5	8.4	647	670
Body diameter, maximum	17	13	17	15.3	1.8	11.7	13	15
Head diameter	8	7	9	7.7	1.3	16.7	8	7
Buccal width	4	3	4	3.8	0.6	15.3	5	4
Buccal length	7	5	7	6.3	0.7	10.6	6	5
Cephalic seta length (CSL)	4	3	4	3.3	0.8	24.5	2	3
CSL/head diameter (%)	56	21	56	38.1	14.7	38.7	17	40
Amphid diameter	6	5	6	5.9	0.6	9.9	5	3
Amphid diameter/c.b.d. (%)	52	52	60	54.2	3.9	7.1	42	31
Amphids to anterior end	10	8	13	10.2	1.9	19.0	8	8
Pharyngeal length	128	113	140	124.5	12.1	9.7	111	118
Pharyngeal base c.b.d.	17	13	17	15.2	1.8	11.9	13	14
Spicule length	41	25	41	30.2	7.3	24.2	–	–
Vulva from anterior end	–	–	–	–	–	–	388	–
Tail length	116	103	121	110.8	9.0	8.1	96	108
a.b.d.	15	11	15	12.8	1.8	14.1	12	13
Tail length/a.b.d.	7.7	7.7	9.7	8.7	0.9	9.9	8.0	8.5
Spicule length/a.b.d.	2.7	2.1	2.7	2.4	0.3	11.3	–	–
a	49.6	49.6	55.1	51.5	2.4	4.7	48.6	45.6
b	6.7	6.0	6.7	6.4	0.3	4.7	5.8	5.7
c	7.4	7.0	7.4	7.2	0.2	2.4	6.7	6.2

Note: CV, coefficient of variation in %; Max, maximum; Min, minimum; SD, standard deviation; -, absent.

particle diameter 127 μm, silt-clay 43.4%, organic matter 0.5%; Station DH1-8, water depth 84 m, water temperature at the sediment–water interface 11.8°C, salinity 33.3, median particle diameter 6 μm, silt-clay 100%, organic matter content 1.2%; Station DH2-7, water depth 70.6 m, water temperature at the sediment–water interface 13.4°C, salinity 33.6, median particle diameter 8 μm, silt-clay 93.6%, organic matter content 1.0%.

Etymology

Composition of the Latin adjective *longus* (long) and the Latin noun *seta* (bristle), referring to the long somatic setae in the cervical and tail region of the species.

Description

Males. Body cylindrical and gradually tapering towards tail end, with head region slightly narrower than body trunk; 733–853 μm long and 13–17 μm wide at maximum

body diameter. Head 7–9 μm wide. Cuticle faintly striated. Many somatic setae 7–8 μm long in cervical region (just behind the amphids) and 11–14 μm long in tail region, where the setae are slightly thicker (Figure 1D).

Buccal cavity cylindrical, cuticularized wall, about 6.3 μm deep and 3.8 μm wide, occupying about half of the head width (Figure 1B). Six labial papillae, 10 cephalic setae in one circle, of equal length, 3–4 μm long and 21–56% of head diameter.

Amphidial fovea round, 5–6 μm in diameter and 52–60% of corresponding body diameter, anterior border of fovea 8–13 μm from anterior body end. Pharynx cylindrical, 113–140 μm long, occupying 15–17% of total body length. Pharyngo-intestinal junction with small, half-moon shaped cardia, not embedded in intestine. Nerve ring located in the middle portion of pharynx, 56–68 μm from anterior body end.

Excretory pore and ventral gland not observed.

Tail devoid of terminal setae, conico-cylindrical and tapered at terminal end, 103–121 μm long and 7.7–9.7 a.b.d.; cylindrical part occupying about one-third of tail length. Three caudal glands (Figure 1A).

Single outstretched testis to the right of intestine. Paired, slender and arcuate spicules, 25–41 μm long and 2.1–2.7 a.b.d. Gubernaculum composed of four parts: the ventral thin piece about 11 μm long, the longer dorsal thin piece about 18 μm long, the shorter dorsal thin piece about 14 μm long, and the ventral main part with several conical projections (Figure 1C). Precloacal supplements not seen.

Females. Similar to males, but with slightly smaller body (647–670 μm versus 733–853 μm) and amphids (3–5 μm versus 5–6 μm). A single anteriorly outstretched ovary to the left of intestine, about 155 μm long. Vulva located at posterior two-fifths of the body, about 388 μm to anterior body end.

Genus ***Paramonohystera*** Steiner, 1916
Paramonohystera sinica sp. nov.
(Figures 2A–F, 3E, F; Tables 2–4)

Diagnosis

Body length about 933–1127 μm. Twelve cephalic setae, smooth and 7–9 μm long. Amphids circular, 6–7 μm across. Cervical setae numerous and up to 14 μm long. Spicules arcuate and slender, about 79–88 μm long and 4.0–4.4 a.b.d. Tail conico-cylindrical, 114–146 μm long and 5.7–6.6 a.b.d.

Type material

Five males and four females were measured and studied.

Holotype. One male on slide DH2-7-02.

