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Research article

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New nematode species (Nematoda: Chromadorea) and records from the New Zealand continental shelf

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Abstract. Little is known about the diversity of free-living nematodes of New Zealand’s continental shelf environments. A preliminary analysis of samples obtained from the continental shelf along the east coast of New Zealand’s North Island revealed the presence of eleven previously described species, which are recorded from this region of New Zealand for the first time. Two of these species were originally described from intertidal sediments, two were described from subtidal or continental shelf environments (5–40 m depth), and seven were originally described from the continental slope (ca 400–1250 m depth). A further three new species, *Psammonema buamphida* sp. nov., *Paramonohystera spinosipsicula* sp. nov. and *Sabatieria pararticulata* sp. nov. are described. *Sabatieria pararticulata* sp. nov., shares the unusual feature for the genus of having long, jointed spicules with *S. articulata* Fu, Leduc & Zhao, 2019, which was also described from New Zealand. The presence of this feature, which is otherwise absent in all other species of the genus, in the two New Zealand species suggests that *S. articulata* and *S. pararticulata* sp. nov. likely evolved from a common ancestor.

Keywords. Desmodoridae, Xyalidae, Comesomatidae, Hawke Bay, Poverty Bay, Tokomaru Bay.

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Introduction

Over 250 species of free-living marine nematodes have been described from New Zealand waters, approximately half of which have been described in the last 20 years (Leduc & Preswell 2023). The majority of these species were described from intertidal or deep-sea environments, and only a few species have been recorded/described from the continental shelf of New Zealand’s main islands, i.e., the South and North islands. To date, nothing is known about the nematode fauna on the continental shelf of the North Island’s east coast, which spans over 500 km.

In February 2023, the east coast of the North Island was hit by the Cyclone Gabrielle, which caused devastating and widespread damage to infrastructure in catchments and the coastal zone. Surveys were conducted in response to this event in order to understand the sediment impacts in affected environments of the region (Leduc *et al.* 2024). The analyses of sediment cores obtained during these surveys provided

the first opportunity to investigate the nematode fauna of the North Island's east coast. Here, three new species of free-living nematodes, *Psammonema buamphida* sp. nov., *Paramonohystera spinosispicula* sp. nov., and *Sabatieria pararticulata* sp. nov., are described from the continental shelf, and 11 new species records are provided for the region.

Material and methods

Sediment samples for analyses of meiofauna were obtained using a multicorer (Ocean Instruments MC-800A) during RV *Kaharoa* voyage KAH2303 (June 2023) off the coast of the Hawke's Bay and Gisborne regions on the east coast of New Zealand's North Island (Leduc *et al.* 2024; Fig. 1, Table 1). Meiofauna subcores were obtained using a cut-off syringe (29 mm internal diameter) and the top 5 cm of sediment was preserved in 5% buffered formalin upon collection. In the laboratory, samples were sieved on a 63 µm mesh to retain meiofauna, which were then extracted from the sediments using the ludox flotation technique (Sommerfield & Warwick 1996). Nematodes were handpicked under a stereo microscope and transferred to pure glycerol (Sommerfield & Warwick 1996).

Species descriptions were made from glycerol mounts using differential interference contrast microscopy and drawings were made with the aid of a camera lucida. Measurements were obtained using an Olympus BX53 compound microscope with cellSens Standard software for digital image analysis. All

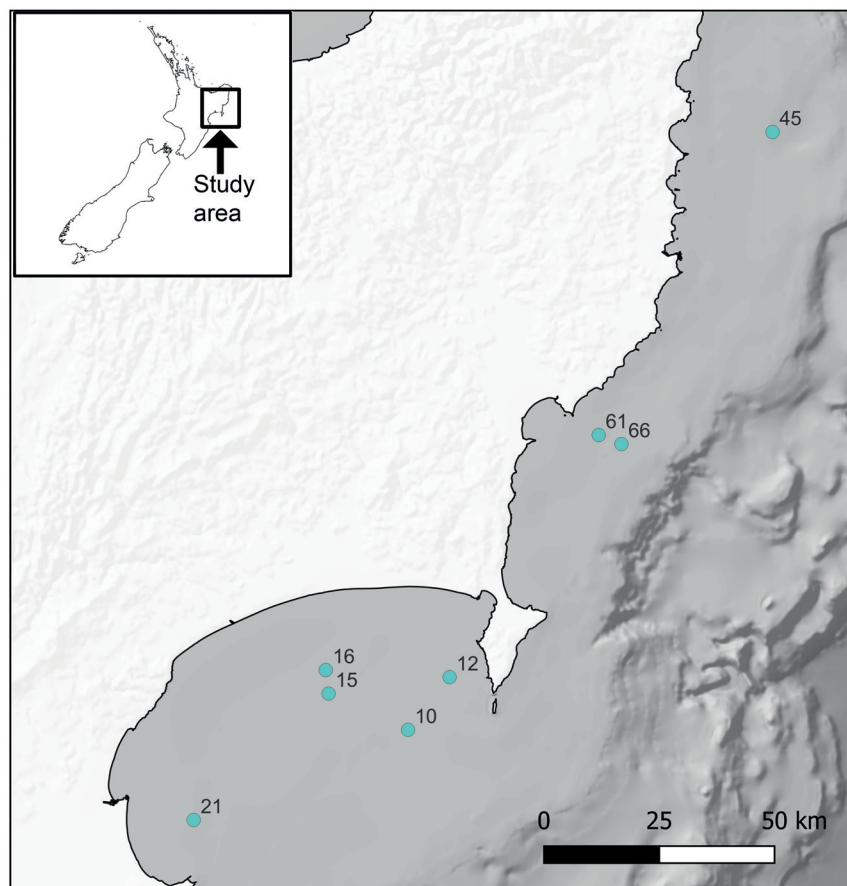


Fig. 1. Map of the study area showing the location of sampling sites (blue circles) on the east coast of New Zealand's North Island. Sites are labelled with station numbers (RV *Kaharoa* voyage KAH2303, June 2023). Inset: map of New Zealand showing location of study area.

Table 1. Details of sampling stations, RV *Kaharoa* voyage KAH2303 (June 2023). TOM: total organic matter content.

station	date	latitude	longitude	area	depth (m)	% TOM	% silt/clay
10	4 Jun. 2023	39.3384° S	177.6442° E	Hawke Bay	76	1.3	81
12	4 Jun. 2023	39.2328° S	177.7514° E	Hawke Bay	39	1.9	80
15	5 Jun. 2023	39.2658° S	177.4395° E	Hawke Bay	61	6.3	95
16	5 Jun. 2023	39.2186° S	177.4321° E	Hawke Bay	47	7.0	92
21	6 Jun. 2023	39.5186° S	177.0916° E	Hawke Bay	30	2.9	89
45	11 Jun. 2023	38.1316° S	178.5839° E	Tokomaru Bay	42	1.8	77
61	15 Jun. 2023	38.7458° S	178.1355° E	Poverty Bay	42	3.5	89
66	16 Jun. 2023	38.7641° S	178.1942° E	Poverty Bay	54	2.8	83

measurements are in μm (unless stated otherwise), and all curved structures are measured along the arc. The terminology used for describing the arrangement of morphological features such as setae follows Coomans (1979), terminology of stoma structures follows Decraemer *et al.* (2014). Type specimens are held in the NIWA Invertebrate Collection (Wellington).

Abbreviations for morphological terms

- a = body length/maximum body diameter
b = body length/pharynx length
c = body length/tail length
c' = tail length/anal or cloacal body diameter
cbd = corresponding body diameter
L = total body length;
n = number of specimens
V = vulva distance from anterior end of body
%V = $V/\text{total body length} \times 100$

Results

A preliminary analysis of the samples obtained from the study sites revealed the presence of at least fourteen nematode species (Table 2), including 11 known species and three species new to science.

Phylum Nematoda Cobb, 1932
Class Chromadorea Inglis, 1932
Order Desmodorida De Coninck, 1965

Family **Desmodoridae** Filipjev, 1922

Diagnosis (from Tchesunov 2014)

Body cylindrical. Cuticle distinctly annulated, without dots, but spines, fringes or longitudinal ornamentation may be present. No specialised ambulatory setae at anterior or posterior body regions. Locomotion is sinuous, typical for nematodes.

Table 2. Details of nematode species recorded from the continental shelf on the east coast of New Zealand’s North Island during RV *Kaharoa* voyage KAH2303, including their NIWA specimen numbers. Type localities are shown for all species recorded from the continental shelf study sites in the present study. Species described in the present study are shown in bold.

Order	Species	KAH2303 station(s)	NIWA specimen no.	Type locality (New Zealand) and depth
Enoplida Flipjev, 1929	<i>Halalaimus talaurens</i> Leduc, 2023	10, 21, 66	181601–181603	Hikurangi Margin, 1230 m
	<i>Desmodorella tenuispiculum</i> (Allgén, 1928) Gerlach, 1963	15, 66	181605–181606	Campbell Island, 40 m
	<i>Onyx exiguus</i> Leduc & Zhao, 2023	12, 13	181607–181608	Pāuatahanui Inlet, 0 m
Desmodorida De Coninck, 1965	<i>Psammonema buamphida</i> sp. nov.	45, 66	181622-4	Poverty Bay, 54 m
	<i>Pseudodesmodora lacrima</i> Leduc & Wharton, 2010	10, 12, 15, 16, 21, 61	181609–181614	Firth of Thames, 5 m
	<i>Pseudochromadora plurichela</i> Leduc & Zhao, 2023	12, 16	181615–181616	Pāuatahanui Inlet, 0 m
	<i>Pseudocheironchus ingluvius</i> Leduc, 2013	16	181617	Chatham Rise, 478 m
Chromadorida Chitwood, 1933	<i>Synonchiella rotundicauda</i> Leduc, 2013	16	181618	Chatham Rise, 422 m
	<i>Linhomoeus pycnocricus</i> Leduc, 2023	66	181604	Hikurangi Margin, 1227 m
Monhysterida Flipjev, 1929	<i>Paramonohystera spinosispicula</i> sp. nov.	16	181625–181626	Hawke Bay, 47 m
	<i>Mudwigglus patumuka</i> Leduc, 2013	15	181619	Chatham Rise, 1195 m
Araeolaimida De Coninck & Schuurmans Stekhoven, 1933	<i>Sabatieria pararticulata</i> sp. nov.	16	181627–181628	Hawke Bay, 47 m
	<i>Setosabatieria conicauda</i> Leduc, Probert & Nodder, 2012	16	181620	Chatham Rise, 1240 m
	<i>Vasostoma hexodontium</i> Rosli, Leduc & Probert, 2014	16	181621	Hikurangi Margin, 670 m

Subfamily **Desmodorinae** Filipjev, 1918

Diagnosis (modified from Tchesunov 2014)

Cuticle annulated except in cephalic region. Cephalic region with thickened cuticle except in lip region and set off as conspicuous cephalic capsule. Amphidial fovea generally not surrounded by annulation of body cuticle; may be located on a cuticularised plate. Buccal cavity mostly with distinct teeth. Pharyngeal bulb round to elongated.

