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Research article

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Three new and five known species of *Diplopetooides* Gerlach, 1962 (Nematoda, Diplopetooididae) from Sweden, and a revision of the genus

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Abstract. Eight species of *Diplopetooides* are described from the Swedish west coast. *Diplopetooides suecicus* sp. nov. has the cuticle with longitudinal striation visible only under SEM; cuticular plate underlying the cephalic cuticle around the amphid present; cephalic sensilla 4–6 µm long; amphid an inverted U-shape; wide space between amphidial branches areolated; spicules 27–31 µm long; gubernaculum with caudal apophysis. *Diplopetooides longicaudatus* sp. nov. is characterized by a cuticle without longitudinal striation; cuticular plate underlying cephalic cuticle around amphid present; cephalic sensilla 13 µm long; amphid an inverted U-shape; narrow space between amphidial branches not ornamented; spicules unequal in size, 27–31 µm long; gubernaculum absent; midventral precloacal cuticular ridge present. *D. grandis* sp. nov. is characterized by a cuticle with longitudinal striation; cuticular plate underlying cephalic cuticle around amphid present; cephalic sensilla 18.5 µm long; amphid an inverted U-shape; wide space between amphidial branches punctate. The following taxonomic changes are proposed: *Diplopetooides aetosus* (Juario, 1974) comb. nov., *Diplopetooides botulus* (Wieser, 1959) comb. nov., *Diplopetooides bulbosus* (Vitiello, 1972) comb. nov., *Diplopetooides lucanicus* (Boucher & Helléouët, 1977) comb. nov., *Diplopetooides pumilus* (Vincx & Gourbault, 1992) comb. nov. and *Diplopetooides striatus* (Gerlach, 1956) comb. nov. *Diplopetooides holovachovi* Fadeeva & Mordukhovich, 2013 is synonymised with *Diplopetooides pumilus* comb. nov. An updated key to the species of *Diplopetooides* is provided.

Keywords. Identification key, morphology, SEM, taxonomy.

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Introduction

The genus *Diplopetooides* was proposed by Gerlach (1962) for the species *Diplopetooides ornatus* Gerlach, 1950 with the main diagnostic characters: “complicated cuticular structure and a ring-shaped cephalic capsule”. The original description was subsequently supplemented by Timm (1961) and Lorenzen (1981), who expanded the description with diagnostic characters of the digestive and the female reproductive systems. Tchesunov (1990, 2006) added three species to this genus: he described *Diplopetooides mastigia* Tchesunov, 1990 as new to science and transferred *Diplopetooides anatolii* Voronov, 1982 and *Diplopetooides nuda* Gerlach, 1956 to *Diplopetooides*. Another new species was added by Jensen (1991), who described *Diplopetooides linkei* Jensen, 1991. One year later, yet another species, *Diplopetooides onustus* Wieser, 1956, was transferred to the genus *Diplopetooides* by Vincx & Gourbault (1992). However, this action was contested in a subsequent publication in which the taxonomy of the genus was completely revised (Holovachov *et al.* 2009). The authors also described three new species (*Diplopetooides axayacatli* Holovachov, Tandingan De Ley, Mundo-Ocampo, Gingold & De Ley, 2009, *D. santaclarae* Holovachov, Tandingan De Ley, Mundo-Ocampo, Gingold & De Ley, 2009 and *D. paramastigia* Holovachov, Tandingan De Ley, Mundo-Ocampo, Gingold & De Ley, 2009) and transferred *Diplopetooides pulchra* Vincx & Gourbault, 1992 and *Diplopetooides sundensis* Jensen, 1978 to *Diplopetooides*. Since then, one new species, *Diplopetooides holovachovi* Fadeeva & Mordukhovich, 2013 was proposed by Fadeeva & Mordukhovich (2013), making a total of 11 species.

Eight species of the genus *Diplopetooides* Gerlach, 1962 were found during ongoing studies of marine nematodes along the west coast of Sweden. Three species, *D. suecicus* sp. nov., *D. longicaudatus* sp. nov. and *D. grandis* sp. nov., are described as new to science. The remaining five species, namely *D. aetosus* (Juario, 1974) comb. nov., *D. bulbosus* (Vitiello, 1972) comb. nov., *D. nudus* (Gerlach, 1956) Tchesunov, 2006, *D. pumilus* (Vincx & Gourbault, 1992) comb. nov. and *D. linkei* Jensen, 1991 are new to the fauna of Sweden.