Paratypes. Three males and three females on slide DH2-7-02; one male and one female on slide DH2-7-01.

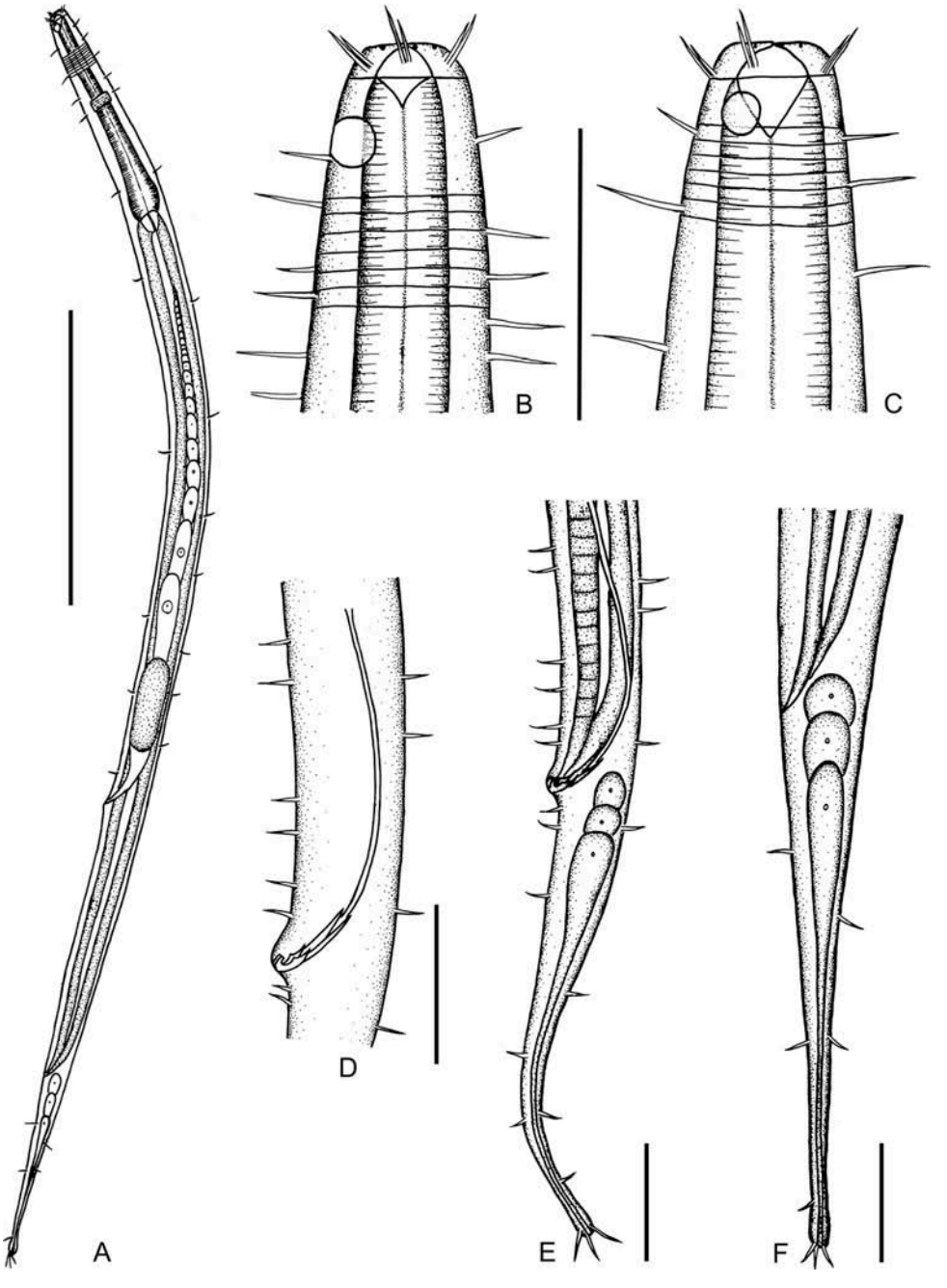

Figure 2. *Paramonohystera sinica* sp. nov. (A) Overall view of a female showing the ovary, eggs and vulva. (B) Lateral view of the anterior portion of the holotype (male). (C, F) Anterior and posterior detail of the female depicted in A. (D, E) Lateral view of the holotype showing the spicules, gubernaculum and tail region. Scale bars: A, 200 μm; B–F, 30 μm.

Figure 3. *Pseudelzalia longiseta* gen. nov., sp. nov. (A–D) and *Paramonohystera sinica* sp. nov. (E, F). (A, E) Anterior portion of the holotype in lateral view. (B, F) Cloacal region of the holotype in lateral view, showing the elongate spicules. (C, D) Tail region of the holotype in lateral view, showing the long caudal setae, the conico-cylindrical tail and the pointed tail-tip devoid of terminal setae. Scale bars: 15 μm.

Type locality and habitat

Muddy sediment at Station DH2-7 (31°01' N, 126°00' E) in the East China Sea; water depth about 70.6 m, water temperature at the sediment–water interface 13.4°C, salinity 33.6, median particle diameter 8 μm, silt-clay 93.6%, organic matter 1.0%.