Genus ***Psammonema*** Verschelde & Vincx, 1995

Type species

Psammonema ovisetum Verschelde & Vincx, 1995.

Diagnosis (emended from Muthumbi & Vincx 2016)

Annulated cuticle with fine lateral alae beginning posterior to, or at level of, pharyngeal region. Females usually with both long slender somatic setae and short somatic setae. Six inner and six outer labial sensilla

on anterior portion of the cephalic capsule, four cephalic sensilla on main portion of cephalic capsule; additional sub-cephalic setae may also occur on main portion of cephalic capsule. Sexual dimorphism usually present in shape and size of amphidial fovea; amphidial fovea located anteriorly on main portion of cephalic capsule, may extend to anterior portion of cephalic capsule. Buccal cavity with one large dorsal tooth and two ventrosublateral teeth; denticles usually present. Pharyngeal lumen not strongly cuticularized; posterior pharyngeal bulb present, may be elongated and partitioned by discontinuities in pharyngeal tissue. Precloacal supplements usually present (thorn-like or cuticular swellings).

Remarks

When erecting the genus, Verschelde & Vincx (1995) noted that *Psammonema* differs from the closely-related genus *Pseudochromadora* Daday, 1899 in the following traits: 1) position and shape of the lateral alae (narrower in *Psammonema* and beginning at level of pharynx instead of posterior to it), 2) anterior position of the amphids on the cephalic capsule (compared to central position in *Pseudochromadora*), 3) presence of denticles in the buccal cavity (absent in *Pseudochromadora*), 4) fine cuticular pharyngeal lumen (thick lumen cuticle with conspicuous valves in *Pseudochromadora*), 5) elongated tripartite pharyngeal bulb (bipartite in *Pseudochromadora*) and 6) two or three types of somatic setae in females (no differentiation in *Pseudochromadora*). Another difference between these genera is the absence of copulatory and/or postcloacal thorns in *Psammonema* (present in *Pseudochromadora*). The distinction between the two genera, however, has become less clear with the subsequent description of additional *Psammonema* species (Jacob *et al.* 2016; Muthumbi & Vincx 2016). The difference in lateral alae position no longer applies, as it is located posterior to the pharynx in *Psammonema waweri* Muthumbi & Vincx, 2016. The latter species also lacks denticles like species of *Pseudochromadora*. A prolonged tripartite bulb is only found in *P. ovisetum*, and not in the other *Psammonema* species. This leaves amphid position, pharyngeal lumen cuticularisation, differentiation of somatic setae in females and presence/absence of copulatory and postcloacal thorns as the characters that can be used to differentiate between the two genera. In the new species, the amphidial fovea is positioned anteriorly on the main portion of the cephalic capsule, the pharyngeal lumen is not cuticularised and copulatory and postcloacal thorns are absent, which agrees with the diagnosis of *Psammonema*. On the other hand, females of the new species have only one type of somatic setae, which agrees with the diagnosis of *Pseudochromadora*. On balance, my assessment is that the new species should be classified with *Psammonema*.

List of valid species

P. ovisetum Verschelde & Vincx, 1995
P. kuriani Jacob, Anilkumar, Philip, Rayaroth, 2016
P. waweri Muthumbi & Vincx, 2016

Psammonema buamphida sp. nov.

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Figs 2–4, Tables 2–3

Diagnosis

Psammonema buamphida sp. nov. is characterised by a body length of ca 840–1020 μm , the lateral alae extending from posterior to pharynx to beyond cloaca/anus, eight longitudinal rows of alternating long and short somatic setae, the main portion of cephalic capsule with vacuoles, the lip region set off from main portion of cephalic capsule by sutura, the large cryptospiral amphidial fovea (69–79% cbd wide) and an unispiral amphidial aperture, no sexual dimorphism in the amphidial fovea shape or size, a pharyngeal bulb without conspicuous partitions; by the absence of thorns in females, and the absence of precloacal supplements, copulatory or postcloacal thorns in males.

Differential diagnosis

The new species differs from the other three species of the genus in having large cryptospiral amphidial fovea in both males and females (sexual dimorphism in amphidial fovea shape and size present in other species) and females having only one type of somatic setae (instead of two or three types in the other species).

Etymology

The species epithet is derived from the latin prefix ‘bu-’ (= ‘large’, ‘huge’, ‘great’) and refers to the large size of the amphidial fovea in both sexes of this species.

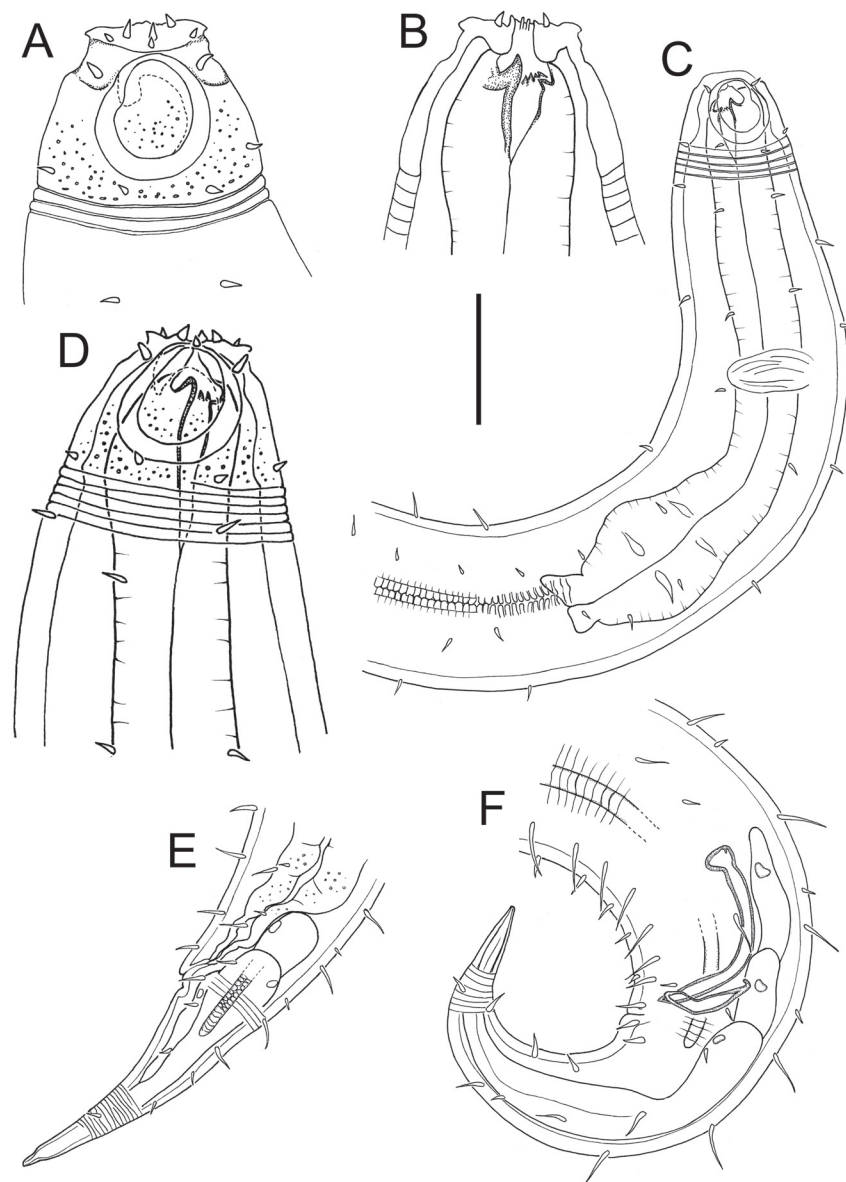


Fig. 2. *Psammonema buamphida* sp. nov. **A–B.** Paratype, ♀ (NIWA 181623), cephalic region. **C.** Holotype, ♂ (NIWA 181622), anterior body region. **D.** Paratype, ♂ (NIWA 181623), cephalic region. **E.** Paratype, ♀ (NIWA 181623), posterior body region. **F.** Holotype, ♂ (NIWA 181622), posterior body region. Scale bar: A–B, D = 20 µm; C = 40 µm; E = 50 µm; F = 35 µm.

Type material**Holotype**

NEW ZEALAND CONTINENTAL SHELF • ♂; North Island, east coast off Poverty Bay; 38.7641° S, 178.1942° E; depth 54 m; 16 Jun. 2023; Alan Orpin leg.; voyage KAH2303, station 66, sandy mud sediments (83% silt/clay); NIWA 181622.

Paratypes

NEW ZEALAND CONTINENTAL SHELF • 2 ♂♂, 2 ♀♀; same data as for holotype; NIWA 181623 • 1 ♂, 2 ♀♀; Tokomaru Bay; 38.1316 ° S, 178.5839° E; depth 42 m; 16 Jun. 2023; Alan Orpin leg.; voyage KAH2303, station 45, sandy mud sediments (77% silt/clay); NIWA 181624.