Morphological data obtained from observations of these eight species provides grounds for the ongoing update of the taxonomy of the genus *Diplopetooides* and a revision of the poorly defined genus *Diplopetooides* Gerlach, 1950, which implies the transfer of six known species from the genus *Diplopetooides* to the genus *Diplopetooides*: *D. botulus* (Wieser, 1959) comb. nov., *D. lucanicus* (Boucher & Helléouët, 1977) comb. nov., *D. striatus* (Gerlach, 1956) comb. nov. and three species mentioned above (*D. aetosus*, *D. bulbosus* and *D. pumilus*). Exclusion of these six species from *Diplopetooides* does not require any modifications to the diagnosis of this genus, recently published by Leduc (2017).

Material and methods

Bottom sediment samples were collected at several locations in the southern part of the Skagerrak and in the Gullmarn Fjord off the west coast of Sweden. All samples were collected with a bottom dredge or box corer and further sieved in the laboratory before fixation. Nematodes were extracted from samples using a decanting and sieving method (smallest mesh sizes: 45 µm or 70 µm). Fresh water was used during sieving to induce an osmotic shock in nematodes inducing their detachment from the substrate. Samples were immediately fixed in a 4% formaldehyde solution in fresh water.

For light microscopy, formaldehyde-preserved specimens were transferred to pure glycerine using the rapid method of Seinhorst (1959) as modified by De Grisse (1969). Permanent nematode mounts on glass slides were prepared using the paraffin wax ring method. After measuring and observations, some specimens were removed from their slides and rehydrated by first gradually adding drops of S2 (5% glycerine, 95% ethanol) to glycerine in an embryo-dish, starting with a 1:4 ratio of S2 to glycerine, until the volume tripled, then gradually adding distilled water until the volume tripled again. The specimens were then washed in distilled water before resuspension in formaldehyde. For SEM, specimens were

post-fixed in 1% osmium tetroxide (OsO₄) and transferred to pure acetone through an acetone/distilled water series. Specimens were critical point dried in liquid CO₂, mounted on stubs, gold-plated under vacuum to a thickness of 200 Å in an Agar High Resolution Sputter Coater Model 20, and examined in a Hitachi S-4300 SEM at an accelerating voltage of 10 kV.

All curved structures were measured along the curved median line. Type and other specimens are deposited in the invertebrate collections of the Department of Zoology, Swedish Museum of Natural History, Stockholm, Sweden (SMNH). Abbreviations used in Tables are according to Hunt & Palomares-Ruis (2012).

Results

Phylum Nematoda Potts, 1932
Class Chromadorea Inglis, 1983
Order Plectida Gadea, 1973
Family Diplopetooididae Tchesunov, 1990 (monotypic)

Genus *Diplopetooides* Gerlach, 1962

Type species

Diplopetooides ornatus (Gerlach, 1950).

Diagnosis (emended after Holovachov 2014)