Etymology

The New Latin adjective *sinicus* (of China) refers to the country where the species was discovered.

Description

Males. Body cylindrical and gradually tapering towards tail end, with head region narrower than body trunk; 933–1023 μm long and 29–34 μm wide at maximum body

Table 2. Individual measurements (in μm) and morphometric data on males (upper line) and females (lower line) of *Paramonohystera sinica* sp. nov.

Characters	Holotype	Min	Max	Mean	SD	CV	*n*
Body length	933	933	1023	979.0	34.8	3.6	5
	–	1063	1127	1097.5	26.2	2.4	4
Body diameter, maximum	29	29	34	32.8	2.1	6.3	5
	–	38	42	39.9	1.4	3.6	4
Head diameter	13	13	16	14.1	0.9	6.5	5
	–	15	18	16.3	1.3	7.7	4
Cephalic seta length (CSL)	7	7	9	7.9	0.5	6.5	5
	–	7	9	8.3	0.9	10.3	4
CSL/head diameter (%)	55	49	62	56.3	4.8	8.6	5
	–	49	58	51.1	6.3	12.4	4
Amphid diameter	6	6	7	6.8	0.5	7.9	5
	–	5	5	5.2	0.2	3.4	4
Amphid diameter/c.b.d. (%)	33	33	46	40.4	4.7	11.6	5
	–	23	28	25.7	2.0	7.9	4
Nerve ring from anterior end	75	75	89	79.5	5.5	6.9	5
	–	83	89	85.6	2.4	2.8	4
Nerve ring c.b.d.	26	26	28	26.8	0.8	2.8	5
	–	31	33	32.1	0.7	2.2	4
Pharyngeal length	153	153	159	156.7	2.4	1.5	5
	–	174	184	179.4	4.3	2.4	4
Pharyngeal c.b.d. at base	29	29	33	31.2	1.8	5.7	5
	–	37	39	37.8	0.9	2.4	4
Spicule length	79	79	88	84.1	3.7	4.3	5
Tail length	121	114	130	123.1	5.9	4.8	5
	–	137	146	140.0	4.0	2.8	4
Anal body diameter (a.b.d.)	19	19	21	20.0	0.8	4.2	5
	–	21	24	22.5	1.3	5.8	4
Tail length/a.b.d.	6.4	5.7	6.6	6.2	0.4	5.9	5
	–	5.7	6.6	6.3	0.4	6.3	4
Spicule length/a.b.d.	4.2	4.0	4.4	4.2	0.2	4.2	5
Vulva from anterior end	–	683	740	709.2	24	3.4	4
Vulva c.b.d.	–	34	42	37.3	3.6	9.5	4
V%	–	63	66	64.6	1.0	1.5	4
a	32.0	27.9	32.0	29.9	1.5	5.2	5
	–	26.3	28.6	27.6	1.0	3.5	4
b	6.1	6.1	6.4	6.2	0.2	2.6	5
	–	5.9	6.3	6.1	0.2	2.8	4
c	7.7	7.6	8.9	8.0	0.5	6.7	5
	–	7.5	8.2	7.9	0.3	3.7	4

Note: CV, coefficient of variation in %; Max, maximum; Min, minimum; SD, standard deviation; –, absent.

diameter. Head 13–16 μm wide. Cuticle with coarse annulations visible throughout body, about 2–3 μm at intervals. Many somatic setae scattered all over body, slightly denser and up to 14 μm long at cervical region. Buccal cavity large with hemispherical cheilostome and conical pharyngostome, 7–10 μm wide and 6–11 μm long, both in an

Table 3. A list of nominal species of *Paramonohystera*.

Nominal species	Basionym / Synonym / Homonym	Species status / Remarks	References
P. albigensis (Riemann 1966)	*Promonhystera albigensis* Riemann, 1966; *Theristus* (*Daptonema*) *albigensis* (Riemann 1966) Hopper, 1968	Invalid; should be a member of *Promonhystera* with distinct labial setae	(Riemann 1966; Hopper 1968; Warwick et al. 1998)
***P. biforma* Wieser, 1956**	*Paramonhystera (P.) biforma* Wieser, 1956	**Valid**; spicules 2.0 a.b.d.	Wieser (1956)
P. breviseta Juario, 1974	*Retrotheristus breviseta* (Juario, 1974) Lorenzen, 1977	Now a member of *Retrotheristus*	(Lorenzen 1977; Annapurna et al. 2012)
***P. buetschlii* (Bresslau and Schuurmans Stekhoven in Schuurmans Stekhoven 1935)**	*Theristus buetschlii* Bresslau and Schuurmans Stekhoven in Schuurmans Stekhoven, 1935	**Valid**; spicules 2.7 a.b.d.	(Schuurmans Stekhoven 1935; Warwick et al. 1998)
P. canicula Wieser and Hopper, 1967	*Metadesmolaimus caniculus* (Wieser and Hopper 1967)	Now a member of *Metadesmolaimus*	(Wieser and Hopper 1967; Gerlach and Riemann 1973)
***P. concinna* Lorenzen, 1977**	*Paramonhystera concinna* Lorenzen, 1977	**Valid**; spicules >2 a.b.d.	Lorenzen (1977)
P. elliptica Filipjev, 1918	*Paramonohystera setosa* Filipjev, 1918; *Paramonhystera (Leptogastrella) elliptica* Filipjev, 1918	Unreliable record; reported unfigured	(Gerlach and Riemann 1973; Warwick et al. 1998)
***P. eurycephalus* Huang and Wu, 2011**	–	**Valid**; spicules 3.1-3.2 a.b.d.	Huang and Wu (2011)
***P. geraerti* Chen and Vincx, 2000**	*Paramonhystera geraerti* Chen and Vincx, 2000	**Valid**; spicules 5.4-5.8 a.b.d.	Chen and Vincx (2000)
***P. halerba* Fadeeva and Belogurov, 1987**	*Paramonohystera (Leptogastrella) halerba*	**Valid**; spicules 2.5 a.b.d.	(Fadeeva and Belogurov 1987; Venekey et al. 2014)