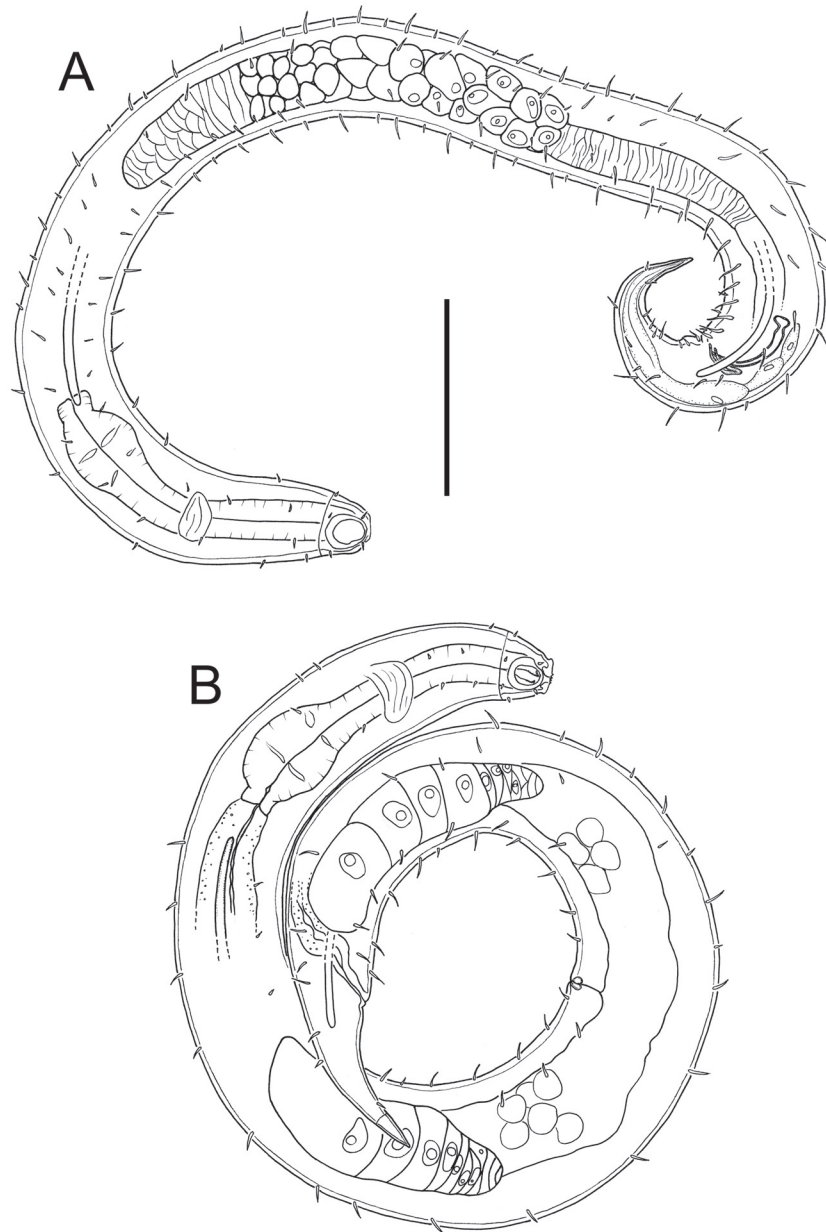


Fig. 3. *Psammonema buamphida* sp. nov. **A.** Entire holotype, ♂ (NIWA 181622). **B.** Entire paratype, ♀ (NIWA 181623). Scale bar = 100 μ m.

Description

Males

Body short, stout, cylindrical, with slight golden-brown colouration, tapering slightly towards anterior and posterior extremities. Cuticle 4–5 μm thick, with ca 2 μm wide annulations; lateral alae extending from level of cardia or slightly further posterior to cardia to slightly posterior to cloaca, cuticle annulations sometimes interdigitate at level of lateral alae depending on angle of specimen. Eight longitudinal rows of somatic setae present, 7–16 μm long setae (longest in posterior half of body) alternating with shorter 2–4 μm long setae. Blunt, truncated cephalic region not offset from rest of body. Non-annulated cephalic capsule 16–29 μm wide, 26–33 μm high, with main portion surrounded by slightly thickened cuticle with numerous small vacuoles; lip region separated from main portion of cephalic capsule by fold in cuticle (sutura), may be extended anteriorly. Circle of six conical inner labial papillae surrounding

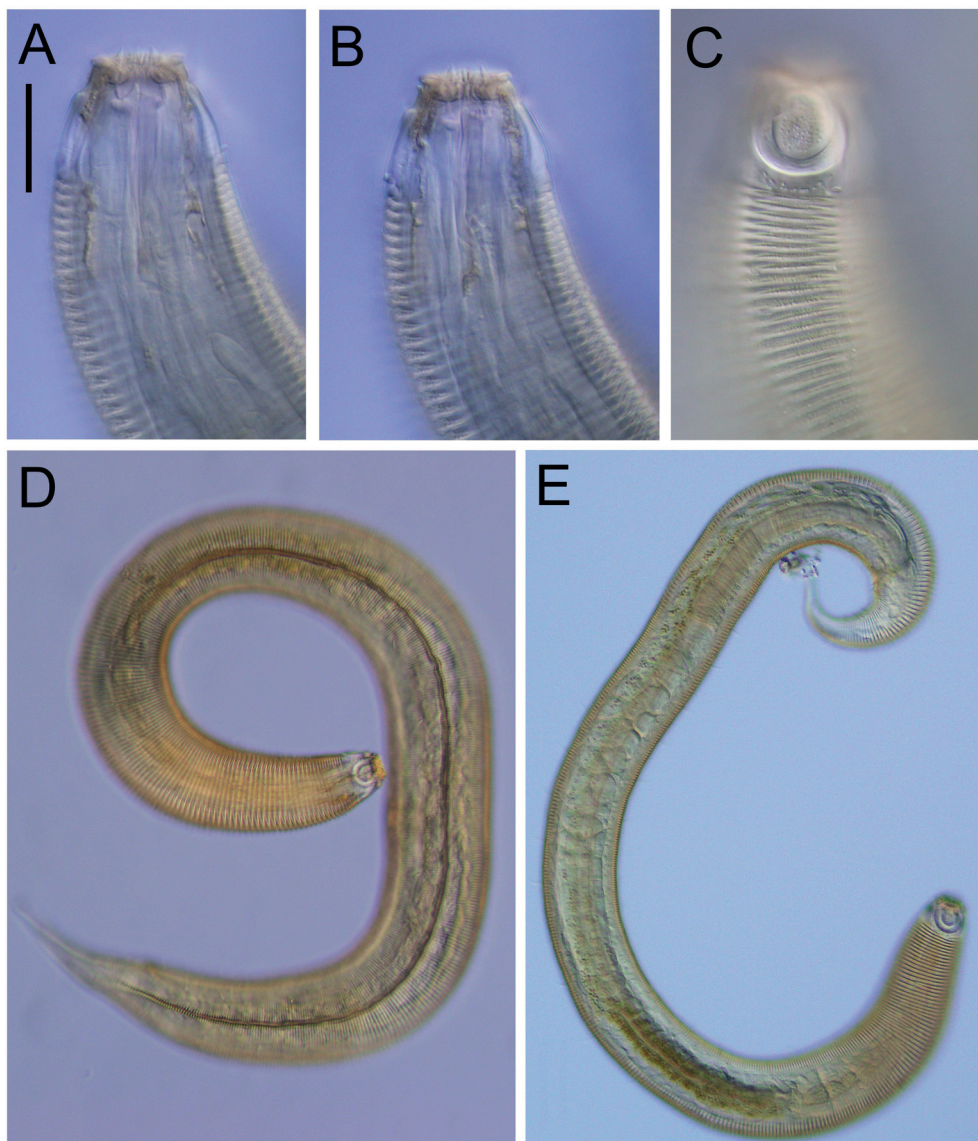


Fig. 4. *Psammonema buamphida* sp. nov., light micrographs. **A–C.** Cephalic region of paratype, ♀ (NIWA 181623). **D.** Entire paratype, ♀ (NIWA 181624). **E.** Entire holotype, ♂ (NIWA 181622). Scale bar: A–C = 20 μm ; D–E = 70 μm .

Table 3. Morphometrics (μm) of *Psammonema buamphida* sp. nov. Abbreviations: a = body length/maximum body diameter; b = body length/pharynx length; c = body length/tail length; c' = tail length/anal or cloacal body diameter; cbd = corresponding body diameter; L = total body length; V = vulva distance from anterior end of body; %V = $V/\text{total body length} \times 100$.