Cuticle annulated, annulation starts at level with the amphids; annules smooth or with fine longitudinal striation. Annules unequal in width; annule width increases gradually from first postcephalic annule to annule located somewhat posterior to the pharyngo-intestinal junction, which is followed by a much narrower one; annules increase in width posterior towards mid-body region. Posterior to two-thirds of body length, annule width gradually decreases again, with the most narrow annule located on tail; the most narrow caudal annule is followed posteriorly by one much wider annule and then by caudal annules, in which the width gradually decreases toward the tail terminus. Lateral alae absent. Body pores and epidermal glands absent. Somatic sensilla present. Labial region bluntly rounded; lip pairs fused into three small lobes. Inner labial sensilla invisible if present. Outer labial sensilla pore-like, located on the anterior surface of lips. Cephalic sensilla setiform or papilliform; their bases located at the base of the labial region, anterior to amphid. Subcephalic and cervical sensilla, deirid and ocelli absent. Amphids in some species lie on strongly cuticularised lateral subcuticular plates that are partly or completely connected together on the ventral and dorsal sides forming a “cephalic framework”. Amphidial fovea loop-shaped (inverted U-shaped). Secretory-excretory system usually present; renette cell elongate, located opposite to the cardia and anterior part of intestine. Secretory-excretory ampulla present, located at the level of the posterior part of pharynx. Cuticularized secretory-excretory duct very short, opens to the exterior posterior to the nerve ring level. Buccal cavity small funnel-shaped: cheilostom can usually be seen as the cylindrical or funnel-shaped anterior-most part, not cuticularised; gymnostom short and not cuticularised; stegostom closed, linear, its slender lining continuous with that of the corpus. Pharyngeal tubes absent. Pharynx subdivided by breaks in muscular tissue into anterior corpus and posterior postcorpus; corpus cylindrical or fusiform, muscular, with evenly distributed myofilaments; postcorpus glandular, consisting of anterior narrower isthmus and basal swelling; dorsal sector of the basal bulb is often enlarged to accommodate dorsal pharyngeal gland; pharyngeal lumen uniform in thickness along the entire pharynx length; valves absent. Dorsal and two subventral gland orifices penetrate pharyngeal lumen at the base of stoma. Dorsal gland nucleus is visible in the basal swelling. Cardia conoid, glandular. Female reproductive system didelphic-amphidelphic with equally developed branches, ovaries reflexed antidromously. Spermatheca absent. Vulva equatorial, transverse

or pore-like. Vagina straight; *pars proximalis vaginae* encircled by sphincter muscle; *pars refringens vaginae* and epiptygmata absent. Male reproductive system diorchic, testes outstretched or opposed in different species. Spicules symmetrical, arcuate; gubernaculum usually present. Supplements, precloacal and postcloacal sensilla absent. Setae in caudal region of males arranged in subventral and subdorsal pairs along the tail. Three caudal glands present, open via three separate openings, their nuclei are incaudal. Spinneret absent.

Valid species

Diplopettoides anatolii (Voronov, 1982)

= *Diplopettula anatolii* Voronov, 1982

Diplopettoides asetosus (Juario, 1974) comb. nov.

= *Diplopettula asetosa* Juario, 1974

Diplopettoides axayacatli Holovachov, Tandingan De Ley, Mundo-Ocampo, Gingold & De Ley, 2009

Diplopettoides botulus (Wieser, 1959) comb. nov.

= *Diplopettula botula* Wieser, 1959

Diplopettoides bulbosus (Vitiello, 1972) comb. nov.

= *Diplopettula bulbosa* Vitiello, 1972

Diplopettoides grandis sp. nov.

Diplopettoides linkei Jensen, 1991

Diplopettoides longicaudatus sp. nov.

Diplopettoides lucanicus (Boucher & Helléouët, 1977) comb. nov.

= *Diplopettula lucanica* Boucher & Helléouët, 1977

Diplopettoides mastigia Tchesunov, 1990

Diplopettoides nudus (Gerlach, 1956)

= *Diplopettula nuda* Gerlach, 1956

Diplopettoides ornatus (Gerlach, 1950)

= *Diplopettis ornatus* Gerlach, 1950

Diplopettoides paramastigia Holovachov, Tandingan De Ley, Mundo-Ocampo, Gingold & De Ley, 2009

Diplopettoides pulcher (Vincx & Gourbault, 1992)

= *Diplopettula pulchra* Vincx & Gourbault, 1992

Diplopettoides pumilus (Vincx & Gourbault, 1992) comb. nov.

= *Diplopettula pumila* Vincx & Gourbault, 1992

= *Diplopettoides holovachovi* Fadeeva & Mordukhovich, 2013 syn. nov.

Diplopettoides santaclarae Holovachov, Tandingan De Ley, Mundo-Ocampo, Gingold & De Ley, 2009

Diplopettoides striatus (Gerlach, 1956) comb. nov.

= *Diplopettula striata* Gerlach, 1956

Diplopettoides suecicus sp. nov.

Diplopettoides sundensis (Jensen, 1978)

= *Diplopettula sundensis* Jensen, 1978

Nomenclatorial changes

1) *Diplopettula asetosa* Juario, 1974 is here transferred to the genus *Diplopettoides* based on the morphology of the female reproductive system with reflexed ovaries in this species vs outstretched ovaries as defined for the genus *Diplopettula* by Fonseca & Bezerra (2014) and Leduc (2017).