(*Continued*)

Table 3. (Continued).

***P. levicula* (Lorenzen 1973)**	*Theristus* (*Daptonema*) *leviculus* Lorenzen in Gerlach and Riemann, 1973; *Theristus* (*Daptonema*) *levis* Lorenzen, 1972	**Valid**; spicules 3.4 a.b.d.	(Lorenzen 1972; Gerlach and Riemann 1973; Lorenzen 1974, 1977)
P. longicaudata Timm, 1963	*Paramonhystera longicaudata* Timm, 1963	Likely a member of *Daptonema*; spicules only 1.5 a.b.d.	Timm (1963)
***P. megacephala* Steiner, 1916**	*Monhystera* (*Paramonohystera*) *megacephala* Steiner, 1916; *Paramonhystera megacephala* Steiner, 1916; *Paramonhystera* (*P.*) *megacephala* Steiner, 1916	**Valid**; type species, spicules 6.0 a.b.d.	(Filipjev 1918; Wieser 1956; Gerlach and Riemann 1973)
P. micramphis Schuurmans Stekhoven, 1950	–	*Species inquirenda*; known from females and juvenile only	(Wieser and Hopper 1967; Chen and Vincx 2000; Venekey et al. 2014)
P. mutila Lorenzen, 1973	*Stylotheristus mutilus* (Lorenzen 1973) Lorenzen, 1977	Now a member of *Stylotheristus*; spicules <1 a.b.d.	(Lorenzen 1973, 1977)
P. mystacoderma Wieser, 1960	–	*Nomen nudum*	Venekey et al. (2014)
***P. parabutschlii* (Timm 1961)**	*Theristus* (*Daptonema*) *parabutschlii* Timm, 1961	**Valid**; spicules >2 a.b.d.	Timm (1961)
P. paranormandica Micoletzky, 1922	*Theristus paranormandicus* Micoletzky, 1922; *Daptonema normandicum* (De Man, 1890)	Invalid; a synonym of *Daptonema normandicum*; spicules only 1.25 a.b.d.	Ansari et al. (2013)

(*Continued*)

Table 3. (Continued).

Nominal species	Basionym / Synonym / Homonym	Species status / Remarks	References
P. pellucida (Cobb, 1920)	*Leptogastrella pellucida* Cobb, 1920; *Paramonhystera (Leptogastrella) pellucida* (Cobb, 1920)	Likely a species complex, most specimens with 20 cephalic setae, while others have a normal circle of 10–12 setae; spicules 2.0 a.b.d.	(Cobb 1920; Wieser 1956)
***P. pilosa* Boucher, 1971**	*Paramonhystera pilosa* Boucher, 1971	**Valid;** spicules 2.7 a.b.d.	WoRMS (2014)
***P. proteus* Wieser, 1956**	*Paramonhystera (P.) proteus* Wieser, 1956	**Valid**; spicules 3.7 a.b.d.	Wieser (1956)
***P. riemanni* (Platt 1973)**	*Theristus* (*Daptonema*) *riemanni* Platt, 1973	**Valid**; spicules 3.1–3.7 a.b.d.	(Platt 1973; Warwick et al. 1998)
P. setosa Filipjev, 1918	*P. (Leptogastrella) elliptica* Filipjev, 1918	Synonym of *P. elliptica*	(Gerlach and Riemann 1973; Warwick et al. 1998)
***P. sinica* sp. nov.**	–	**Valid**; spicules 4.0–4.4 a.b.d.	This paper
P. stricta (Gerlach 1956)	*Leptogastrella stricta* Gerlach 1956	Likely a member of *Promonhystera*, with distinct labial setae	(Gerlach 1956; Gerlach and Riemann 1973)
P. tschislenkoi Platonova, 1971	–	*Species inquirenda*, number of cephalic setae unknown	(Platonova 1971; Gerlach and Riemann 1973)
P. wieseri Ott, 1977	–	Likely a member of *Daptonema*; spicules only 1.1–1.3 a.b.d.	Ott (1977)
***P. zizichi* Pastor de Ward, 1985**	–	**Valid**; spicules 2.1 a.b.d.	Pastor de Ward (1985)

Table 4. Tabular key to the 14 species of *Paramonohystera* recognized as valid, based upon characteristics of male specimens. Measurements in µm.