	Holotype	Male paratypes				Female paratypes			
	M1	M2	M3	M4	F1	F2	F3	F4	
L	876	997	1021	842	1021	913	925	915	
a	17	17	18	15	14	14	14	15	
b	5	5	5	5	6	5	5	5	
c	7	9	9	8	11	10	10	10	
c'	2.8	2.5	2.6	2.7	2.5	2.7	2.8	2.6	
body diam. at cephalic setae	22	19	19	17	21	20	20	21	
body diam. at amphids	29	27	28	26	30	26	28	27	
length of sub-cephalic setae	2	2	4	2	2	2	2	2	
length of cephalic setae	2–3	2–3	3	3	3	3–4	3	3	
amphid height	20	19	20	20	19	18	18	17	
amphid width	20	19	22	18	18	16	16	17	
amphid width/cbd (%)	69	70	79	69	60	62	57	63	
amphid from anterior end	2	<1	<1	<1	3	<1	2	1	
nerve ring from anterior end	88	91	99	74	89	95	97	91	
nerve ring cbd	51	51	53	52	54	56	54	55	
pharynx length	168	184	201	165	172	187	203	182	
pharyngeal bulb length	52	52	53	62	53	50	60	55	
pharyngeal bulb diam.	37	37	40	39	42	42	41	42	
pharynx cbd at base	53	54	56	56	59	60	59	60	
max. body diam.	53	57	56	56	75	64	65	63	
spicules length	59	61	60	60	–	–	–	–	
gubernaculum length	24	21	22	27	–	–	–	–	
cloacal/anal body diam.	42	44	44	40	36	33	32	35	
tail length	118	112	115	107	90	89	91	91	
V	–	–	–	–	569	526	544	516	
%V	–	–	–	–	56	58	59	56	
vulval body diam.	–	–	–	–	75	64	65	63	

buccal opening followed by circle of six slightly smaller outer labial papillae located slightly further posteriorly on lip region. Four short cephalic setae, ca 0.1–0.2 cbd long, at level of sutura and anterior edge of amphidial fovea. Amphidial fovea large, cryptospiral, located on main portion of cephalic capsule. Amphidial aperture unispiral; aperture width narrowest anteriorly and widest posteriorly. Mouth opening surrounded by cuticular folds (cheilorhabdia). Buccal cavity medium-sized, with large, conspicuous, cuticularised dorsal tooth and two smaller ventrosublateral teeth; ring of 8–10 denticles spanning both ventrosublateral sectors either side of the ventrosublateral teeth. Ducts of pharyngeal glands not observed. Pharynx muscular, lumen not cuticularised; anterior portion surrounding buccal cavity, slightly swollen. Posterior pharyngeal bulb present, 52–62 μm long, without conspicuous partitions. Nerve ring located near middle of pharynx. Secretory-excretory system not observed. Cardia short, 8–10 μm long, not surrounded by intestinal tissue. Reproductive system with single outstretched testis located to the right of intestine; sperm cells globular or spherical, 9–19 \times 14–26 μm . Spicules short, 1.4–1.5 cloacal body diameters long, arcuate, with swollen proximal portion (capitulum); velum not observed. Bent or curved gubernaculum without apophyses, ca 35–45% of spicule length, flanking spicules distally. Precloacal supplements not observed; copulatory and postcloacal thorns absent. Tail conical, with 4–12 μm long subventral and subdorsal setae. Three caudal glands and spinneret present. Non-annulated tail tip 19–22 μm long.

Females

Similar to males but with slightly lower values of a (14–15 vs 15–18 in males) and slightly higher values of c (10–11 vs 7–9 in males). Reproductive system with two opposed and reflexed ovaries located ventrally relative to intestine. Mature eggs and spermatheca not observed. Vulva located slightly posterior to mid-body. Cuticular pars distalis vaginae.

Order Monhysterida Filipjev, 1929

Family **Xyalidae** Chitwood, 1951

Diagnosis (from Fonseca & Bezerra 2014)

Cuticle striated. Six outer labial setae and four cephalic setae in one circle, with cephalic setae shorter than or at most equal to labial ones. Often additional cephalic setae and occasionally eight groups of sub-cephalic setae are present. Stoma usually funnel-shaped, completely, or only at the base surrounded by pharyngeal tissue. Ventral gland mostly absent (or invisible under light microscopy). Females with one (anterior) ovary to the left side of intestine. Males usually with two testes, the anterior one to the left side of intestine, the posterior one (may be absent) to the right side.

Genus **Paramonohystera** Steiner, 1916

Monhystera (Paramonohystera) megacephala – Steiner 1916: 639–641, fig37

Paramonohystera megacephala – Filipjev 1918: 279

Type species

Paramonohystera megacephala (Steiner, 1916).

Diagnosis (modified from Fonseca & Bezerra 2014 and Yu & Xu 2015)

Conspicuous lip region bearing six inner labial papillae. Six outer labial setae and four cephalic setae situated in single circle at base of lip region; two additional lateral setae sometimes present. Medium to large buccal cavity funnel-shaped. Amphidial fovea circular or elliptical. Spicules elongate (> 2 cloacal body diameter long), gubernaculum usually tubular and without apophyses.

Remarks

Gerlach & Riemann (1973) noted that *Paramonohystera* as used by Filipjev (1918: 279) and several subsequent workers is an invalid emendation. The genus was most recently revised by Yu & Xu (2015) and a list of valid species was most recently provided by Zhai *et al.* (2022). An additional species was subsequently described by Leduc & Zhao (2023).

List of valid species

P. biforma Wieser, 1956

P. brevicaudata Gagarin & Nguyen Thi Thu, 2008

P. buetschlii (Bresslau & Schuurmans Stekhoven in Schuurmans Stekhoven, 1935)

= *Daptonema buetschlii* Schuurmans Stekhoven, 1935

= *Paramonohystera buetschlii* Bresslau & Schuurmans Stekhoven in Schuurmans Stekhoven, 1935

= *Thalassomonohystera buetschlii* Bresslau & Schuurmans Stekhoven, 1940

= *Theristus buetschlii* Bresslau & Schuurmans Stekhoven in Schuurmans Stekhoven, 1935

P. concinna Lorenzen, 1977

P. eurycephalus Huang & Wu, 2011

P. gracilis Zhai, Geng & Sun, 2022

- P. geraerti* Chen & Vincx, 2000
P. halerba Fadeeva & Belogurov, 1987
P. leptamphida Leduc & Zhao, 2023
P. levicula (Lorenzen, 1973) Lorenzen 1977
 = *Theristus (Daptonema) leviculus* Lorenzen in Gerlach & Riemann, 1973
 = *Theristus (Daptonema) levis* Lorenzen, 1972
 = *Daptonema leviculus* Lorenzen, 1972
 = *Paramonhystera levicula* Lorenzen, 1972
 = *Paramonhystera levis* Lorenzen, 1972
P. megacephala Steiner, 1916
P. parabutschlii (Timm, 1961) Lorenzen 1977
 = *Thalassomonhystera parabuetschlii* Timm, 1961
 = *Theristus (Daptonema) parabutschlii* Timm, 1961
 = *Daptonema parabutschlii* Timm, 1961
P. pilosa Boucher, 1971
P. proteus Wieser, 1956
P. riemanni (Platt, 1973) Lorenzen 1977
 = *Paramonhystera riemanni* Platt, 1973
 = *Theristus (Daptonema) riemanni* Platt, 1973
 = *Daptonema riemanni* Platt, 1973
P. sinica Yu & Xu, 2015
P. weihaiensis Huang & Sun, 2019
P. zizichi Pastor de Ward, 1985

***Paramonhystera spinosispicula* sp. nov.**

urn:lsid:zoobank.org:act:960CE6DF-E1BA-412D-97D9-FE0D06A596EB

Figs 5–7, Tables 2, 4

Diagnosis

Paramonhystera spinosispicula sp. nov. is characterised by body length 1393–1716 µm, the outer labial setae at same level as, and similar in size to, the four jointed cephalic setae, the four short subcephalic setae located subdorsally and subventrally at level of amphids, and circular amphidial fovea (57–69% cbd in males, 50–57% cbd in females). Males have spicules 3.9–4.4 cloacal body diameters long with distal fifth to quarter swollen and covered in small spines; by the gubernaculum with pointed proximal projections extending along spicules dorsally, laterally and ventrally, and distal end with several small, pointed protuberances. Female reproductive system with spermatheca and a post-vulval sac.

Differential diagnosis

The new species differs from all other species of the genus in the structure of the spicules, which are swollen distally with numerous small spines (vs smooth and lacking spines in all other species). In terms of spicules length, *P. spinosispicula* sp. nov. is most similar to *P. sinica* (3.9–4.4 vs 4.0–4.4 cloacal body diameters in *P. sinica*), but can be differentiated from the latter by the greater body length (1393–1716 vs 933–1023 µm in *P. sinica*), the number of combined cephalic setae and outer labial setae (10 vs 12 in *P. sinica*), and shorter tail ($c' = 4.2$ – 5.2 vs 5.7 – 6.6 in *P. sinica*).

Etymology

The species epithet is derived from the latin ‘*spinosus*’ (= ‘thorny’) and refers to the numerous small thorns on the distal part of the spicules in this species.