2) *Diplopettula botula* Wieser, 1959 is here transferred to the genus *Diplopettoides* based on the fact that it shows no qualitative differences from several species currently assigned to the genus *Diplopettoides*.

3) *Diplopettula bulbosa* Vitiello, 1972 is here transferred to the genus *Diplopetooides* based on the morphology of the female reproductive system with reflexed ovaries in this species vs outstretched ovaries as defined for the genus *Diplopettula* by Fonseca & Bezerra (2014) and Leduc (2017).

4) *Diplopettula lucanica* Boucher & Helléouët, 1977 is here transferred to the genus *Diplopetooides* based on the characteristic morphology of the amphid (with a crenate interamphideal shield – a feature common to other species of *Diplopetooides*, but not in *Diplopettula* and its type species *Diplopettula breviceps* Gerlach, 1950).

5) *Diplopettula pumila* Vincx & Gourbault, 1992 is here transferred to the genus *Diplopetooides* based on its close morphological affinities to *Diplopetooides holovachovi* Fadeeva & Mordukhovich, 2013 in general morphology, structure of cuticle, anterior end and spicules. Since the only known difference between the two species is in the length of the spicules, *Diplopetooides holovachovi* is here considered a junior synonym of *Diplopetooides pumilus*.

6) *Diplopettula striata* Gerlach, 1956 is here transferred to the genus *Diplopetooides* based on unpublished observations on the morphology of the female reproductive system (reflexed ovaries) in this species.

***Diplopetooides suecicus* sp. nov.**

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Figs 1–3; Table 1

Diagnosis

Diplopetooides suecicus sp. nov. is characterised by a body of 0.82–1.02 mm long; cuticle with longitudinal striation visible only under SEM; cuticularised plate underlying cephalic cuticle around amphid present; cephalic sensilla setiform, 4–6 µm long; amphidial fovea an inverted U-shape, 14–21 µm long and 6–9 µm wide; wide space between amphidial branches areolated; secretory-excretory pore located opposite to basal pharyngeal swelling; tail subcylindrical with bluntly rounded terminus; testes outstretched; spicules 27–31 µm long, strongly curved, with weakly defined manubrium and subcylindrical shaft; gubernaculum plate-like, with caudal apophyses.

Etymology

The specific epithet “*suecicus*” (masculine) – Swedish, refers to the country where the new species was first discovered.

Type material

Holotype

SWEDEN: ♂, Gullmarn Fjord near Fiskebäckskil, 58°15'25" N, 11°27'30" E, soft mud from 30 m deep, 11 Aug. 2011, O. Holovachov leg. (SMNH Type-8840).

Paratypes

SWEDEN: 4 ♀♀, 1 ♂, Gullmarn Fjord near Fiskebäckskil, 58°15'25" N, 11°27'30" E, soft mud from 30 m deep, 11 Aug. 2011, O. Holovachov leg. (SMNH Type-8841); 1 ♀, 2 ♂♂, Gullmarn Fjord near Fiskebäckskil, 58°15'37" N, 11°27'43" E, soft mud from 44 m, 11 Aug. 2011, O. Holovachov leg. (SMNH Type-8842).