Species	Body length	Head diameter	Spicule length	Spicule length to anal body diameter	Cephalic setae, number	Cervical setae in a circle	Tail length	References
P. biforma – small form	760	20–22	38–40	2.0	10	no	95	Wieser (1956)
P. biforma – large form	1770	37	38–40	2.0	10	no	230	Wieser (1956)
P. buetschlii	2000	–	–	2.7	12	no	182	Schuurmans Stekhoven (1935)
P. concinna	1090	–	97	>2.0	12 (segmented)	no	136	Lorenzen (1977)
P. eurycephalus	1695–1860	31–33	140–168	3.1–3.2	10	no	260–263	Huang and Wu (2011)
P. geraerti	705–767	11–12	108–117	5.4–5.8	10	no	74–84	Chen and Vincx (2000)
P. halerba	1200–1460	9–12	105–113	2.5	12	no	137–188	(Fadeeva and Belogurov 1987)
P. levicula	920	16	64	3.4	10	no	140	(Lorenzen 1972; Gerlach and Riemann 1973; Lorenzen 1974, 1977)
P. megacephala	1200–1660	13–18	195	6.0	10	no	–	(Filipjev 1918; Wieser 1956; Gerlach and Riemann 1973)
P. parabutschlii	918	–	–	>2.0	10	no	161 (tip with 2 spines)	Timm (1961)
P. pilosa	1660	32	167	2.7	12	no	~200	WoRMS (2014)
P. proteus	1150–1500	24–27	120	3.7	10	no	–	Wieser (1956)
P. riemanni	950–1026	10	49–55	3.1–3.7	10	yes	112–126	(Platt 1973; Warwick et al. 1998)
P. sinica	933–1023	13–16	79–88	4.0–4.4	12	no	114–130	This paper
P. zizichi	870	7	72	2.1	10	no	110	Pastor de Ward (1985)

–, data not available.

average of 8 μm. Anterior sensilla, arranged in two circles: the anterior one composed of six labial papillae, usually difficult to observe; the posterior one with 12 cephalic setae in six pairs, each pair composed of a shorter and a longer seta, the shorter setae 5–7 μm long, and the longer ones about 7–9 μm long. Amphidial fovea round, 6–7 μm in diameter and 33–46% c.b.d., anterior border of fovea 6–10 μm from anterior body end (Figure 2B). Pharynx cylindrical, slightly widened at base, 153–159 μm long (about 16% of total body length). Pharyngo-intestinal junction with small triangular cardia. Nerve ring located near the middle of pharynx, 75–89 μm distant to anterior body end. Excretory pore and ventral gland not observed. Tail conico-cylindrical, 114–130 μm long and 5.7–6.6 a.b.d., with cylindrical part occupying about one-third of tail length. Three terminal setae, about 7 μm long. Three caudal glands in tail region (Figure 2E).

Two opposite and outstretched testes, the anterior one to the left of the intestine, and the posterior one to the right. Spicules paired, slender and arcuate, 79–88 μm long and 4.0–4.4 anal body diameter. Gubernaculum complex, paired large parts slender and proximally pointed, 20–24 μm long; paired small parts stout, distally hook-shaped, pointed in the proximal end, with a ventral apophysis in the middle part, 8–11 μm long. No precloacal supplements (Figure 2D).

Females. Similar to males, but the body slightly larger (1063–1127 μm versus 933–1023 μm), amphids slightly smaller in both diameter (5.0–5.3 μm versus 6.0–7.3 μm) and corresponding body diameter (23–28% versus 33–46%), buccal cavity broader (10 μm versus 8 μm), head slightly larger (15–18 μm versus 13–16 μm in diameter), and cervical setae sparser (Figure 2C). A single anteriorly outstretched ovary to the left of intestine in three-quarters of specimens, and the rest to the right. Some eggs present in the ovary, the largest ones oblong with narrowly rounded anterior end, up to 97 μm long; the smallest ones roundish, about 4 μm across. Many small circular spermatozoa in uterus, about 2 μm in diameter. Vulva located at posterior third of the body (Figure 2A).

Comparison with related species and genera and overview of Paramonohystera species

Paramonohystera was first established by Steiner (1916) as a subgenus of *Monhystera* Bastian, 1865 being characterized by retractable head, bubble amphids and simple conical buccal cavity, with *Monhystera* (*Paramonohystera*) *megacephala* Steiner, 1916 as the type species. Soon afterward, it was raised to genus level by Filipjev (1918). It is worthy of note that the similar name *Paramonhystera* as used by Filipjev (1918) and many subsequent authors is an invalid emendation, as clearly stated by Gerlach and Riemann (1973). Two subgenera have previously been proposed for *Paramonohystera*: *Paramonohystera* and *Leptogastrella* (Wieser 1956; Gerlach and Riemann 1973; Lorenzen 1994). Wieser (1956) defined the two subgenera mainly by the arrangement of cephalic (10 cephalic setae, without additional cephalic setae versus 10–12 cephalic setae, plus additional cephalic setae) and cervical setae (of equal length versus one circle much longer). However, these differences are not distinct and the characters may overlap in a single species (e.g. *P. riemanni*; Table 4). On the other hand, all species assigned to the subgenus *Leptogastrella* have either been synonymized or considered as unreliable reports. Hence, the two subgenera have rarely been employed. The redescription of *P.* (*Leptogastrella*) *pellucida* (Cobb, 1920) by Wieser (1956) is probably involved in a species complex composed of specimens with about 20 cephalic setae and

specimens with a normal circle of 10–12 setae. These specimens might be classified if other typical specimens are available, as stated by Wieser (1956).