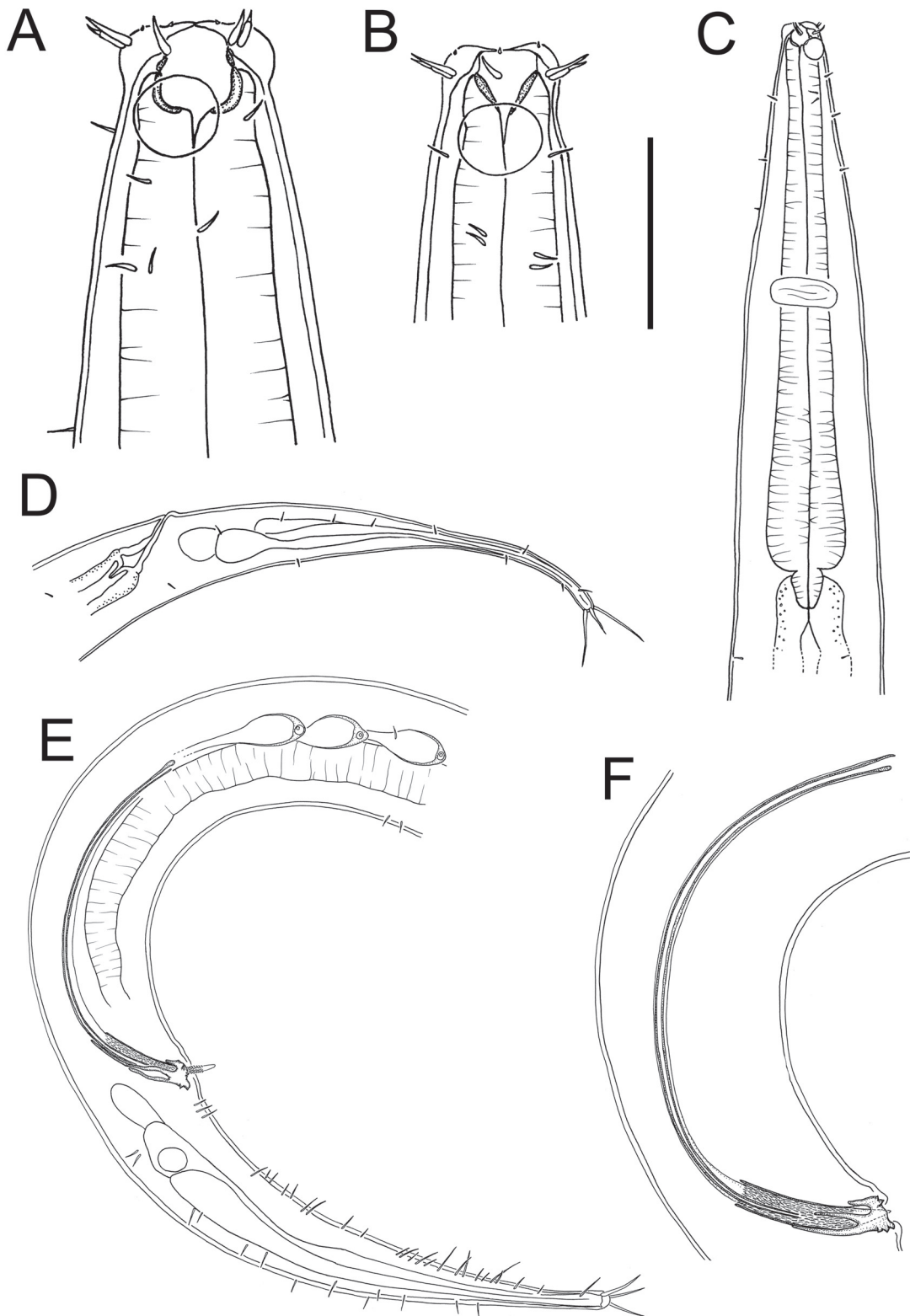


Fig. 5. *Paramonohystera spinosispicula* sp. nov. **A, C–D.** Paratype, ♀ (NIWA 181626). **B, E–F.** Holotype, ♂ (NIWA 181625). **A–B.** Cephalic region. **C.** Anterior body region. **D–E.** Posterior body region. **F.** Specular apparatus. Scale bar: A–B = 20 µm; C = 85 µm; D = 95 µm; E = 65 µm; F = 45 µm.



Fig. 6. *Paramonohystera spinosispicula* sp. nov. A. Entire paratype, ♂ (NIWA 181626). B. Entire paratype, ♀ (NIWA 181626). Scale bar = 200 μ m.

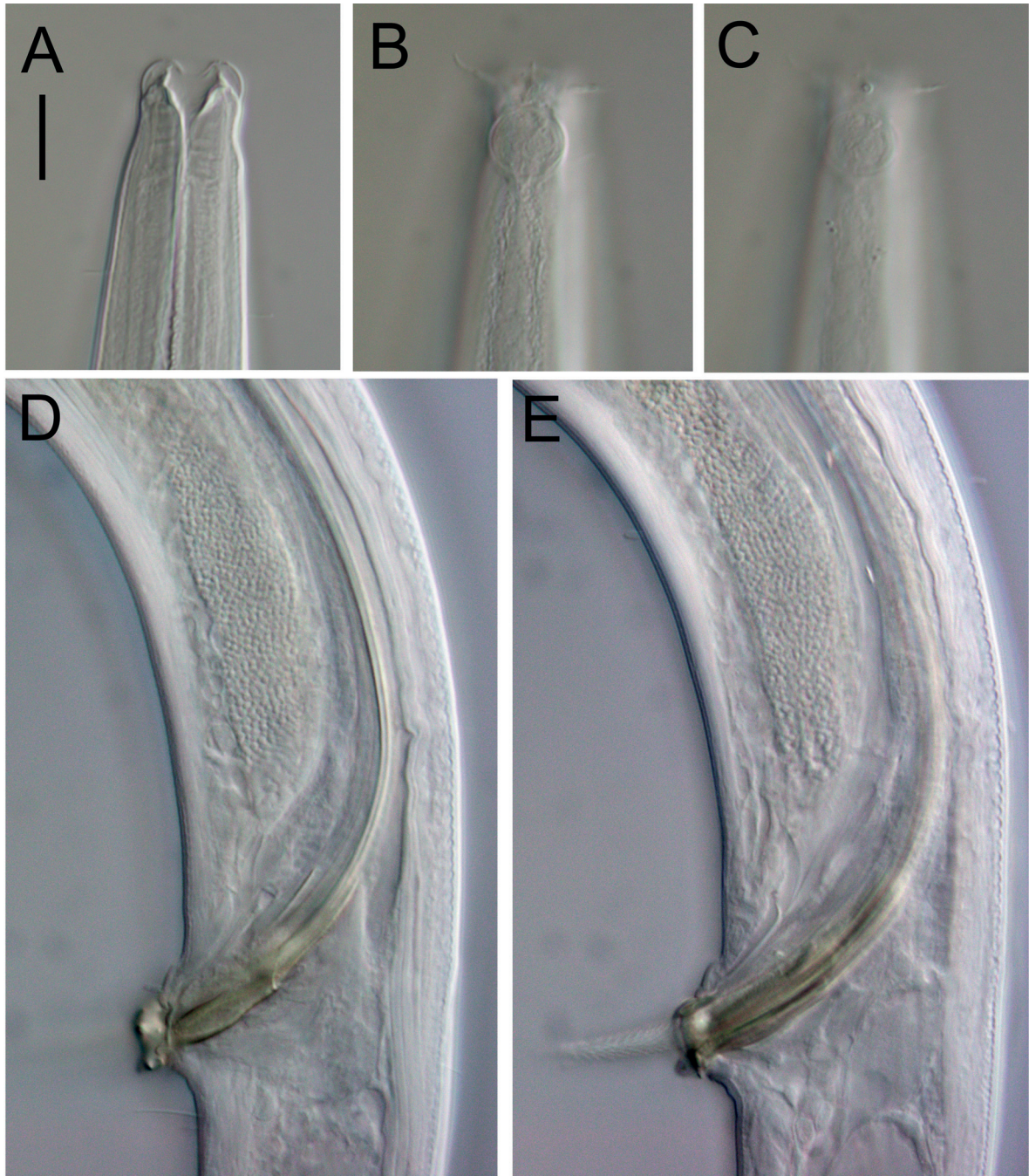


Fig. 7. *Paramonohystera spinosispicula* sp. nov., light micrographs. **A–C.** Cephalic region of paratype, ♂ (NIWA 181626). **D–E.** Spicular apparatus of holotype, ♂ (NIWA 181625). Scale bar: A–C = 10 μm ; D–E = 11 μm .

Table 4. Morphometrics (μm) of *Paramonohystera spinosispicula* sp. nov. Abbreviations: a = body length/maximum body diameter; b = body length/pharynx length; c = body length/tail length; c' = tail length/anal or cloacal body diameter; cbd = corresponding body diameter; L = total body length; V = vulva distance from anterior end of body; %V = V/total body length \times 100.

	Holotype	Male paratypes					Female paratypes			
	M1	M2	M3	M4	M5	F1	F2	F3	F4	
L	1533	1393	1472	1426	1508	1655	1716	1512	1611	
a	28	30	24	26	27	23	23	20	27	
b	7	6	7	7	7	7	7	7	7	
c	8	8	8	8	8	8	8	10	9	
c'	4.7	4.8	4.2	4.4	4.5	5.2	4.9	3.6	4.7	
body diam. at cephalic setae	12	12	12	12	13	17	17	16	13	
body diam. at amphids	14	13	14	13	13	19	20	17	14	
length of sub-cephalic setae	4	3–4	3	3	3	4	3	4	3	
length of cephalic setae	6–7	5–6	5	5–6	6–7	6–7	6	6	6	
amphid height	8	8	8	9	9	10	10	9	8	
amphid width	8	9	8	9	9	10	10	9	8	
amphid width/cbd (%)	57	69	57	69	69	53	50	53	57	
amphid from anterior end	6	5	5	6	6	9	6	6	6	
nerve ring from anterior end	104	111	110	104	108	111	114	104	114	
Nerve ring cbd	39	35	38	38	39	48	51	46	41	
pharynx length	218	233	225	214	222	242	239	225	235	
pharyngeal diam. at base	26	23	27	25	24	35	36	35	30	
pharynx cbd at base	49	42	51	49	50	61	66	63	54	
max. body diam.	55	47	61	54	55	72	74	75	60	
spicules length	157	160	166	152	160	–	–	–	–	
gubernaculum length	39	40	40	42	40	–	–	–	–	
cloacal/anal body diam.	39	36	43	40	41	41	43	42	39	
tail length	183	172	179	174	183	212	211	150	185	
V	–	–	–	–	–	839	869	781	876	
%V	–	–	–	–	–	51	51	52	54	
vulval body diam.	–	–	–	–	–	69	72	69	57	

Type material

Holotype

NEW ZEALAND CONTINENTAL SHELF • ♂; North Island, east coast off Hawke Bay; 39.2186° S, 177.4321° E; depth 47 m; 5 Jun. 2023; Alan Orpin leg.; voyage KAH2303, station 16, sandy mud sediments (92% silt/clay); NIWA 181625.

Paratypes

NEW ZEALAND CONTINENTAL SHELF • 3 ♂♂, 4 ♀♀; same data as for holotype; NIWA 181626.