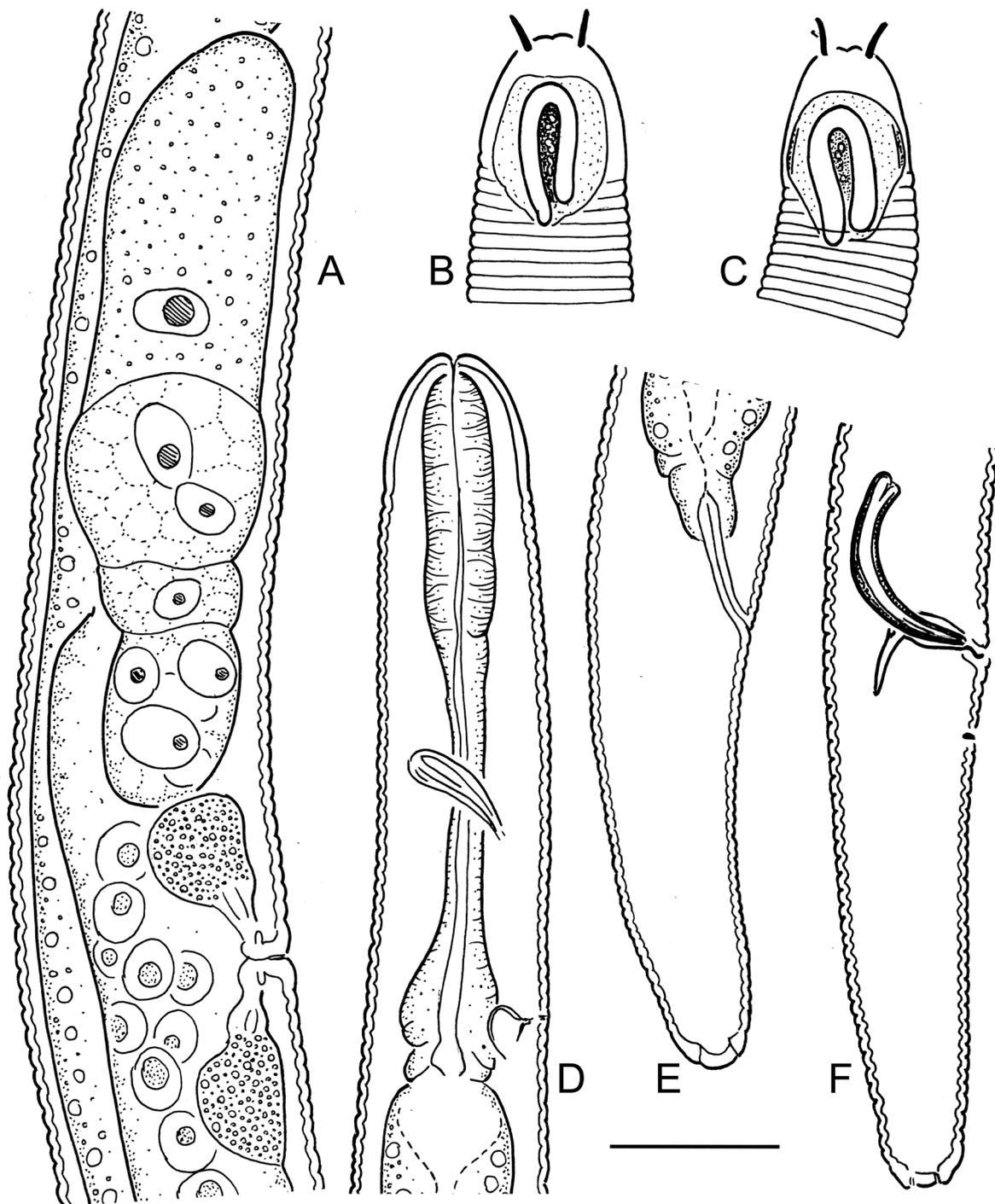


Fig. 1. *Diplopeltoides suecicus* sp. nov. **A.** Anterior part of the female reproductive system. **B.** Female anterior end, surface view. **C.** Male anterior end, surface view. **D.** Female pharyngeal region, optical median section. **E.** Female tail. **F.** Male tail. Scale bar = 20 μ m.

Description

Adult

Body cylindrical, posteriorly tapering in the tail region, straight or weakly ventrally curved upon fixation. Cuticle coarsely annulated along entire body, except for visually smooth anterior end (faint annulation is visible under the scanning electron microscope) and terminal part of the tail; annules 1.5–2.5 μm wide at mid-body region; longitudinal striation not observed under the light microscope but distinct under the scanning electron microscope, covers annules over entire body length. Somatic setae visible on tail. Labial region bluntly rounded, lips fused. Cuticularised plate underlying cephalic cuticle around amphid, extending from the level of the anteriormost edge of amphid to the posteriormost edge of amphid, 17–21.5 μm long and 12–14.5 μm wide at its base; cuticular plates are connected with each other on ventral and on dorsal sides. Inner labial sensilla not seen; outer labial sensilla small papilliform, located on the anterior surface of lips. Cephalic sensilla setiform, equal to 0.5–0.8 labial region diameters in length, their bases are located 1.5–2 μm from anterior end. Amphids similar in shape and size between sexes: amphidial fovea an inverted U-shape with its dorsal branch longer than ventral branch. Wide space