Paramonohystera sinica sp. nov. possesses 12 cephalic setae, whereas most known species of *Paramonohystera* have 10 cephalic setae (Table 4). As the number of cephalic setae is very stable within species, it seems reasonable to split *Paramonohystera* and erect a new genus with 12 cephalic setae. However, variability in the number of cephalic setae is usual in Xyalidae, in which *Xyala* and *Cobbia* have 10 or 12 cephalic setae, and *Theristus* and *Daptonema* have even 10, 12 or 14 cephalic setae. Wieser (1956) also emphasized the variability in the number of the cephalic setae in *Paramonohystera.* Hence, it is too early to create a new genus before further materials and molecular proofs are available. Within the genus *Paramonohystera*, only *P. buetschlii* (Bresslau and Schuurmans Stekhoven in Schuurmans Stekhoven, 1935), *P. concinna* Lorenzen, 1977, *P. halerba* Fadeeva and Belogurov, 1987 and *P. pilosa* Boucher, 1971 possess 12 cephalic setae (Table 4). The new species *P. sinica* differs from *P. buetschlii* by body length (933–1023 μm versus 2000–2200 μm) and the ratio of spicule length to a.b.d. (4.0–4.4 versus 2.7). *Paramonohystera concinna* has segmented cephalic setae which are smooth in *P.sinica*. *Paramonohystera pilosa* has much longer spicules (167 μm versus 79–88 μm), broader head (32 μm versus 13–16 μm) and smaller ratio of spicule length to anal body diameter (2.7 versus 4.0–4.4). In addition *P. halerba* has two rows of setae on the ventral side of the tail (versus absent in *P. sinica*), shorter cervical setae (4–6 μm versus up to 14 μm), longer spicules (105–113 μm versus 79–88 μm) and smaller ratio of spicule length to anal body diameter (2.5 versus 4.0–4.4). All other species of *Paramonohystera* are easily distinguished from the new species by the number of cephalic setae.

Within the family Xyalidae, *Paramonohystera* Steiner, 1916 is similar to *Daptonema*, differentiated by the elongate (>2 a.b.d.) and slender spicules (Lorenzen 1977; Warwick et al. 1998). Chen and Vincx (2000) recognized nine species of *Paramonohystera* and provided a key of species including *P. breviseta* Juario, 1974, *P. longicaudata* Timm, 1963 and *P. wieseri* Ott, 1977. Among these, *P. breviseta* has been regarded as a member of the genus *Retrotheristus* Lorenzen, 1977. *Paramonohystera longicaudata* and *P. wieseri* have relatively short spicules (<1.5 a.b.d.) and probably belong to the genus *Daptonema* (Table 3). Chen and Vincx (2000) did not include *P. buetschlii* (Bresslau and Schuurmans Stekhoven in Schuurmans Stekhoven, 1935), *P. parabutschlii* (Timm, 1961), *P. riemanni* (Platt, 1973) and *P. zizichi* Pastor de Ward, 1985 etc., without any comments. All of these species have spicules >2 a.b.d., match *Paramonohystera* well and should be considered as valid species of the genus (Table 3). Venekey et al. (2014) recognized 18 species of *Paramonohystera* as valid, and regarded *P. micramphis* as *species inquirenda* and *P. mystacoderma* as *nomen nudum*. Among the valid species of Venekey et al. (2014), *P. longicaudata* is probably a member of *Daptonema*; *P. paranormandica* has already been transferred to *Daptonema* (Ansari et al. 2013); *P. pellucida* is likely to be a species complex, as mentioned above; *P. stricta* is probably a member of *Promonhystera* possessing distinct labial setae; and *P. tschilenkoi* might be a *species inquirenda* since the number of cephalic setae that distinguishes *Paramonohystera* from *Retrotheristus* was not included in the original description of Platonova (1971), Venekey et al. (2014) also overlooked *P. buetschlii*, which has been considered as a valid species (Warwick et al. 1998). Pastor de Ward (1985) previously described a population under the name of *Paramonohystera* (*P.*) *parabutschlii* Timm, 1961. It is

likely a misidentification because the specimens are distinctly longer (2100 μm vs. 918 μm in male) and has a higher number of cephalic setae (12 vs. 10) than the type specimen described by Timm (1961).