Description

Males

Body colourless, cylindrical, tapering slightly towards both extremities. Cuticle slightly striated, no lateral differentiation. Eight rows of sparsely distributed somatic setae, 2–4 μm long. Cephalic region set-off by slight constriction at level of amphids; well-developed lip region bearing six small labial papillae. Six outer labial setae, 0.4–0.6 cbd long, in same circle as four jointed cephalic setae of similar length. Four short, 3–4 μm long subcephalic setae present subdorsally and subventrally at level of amphids. Amphidial fovea large, circular, with slightly cuticularised outline and almost entirely surrounded by cuticle striations, ca 0.4–0.5 cbd from anterior extremity. Buccal cavity large, funnel- to barrel-shaped, with cuticularised walls, 7–11 μm deep, 5–6 μm wide, without teeth. Pharynx muscular,

anterior portion surrounding buccal cavity, widening gradually posteriorly. Nerve ring located near middle of pharynx. Secretory-excretory system not observed. Cardia ca 12–14 μm long, surrounded by intestinal tissue. Reproductive system with two outstretched testes; anterior testis to the left of intestine, posterior testis to the right of intestine. Sperm cells small, globular to spherical, 3–5 \times 4–5 μm . Spicules thin, elongated, 3.9–4.4 cloacal body diameters long, cuticularised along almost entire length; distal fifth to quarter of spicules swollen, less strongly cuticularized, covered in small, dense spines pointing towards spicule's proximal extremity. Gubernaculum ca 40 μm long, forming sheath surrounding distal quarter of spicules, with pointed proximal projections extending along spicules dorsally, laterally and ventrally; distal end of gubernaculum with several small, pointed protuberances, each with internal duct. Precloacal supplements and seta not observed. Three pairs of ejaculatory glands present slightly anterior to spicules. Tail conicocylindrical with rows of subventral and subdorsal setae, 2–10 μm long; three terminal setae 20–29 μm long. Three caudal glands and spinneret present.

Females

Similar to males but with generally wider cephalic and maximum body diameter, amphidial fovea slightly smaller (as % cbd) and tail with sparse setae. Reproductive system with single outstretched ovary to the left of intestine. Spermatheca present; post-vulval sac 65–87 μm long, 13–20 μm wide. Vaginal glands present. Vulva located near mid-body body or slightly posterior. Pars proximalis vaginae surrounded by constrictor muscle.

Order Araeolaimida De Coninck & Scurmans Stekhoven, 1933

Family Comesomatidae Filipjev, 1918

Diagnosis (from Fonseca & Bezerra 2014)

Cuticle striated and/or ornamented with dots in transverse rows, usually differentiated laterally, sometimes with weakly cuticularized body pores. Anterior sensilla usually in three crowns, two crowns may also occur. Amphidial fovea multispiral. Buccal cavity in two compartments with globular, cup-shaped or shallow anterior portion. Posterior portion of the buccal cavity either narrow, weakly cuticularized, collapsed tube or a dilated, cylindrical to conical portion with cuticularized walls and projections at the border between the two portions. Pharynx with three marginal tubes. Pharyngeal gland opening at the bottom of the buccal cavity. Excretory pore behind the nerve ring. Female reproductive system didelphic-amphidelphic with outstretched ovaries, spermatheca present. Male gonads diorchic with opposite and outstretched testes. Copulatory apparatus with weakly to strongly cuticularized spicules and gubernaculum; paired apophyses of variable position. Precloacal supplements usually tubular. Tail conico-cylindrical with tip slightly dilated, non-cuticularized, symmetrical and with three terminal setae.

Genus *Sabatieria* Rouville, 1903

Sabatieria Rouville, 1903: 137

Parasabatieria de Man, 1907: 237

Actarjania Hopper, 1967: 142, figs 8–9

Type species

Sabatieria cettensis Rouville, 1903.

Diagnosis (modified from Jensen 1979 and Rosli *et al.* 2014)

Cuticle usually punctated, sometimes with lateral differentiation of larger or irregular punctations; in rare cases cuticle may appear striated or smooth. Four cephalic setae longer than the six outer labial setae. Anterior buccal cavity globular to cup-shaped, posterior buccal cavity narrow; small teeth-like

structure sometimes present at the base of the anterior buccal cavity. Spicules usually short and arcuate; gubernaculum with dorsocaudal or caudal apophyses.

Remarks

Sabatieria is a species-rich genus, with a total of 82 valid species described prior to this study. The type species *S. cettensis* was considered species dubia by Filipjev (1922) and Wieser (1954).

List of valid species

Praedatrix group

- S. alata* Warwick, 1973
- S. ancudiana* Wieser, 1954
- S. articulata* Fu, Leduc & Zhao, 2019
- S. balbutiens* Leduc, 2013
- S. bitumen* Botelho, Da Silva, Esteves & Fonseca-Genevois, 2007
- S. bubulba* Leduc, 2013
- S. challengerensis* Leduc, 2013
- S. conicauda* Vitiello, 1970
- S. conicoseta* Guo, Chang & Yang, 2018
- S. coomansi* Chen & Vincx 1999
- S. curvispiculata* Gagarin, 2013
- S. demani* Bresslau & Stekhoven, 1940
- S. doancanhi* Tu, Thanh, Smol & Vanreusel, 2008
- S. dodecaspapillata* (Kreis, 1929) Filipjev 1922
= *Parasabatieria dodecaspapillata* Kreis, 1929
- S. exculta* Leduc, 2013
- S. exilis* Botelho, Da Silva, Sobral & Fonseca Genevois, 2009
- S. falcifera* Wieser, 1954
- S. fidelis* Botelho, Da Silva, Sobral & Fonseca-Genevois, 2009
- S. finitima* Fadeeva & Belogurov, 1984
- S. flecha* Pastor de Ward, 2003
- S. foetida* Gagarin & Thanh, 2008
- S. granifer* Wieser, 1954
- S. granulosa* Vitiello & Boucher, 1971
- S. heipi* Chen & Vincx, 2000
- S. intacta* Fadeeva & Belogurov, 1984
- S. intermissa* Wieser, 1954
- S. kolaensis* (Ssaweljev, 1912) Filipjev 1922
= *Parasabatieria kolaensis* Ssaweljev, 1912
- S. labium* Botelho, Esteves & Fonseca-Genevois, 2014
- S. lawsi* Platt, 1983
- S. lepida* (Vitiello, 1976) Jensen, 1979
= *Actarjania lepida* Vitiello, 1976
- S. lucia* Muthumbi, Soetaert & Vincx, 1997
- S. lyonessa* Warwick, 1977
- S. major* Yang, Guo, Chen & Lin, 2019
- S. microsetosa* Timm, 1967
- S. multisupplementia* Yang, Guo, Chen & Lin, 2019
- S. palmaris* Fadeeva & Belogurov, 1984
- S. parabyssalis* Wieser, 1954

- S. paracupida* Wieser & Hopper, 1967
S. paradoxa Wieser & Hopper, 1967
S. parapraedatrix Leduc, 2013
S. parvula Gagarin & Thanh, 2006
S. praedatrix de Man, 1907
= *S. dubia* Ditlevsen, 1918
= *S. cobbi* Kreis, 1929
= *S. rugosa* Schuurmans Stekhoven, 1950
S. paraspiculata Botelho, Da Silva, Esteves & Fonseca-Genevois, 2007
S. sanjosensis Pastor de Ward, 2003
S. spiculata Botelho, Da Silva, Esteves & Fonseca-Genevois, 2007
S. stekhoveni Vitiello, 1970
S. subrotundicauda Da Silva, Esteves & Fonseca-Genevois, 2007
S. triplex Wieser, 1954
S. vasicola Vitiello, 1970
S. verteris Botelho, Esteves & Fonseca-Genevois, 2014

Pulchra group

- S. chukchensis* Yang, Guo, Chen & Lin, 2019
S. maboyae Gourbault & Vincx, 1990
S. mortenseni (Ditlevsen, 1921) Filipjev 1922
= *Parasabatieria mortenseni* Ditlevsen, 1921
= *Sabatieria annulata* Leduc & Wharton, 2008
S. pisinna Vitiello, 1970
S. propisinna Vitiello, 1976
S. pulchra (Schneider, 1906) Riemann 1970
= *Aphanolaimus pulcher* Schneider, 1906
= *Sabatieria vulgaris* de Man, 1907
= *Parasabatieria clavicauda* Filipjev, 1918
= *Sabatieria clavicauda* Filipjev, 1918
= *Sabatieria quadripapillata* Filipjev, 1922
= *Sabatieria breviseta* Schuurmans Stekhoven, 1935
= *Sabatieria trivialis* Tchesunov, 1978
S. pumila Leduc, 2013
S. punctata (Kreis, 1924) Filipjev 1922
= *Parasabatieria punctata* Kreis, 1924
= *Sabatieria americana* Timm, 1952
S. sinica Zhai, Wang & Huang, 2020

Celtica group

- S. bathycopia* Leduc, 2013
S. brevicaudata Fu, Zhang, Leduc, Mou & Lin, 2023
S. celtica Southern 1914
= *Sabatieria cupida* Breslau & Schuurmans Stekhoven in Schuurmans Stekhoven, 1935
= *Sabatieria longiseta* Steiner, 1916
= *Parasabatieria longiseta* Allgén, 1934
S. furcillata Wieser, 1954
S. kelleti Platt, 1983
S. multipora Fu, Zhang, Leduc, Mou & Lin, 2023
S. strigosa Lorenzen, 1971

Armata group

- S. armata* Gerlach, 1952
S. elongata Jayasree & Warwick, 1977
S. longispinosa Lorenzen, 1972
S. migrans Jensen & Gerlach, 1977
S. pomarei (Boucher, 1973) Jensen 1979
 = *Actarjania pomarei* Boucher, 1973
S. splendens (Hopper, 1967) Jensen 1979
 = *Actarjania splendens* Hopper, 1967
S. supplicans Gerlach, 1956

Ornata group

- S. abyssalis* (Filipjev, 1918) Filipjev 1922
 = *Parasabatieria abyssalis* Filipjev, 1922
S. longisetosa (Kreis, 1929) Filipjev 1922
 = *Parasabatieria longisetosa* Kreis, 1929
S. macramphis Lorenzen, 1972
S. ornata (Ditlevsen, 1918) Filipjev 1922
 = *Parasabatieria ornata* Ditlevsen, 1918
S. paramacramphis Leduc & Zhao, 2023
S. parvamphis Yang, Guo, Chen & Lin, 2019
S. stenocephalus Huang & Zhang, 2006

Ungrouped

- S. dispunctata* Rosli, Leduc & Probert, 2014
S. megadena Leduc, 2017

***Sabatieria pararticulata* sp. nov.**

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Figs 8–10, Tables 2, 5

Diagnosis

Sabatieria pararticulata sp. nov. is characterized by body length of 1245–1490 µm, a cuticle without lateral differentiation, spiral amphidial fovea with 2 ½–2 ¾ turns, and a tail 3.3–4.0 cloacal/anal body diameters long. Males have slightly bent, jointed, 2.6–3.0 cloacal body diameters long spicules, gubernaculum with straight dorso-caudal apophyses, and 7–9 minute, pore-like precloacal supplements. The vulva is located slightly anterior to the mid-body.

Differential diagnosis

Sabatieria pararticulata sp. nov. belongs to the *praedatrix* group, which is characterized by simple tubular or pore-like precloacal supplements, straight gubernacular apophyses, cuticle usually with lateral differentiation of larger, more widely-spaced dots, and amphidial fovea usually with three turns (Platt 1985). The new species differs from all other species in this group, as well as all other species from the genus, except *S. articulata* Fu, Leduc & Zhao, 2019, in having jointed spicules. The new species can be distinguished from the latter by the shorter body length (1245–1490 vs 1758–2177 µm in *S. articulata*), cuticle without lateral differentiation (vs lateral differentiation present in *S. articulata*), amphidial fovea with slightly fewer turns (2 ½–2 ¾ vs 3 turns in *S. articulata*), fewer precloacal supplements (7–9 vs 10–14 precloacal supplements in *S. articulata*), and sperm dimorphism between the anterior and posterior testes (vs no sperm dimorphism in *S. articulata*).

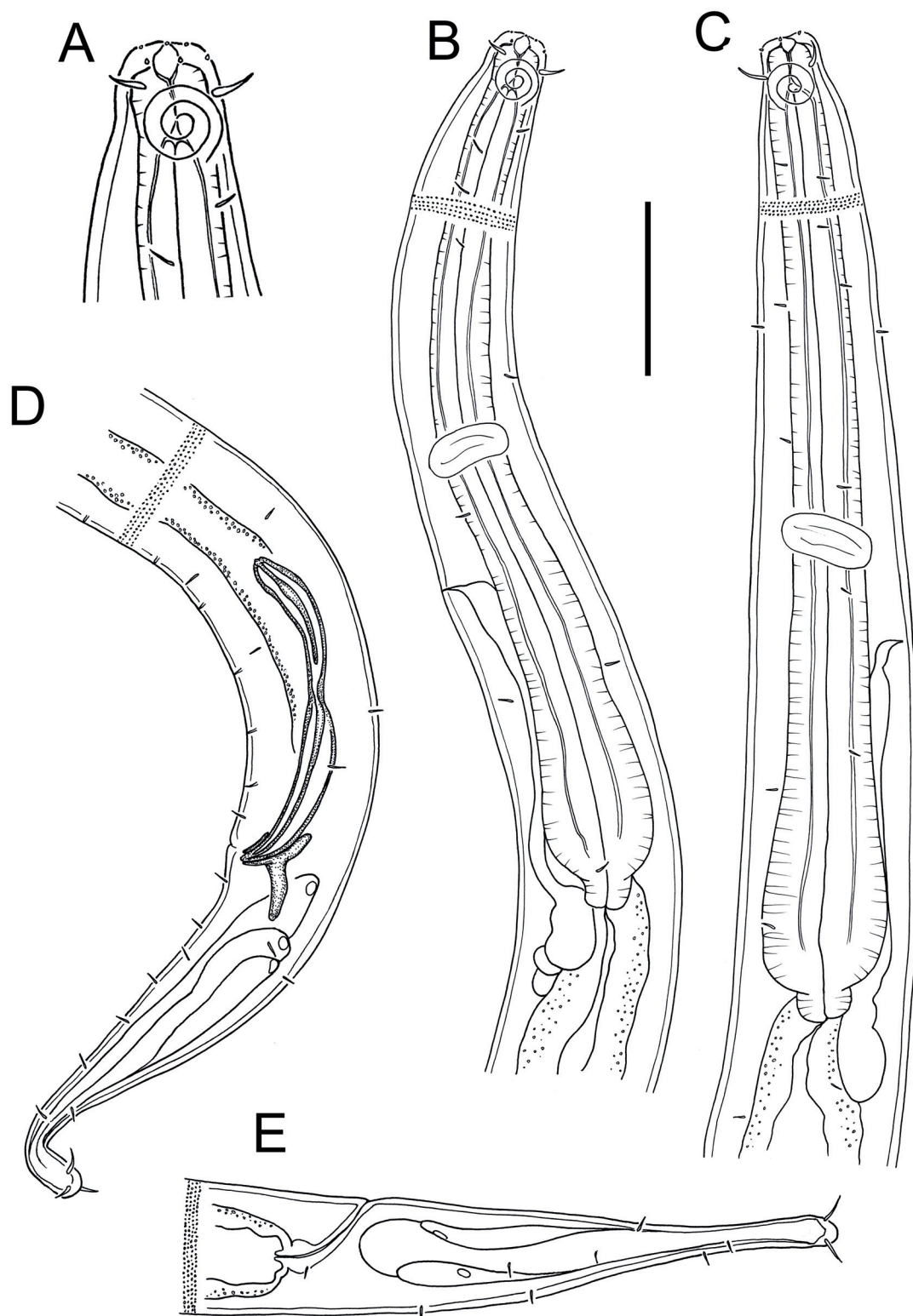


Fig. 8. *Sabatieria pararticulata* sp. nov. **A–B, D.** Holotype, ♂ (NIWA 181627). **C, E.** Paratype, ♀ (NIWA 181628). **A.** Cephalic region. **B–C.** Anterior body. **D–E.** Posterior body region. Scale bar: A = 20 µm; B–E = 35 µm.

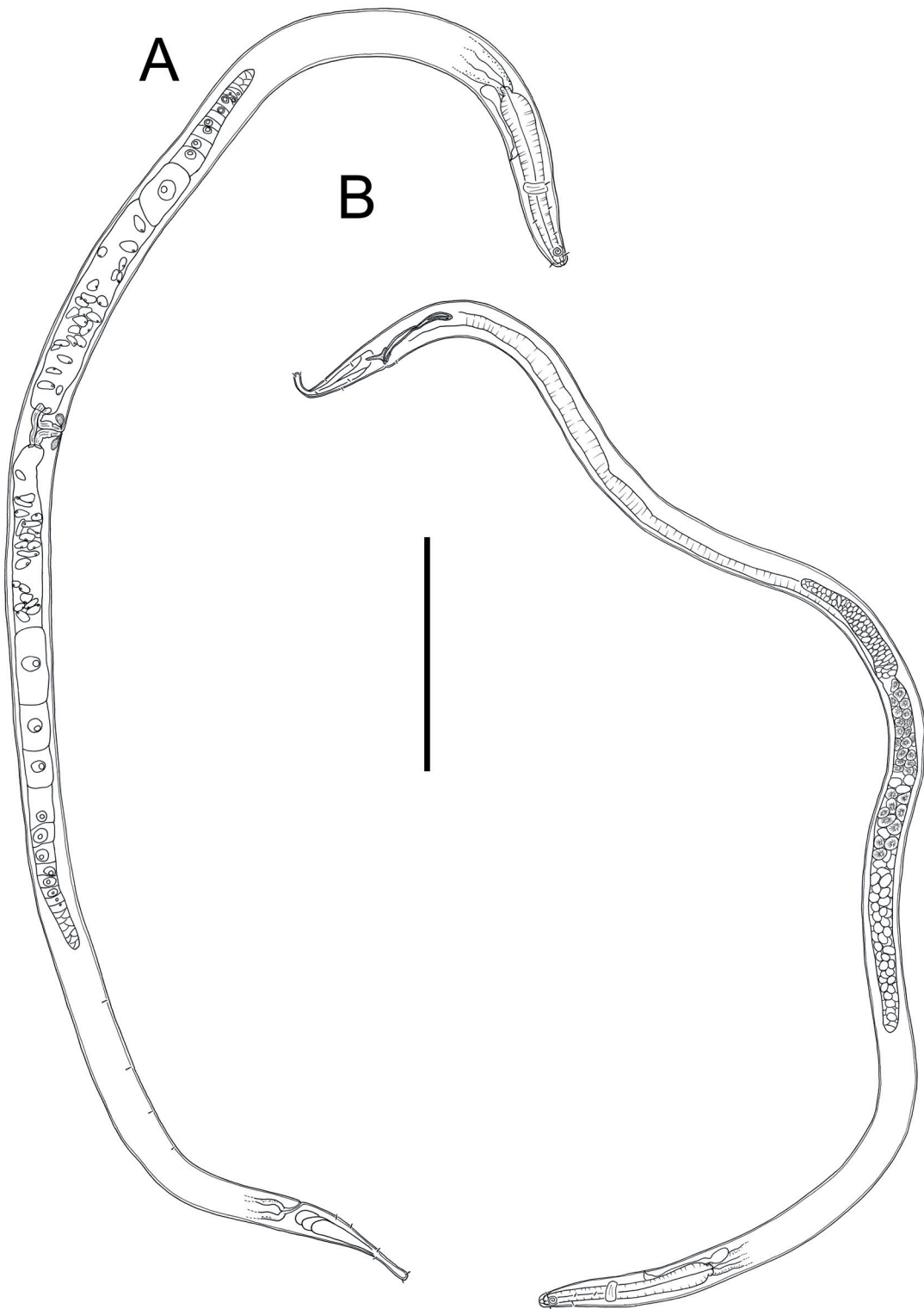


Fig. 9. *Sabatieria pararticulata* sp. nov. **A.** Entire paratype, female (NIWA 181628). **B.** Entire paratype, ♂ (NIWA 181628). Scale bar = 250 μ m.

Etymology

The species epithet refers to the close similarity between the new species and *Sabatieria articulata* Fu, Leduc & Zhao, 2019, which like the new species possesses long, jointed spicules.

Type material

Holotype

NEW ZEALAND CONTINENTAL SHELF • ♂; North Island, east coast off Hawke Bay; 39.2186° S, 177.4321° E; depth 47 m; 5 Jun. 2023; Alan Orpin leg.; voyage KAH2303, station 16, sandy mud sediments (92% silt/clay); NIWA 181627.