Based on the evaluation of 28 nominal species of *Paramonohystera*, we recognize 14 valid species and provide a tabular key to the genus (Tables 3, 4). Additionally, we provide an emended generic diagnosis for *Paramonohystera*: Xyalidae with 6 labial papillae and 10 or 12 cephalic setae usually in six groups, unarmed conical buccal cavity with domed anterior end, circular (mostly) or elliptical amphids, elongate (≥2 a.b.d.) spicules, and conico-cylindrical tail with terminal setae. *Paramonohystera* is most similar to *Daptonema* and *Promonhystera*, but differs from *Daptonema* by the elongate (≥2 a.b.d. versus ca.1 a.b.d) and slender spicules and from *Promonhystera* by the lack of long and distinct labial setae (Warwick et al. 1998; Coomans and Abebe 2006).

Acknowledgements

We thank Professor A.V. Tchesunov for providing the necessary literature and Mr Benze Shi for his help in sample processing. Special thanks are due to the anonymous reviewers who recognized the new genus described herein and offered critical and informative suggestions on an earlier version of the manuscript.

Funding

This work was supported by the Knowledge Innovation Programme of the Chinese Academy of Sciences [grant number KSCX2-EW-Z-5] to K. Xu, the Natural Science Foundation of China [grant number 41176107] to Y. Huang, and the Open Research Cruise offshore China by Research Vessel KE XUE SAN HAO, IOCAS.

References

Annapurna C, Bhanu CV, Rao MS, Sivalakshmi MV, Cooper LM, Rao YK. 2012. Free-living nematodes along the continental slope off northeast coast of India. J Mar Biol Ass India. 54:52–60.

Ansari KGMT, Lyla PS, Khan SA. 2013. New records of five *Daptonema* species (Nematoda: Xyalidae) from Indian waters. J Mar Biol Ass India. 55:1–78. doi:10.6024/jmbai.2013.55.1.01760-12

Bastian HC. 1865. II. Monograph on Angillulidae, or free nematoids, marine, land, and freshwater; with descriptions of 100 new species. Trans Linn Soc London. 25:73–184.

Boucher G. 1971. Deux espèces nouvelles de Monhysterida (Nématodes) de la vase terrigène côtière de Banyuls-sur-mer. Bull Soc Zool Fr. 96:557–562.

Chen GT, Vincx M. 2000. New and little known nematodes (Monhysterida, Nematoda) from the Strait of Magellan and Beagle Channel (Chile). Hydrobiologia. 429:9–23. doi:10.1023/A:1003995005971

Chitwood BG. 1951. North American marine nematodes. Tex J Sci. 3:617–672.

Cobb NA. 1920. One hundred new nemas (type species of 100 new genera). Baltimore: Waverly Press.

Coomans A, Abebe E. 2006. Order Monhysterida. In: Eyualem A, Andrássy I, Traunspurger W, editors. Freshwater nematodes: ecology and taxonomy. London (MA): CABI Publishing; p. 574–603.

Fadeeva NP, Belogurov OI. 1987. The structure of the cephalic end in Xyalidae and description of three species. Biologiya Morya Vladivostok. 1:11–21.
Filipjev IN. 1918. Free-living marine nematodes in the vicinity of Sevastopol. Part I. Trans Zool Lab Sevastopol Biol Stn Russian Acad Sci, Ser II. 4:1–362.
Filipjev IN. 1929. Les Nématodes libres de la baie de la Neva et de l'extrémité orientale du Golfe de Finlande. I. Arch Hydrobiol. 20:637–699.
Gerlach SA. 1956. Brasilianische Meeres-Nematoden 1: (ergebnisse eines studienaufenthaltes an der Universität São Paulo). Bol Inst Oceanogr. 5:3–69. doi:10.1590/S0373-55241954000100001
Gerlach SA. 1957. Die Nematodenfauna des Sandstrandes an der Küste von Mittelbrasilien (Brasilianische Meeres-Nematoden IV). Mitt Zool Mus Berlin. 33:411–459. doi:10.1002/mmnz.19570330206
Gerlach SA, Riemann F. 1973. The Bremerhaven checklist of aquatic nematodes. Veröff Inst Meeresforsch Bremerh. 4:1–295.
Hopper BE. 1968. Marine nematodes of Canada. I. Prince Edward Island. Can J Zool. 46:1103–1111. doi:10.1139/z68-158
Huang Y, Wu XQ. 2011. Two new free-living marine nematode species of Xyalidae (Monhysterida) from the Yellow Sea, China. J Nat Hist. 45:567–577. doi:10.1080/00222933.2010.534562
Huang Y, Xu K. 2013. Two new species of the genus *Paracyatholaimus* Micoletzky (Nematoda: Cyatholaimidae) from the Yellow Sea. J Nat Hist. 47:1381–1392. doi:10.1080/00222933.2012.752544
Juario J. 1974. Neue freilebende Nematoden aus dem Sublitoral der Deutschen Bucht. Veröff Inst Meerseforsch Bremerh. 14:275–303.
Lorenzen S. 1972. Die Nematodenfauna im Verklappungsgebiet für Industrieabwasser nordwestlich von Helgoland. I. Araeolaimida und Monhysterida. Zool Anz. 187:223–248.
Lorenzen S. 1973. Freilebende Meeresnematoden aus dem Sublitoral der Nordsee und der Kieler Bucht. Veröff Inst Meeresforsch Bremerh. 14:103–130.
Lorenzen S. 1974. Die Nematodenfauna der sublitoralen Region der Deutschen Bucht, insbesondere im Titan-Abwassergebiet bei Helgoland. Veröff Inst Meeresforsch Bremerh. 14:305–327.
Lorenzen S. 1977. Revision der Xyalidae (freilebende Nematoden) auf der Grundlage einer kritischen Analyse von 56 Arten aus Nord-und Ostsee. Veröff Inst Meeresforsch Bremerh. 16:197–261.
Lorenzen S. 1994. The phylogenetic systematics of free-living nematodes. Andover: Ray Society.
Micoletzky H. 1922. Die freilebenden Erdnematoden. Arch Naturgesch. 87A:1–650.
Miljutin DM, Gad G, Miljutina MM, Mokievsky VO, Fonseca-Genevois V, Esteves AM. 2010. The state of knowledge on deep-sea nematode taxonomy: how many valid species are known down there? Mar Biodiv. 40:143–159. doi:10.1007/s12526-010-0041-4
Ott JA. 1977. New free-living marine nematodes from the West Atlantic I. Four new species from Bermuda with a discussion of the genera *Cytolaimium* and *Rhabdocoma* Cobb 1920. Zool Anz. 198:120–138.
Pastor de Ward CT. 1985. Nematodes marinos de la ria deseado (Monhysteroidea, Xyalidae) Santa Cruz Argentina II. Physis (Buenos Aires) Secc A. 43:113–130.
Platonova TA. 1971. Exploration of the fauna of the seas VIII fauna and flora of the Possjet Bay of the Sea of Japan. Zool Inst Acad Sci USSR. 8:72–108.
Platt HM. 1973. Free-living marine nematodes from Strangford Lough, Northern Ireland. Cah Biol Mar. 14:295–321.
Platt HM, Warwick RM, 1983. Free-living marine nematodes part I: British enoplids. Pictorial key to world genera and notes for the identification of British species. Cambridge