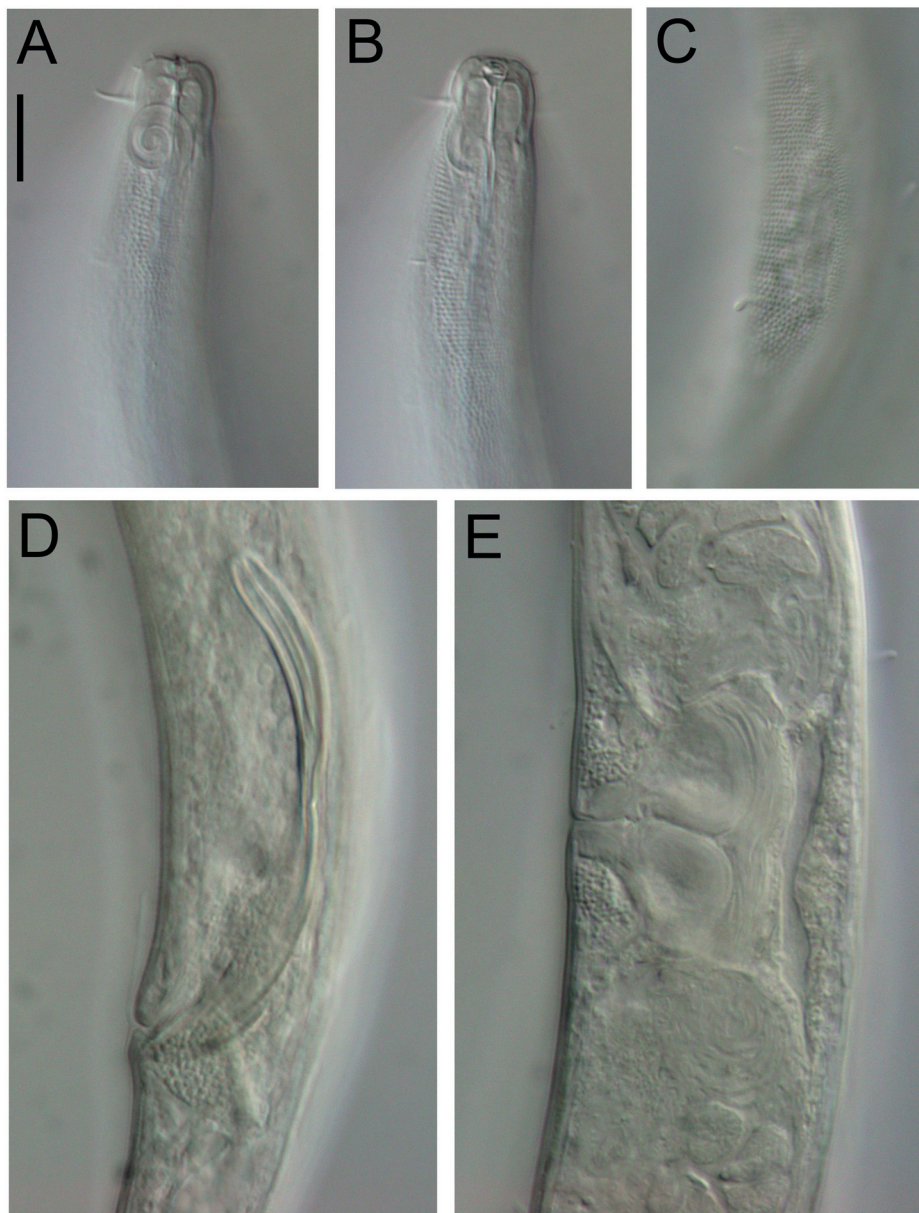


Fig. 10. *Sabatieria pararticulata* sp. nov., light micrographs. **A–C.** Holotype, ♂ (NIWA 181627). **D–E.** Paratype, ♀ (NIWA 181628). **A–B.** Cephalic region. **C.** Cuticle in cloacal. **D.** Spicular apparatus. **E.** Vulva. Scale bar = 10 µm.

Table 5. Morphometrics (μm) of *Sabatieria pararticulata* sp. nov. Abbreviations: a = body length/maximum body diameter; b = body length/pharynx length; c = body length/tail length; c' = tail length/anal or cloacal body diameter; cbd = corresponding body diameter; L = total body length; V = vulva distance from anterior end of body; %V = V/total body length \times 100.

	Holotype	Male paratypes				Female paratypes	
	M1	M2	M3	M4	F1	F2	
L	1281	1277	1245	1339	1422	1490	
a	43	41	43	43	41	43	
b	9	9	9	10	11	9	
c	14	15	15	15	15	16	
c'	3.6	3.3	3.4	3.6	3.6	4.0	
body diam. at cephalic setae	11	5	4	5	4	5	
body diam. at amphids	13	11	11	12	13	12	
length of sub-cephalic setae	2	2	2	2	2	2	
length of cephalic setae	5	5	4	5	4	5	
amphid height	8	8	8	8	8	8	
amphid width	8	8	8	8	7	8	
amphid width/cbd (%)	62	73	73	67	54	67	
amphid from anterior end	4	4	5	5	5	5	
nerve ring from anterior end	75	72	75	70	67	83	
nerve ring cbd	25	24	25	25	27	26	
excretory pore from anterior	95	98	99	85	85	108	
pharynx length	149	145	142	136	134	164	
pharyngeal diam. at base	17	19	18	20	23	22	
pharynx cbd at base	29	28	28	29	31	31	
max. body diam.	30	31	29	31	35	35	
spicules length	72	66	67	76	–	–	
cubernaculum length	12	11	11	12	–	–	
cloacal/anal body diam.	25	25	24	25	26	24	
tail length	89	83	81	89	94	95	
V	–	–	–	–	653	718	
%V	–	–	–	–	46	48	
vulval body diam.	–	–	–	–	35	35	

Paratypes

NEW ZEALAND CONTINENTAL SHELF • 3 ♂♂, 2 ♀♀; same data as for holotype; NIWA 181628.

Description

Males

Body colourless, cylindrical, tapering slightly towards both extremities. Cuticle punctated, without lateral differentiation. Sparsely distributed somatic setae present along entire body length, 2–3 μm long. Slightly rounded cephalic region, set off from rest of body by slight constriction at level of amphids. Six small inner labial papillae present on lip region; six outer labial papillae in a separate circle and four cephalic setae situated further posteriorly, 0.4–0.5 cbd long. Amphidial fovea large, spiral, situated immediately posterior to cephalic setae, with 2 $\frac{1}{2}$ –2 $\frac{3}{4}$ turns. Buccal cavity medium-sized, cup-shaped, with slightly cuticularised walls. Pharynx muscular, partially surrounding buccal cavity, widening posteriorly but not forming true bulb. Pharyngeal gland ducts visible, connecting with pharyngeal lumen at level of amphids. Nerve ring located near half of pharynx length. Secretory-excretory gland located immediately posterior to pharynx; secretory-excretory pore situated ca 1.0 cbd posterior to nerve

ring, with two small, nucleated accessory glands. Cardia short, 6–9 μm long, surrounded by intestinal tissue. Reproductive system with two opposed outstretched testes; anterior testis to the left of intestine, posterior testis to the right of intestine. Sperm cells globular to ovoid, dimorphic, slightly larger in anterior testis (5–9 \times 14–20 μm) than posterior testis (4–5 \times 9–12 μm). Spicules slightly bent, 2.6–3.0 cloacal body diameters long, with joint present at 40–45% of spicules length from the proximal end; central lamella present in proximal third to half of spicule. Gubernaculum with straight dorso-caudal apophyses. Seven to nine minute, pore-shaped precloacal supplements; posteriormost supplement 12–33 μm from cloaca. Distance between supplements 11–27 μm , may decrease slightly anteriorly, increase slightly anteriorly, or show no obvious pattern. Precloacal seta present. Ejaculatory glands not observed. Tail conicocylindrical, with sparse subventral setae and sparse subdorsal setae, 2–3 μm long; three terminal setae, 4–6 μm long. Three caudal glands present.

Females

Similar to males but with slightly longer tail. Reproductive system with two opposed, outstretched ovaries; anterior ovary to the left of intestine, posterior ovary to the right of intestine. Spermatheca not clearly defined. Vulva located near mid-body; vaginal glands present.

Discussion

The present study is the first to investigate the nematode fauna on the continental shelf along the east coast of New Zealand's North Island. Fourteen nematode species are recorded from the region for the first time, including three species new to science. Of the 11 previously known species, all were first described from elsewhere within the wider New Zealand Exclusive Economic Zone. Two of these species were originally described from intertidal sediments, two were described from subtidal or continental shelf environments (5–40 m depth), and seven were originally described from the continental slope (ca 400–1250 m depth) (see Table 2). One of these species, *Desmodorella tenuispiculum* (Allgén, 1928) Gerlach, 1963 is considered to be a cosmopolitan species (Nemys 2024), while the rest have so far only been recorded in New Zealand.

Psammonema buamphida sp. nov. is the first species of the genus to be described or recorded from New Zealand waters. *Paramonohystera spinosipsicula* sp. nov. is the second *Paramonohystera* species to be described from the New Zealand region. The new species can be differentiated from *Paramonohystera leptamphida* Leduc & Zhao, 2023 (originally described from intertidal sediments) by the shape of the amphids (circular instead of elliptical in *P. leptamphida*) and the presence of spines on the spicules (the spicules of *P. leptamphida* lack any spines). Fourteen species of *Sabatieria* were known from New Zealand waters prior to this study. The new species, *S. pararticulata* sp. nov., shares the unusual feature for the genus of having long, jointed spicules with *S. articulata* Fu, Leduc & Zhao, 2019, which was described from the Conway Trough, located some 495 km to the southwest of Hawke Bay on the North Island's east coast, at depths of 491–586 m. The presence of this feature, which is otherwise absent in all other species of the genus, in two New Zealand species suggests that *S. articulata* and *S. pararticulata* sp. nov. likely evolved from a common ancestor.

Acknowledgments

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