University Press, for the Linnean Society of London and the Estuarine and Brackish-Water Sciences Association.
Riemann F. 1966. Die interstitielle Fauna im Elbe-Aestuar. Verbreitung und Systematik. Arch Hydrobiol Suppl. 31:1–279.
Schuurmans Stekhoven JH. 1935. Nematoda: Systematische Teil, Nematoda errantia. In: Grimpe G, Wagler E, editors. Die Tierwelt der Nord- und Ostsee. 5B. Leipzig: Akademische Verlagsgesellschaft; p. 1–173.
Schuurmans Stekhoven JH. 1950. The freeliving marine nemas of the Mediterranean. I. The Bay of Villefranche. Mém Inst r Sci nat Belg. 37:1–220.
Steiner G. 1916. Freilebende Nematoden aus der Barentsee. Zool Jahrb Syst. 39:511–676.
Tchesunov AV. 1990. New taxa of marine free-living nematodes of the Family Xyalidae Chitwood, 1951 (Nematoda, Chromadorida, Monhysterida) from the White Sea. In: Gagarin VG, editor. Fauna, biology and systematics of free-living lower worms. Institute of Inland Water Biology. Moscow: Academy of Sciences of the USSR; p. 101–117.
Tchesunov AV. 2006. Biology of marine nematodes. Moscow: KMK Scientific Press Ltd.
Timm RW. 1961. The marine nematodes of the Bay of Bengal. Proc Pakist Acad Sci. 1:25–88.
Timm RW. 1963. Marine nematodes of the suborder Monhysterina from the Arabian Sea at Karachi. Proc Helminth Soc Wash. 30:34–49.
Venekey V, Gheller PF, Maria TF, Brustolin MC, Kandratavicius N, Vieira DC, Brito S, Souza GS, Fonseca G. 2014. The state of the art of Xyalidae (Nematoda, Monhysterida) with reference to the Brazilian records. Mar Biodivers. 2014:1–24.
Warwick RM, Platt HM, Somerfield PJ. 1998. Free-living marine nematodes. Part III: Monhysterids. London: Field Studies Council.
Wieser W. 1956. Free-living marine nematodes. III. Axonolaimoidea and Monhysteroidea. Reports of the Lund University Chile Expedition 1948–49. Acta Univ Lund, NF Avd. 52:1–115.
Wieser W. 1960. Algenbewohnende Nematoden aus Rovinj (Istrien). Zool Anz. 164:82–88.
Wieser W, Hopper B. 1967. Marine nematodes of the east coast of North America. I. Florida. Bull Mus Comp Zool Harv. 135:239–344.
[WoRMS] World Register of Marine Species. 2014. *Paramonhystera pillosa* [Internet]. In: Vanaverbeke J, et al. 2014. NeMys: World Database of Free-Living Marine Nematodes. Available from: http://www.marinespecies.org/aphia.php?p=taxdetails&id=230745/
Zhang Y, Zhang ZN. 2006. Two new species of the genus *Elzalia* (Nematoda: Monhysterida: Xyalidae) from the Yellow Sea, China. J Mar Biol Ass UK. 86:1047–1056. doi:10.1017/S0025315406014020