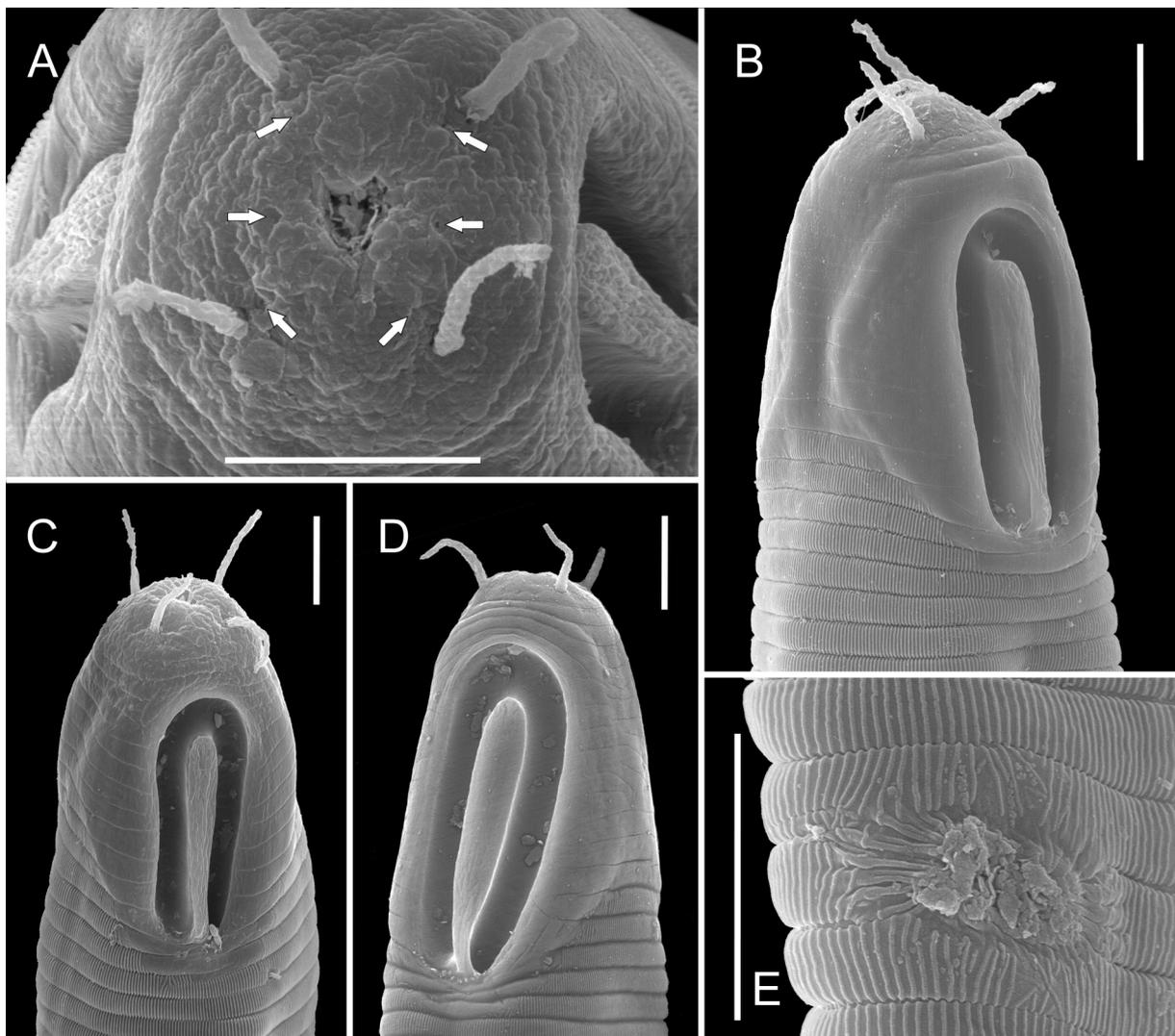


Fig. 2. *Diplopettoides suecicus* sp. nov. SEM micrographs. **A, C–D.** Male. **B, E.** Female. **A.** Anterior end, apical view (arrows point at outer labial sensilla). **B–D.** Anterior end, left sublateral view. **E.** Vulval region. Scale bars: A–E = 5 μm .

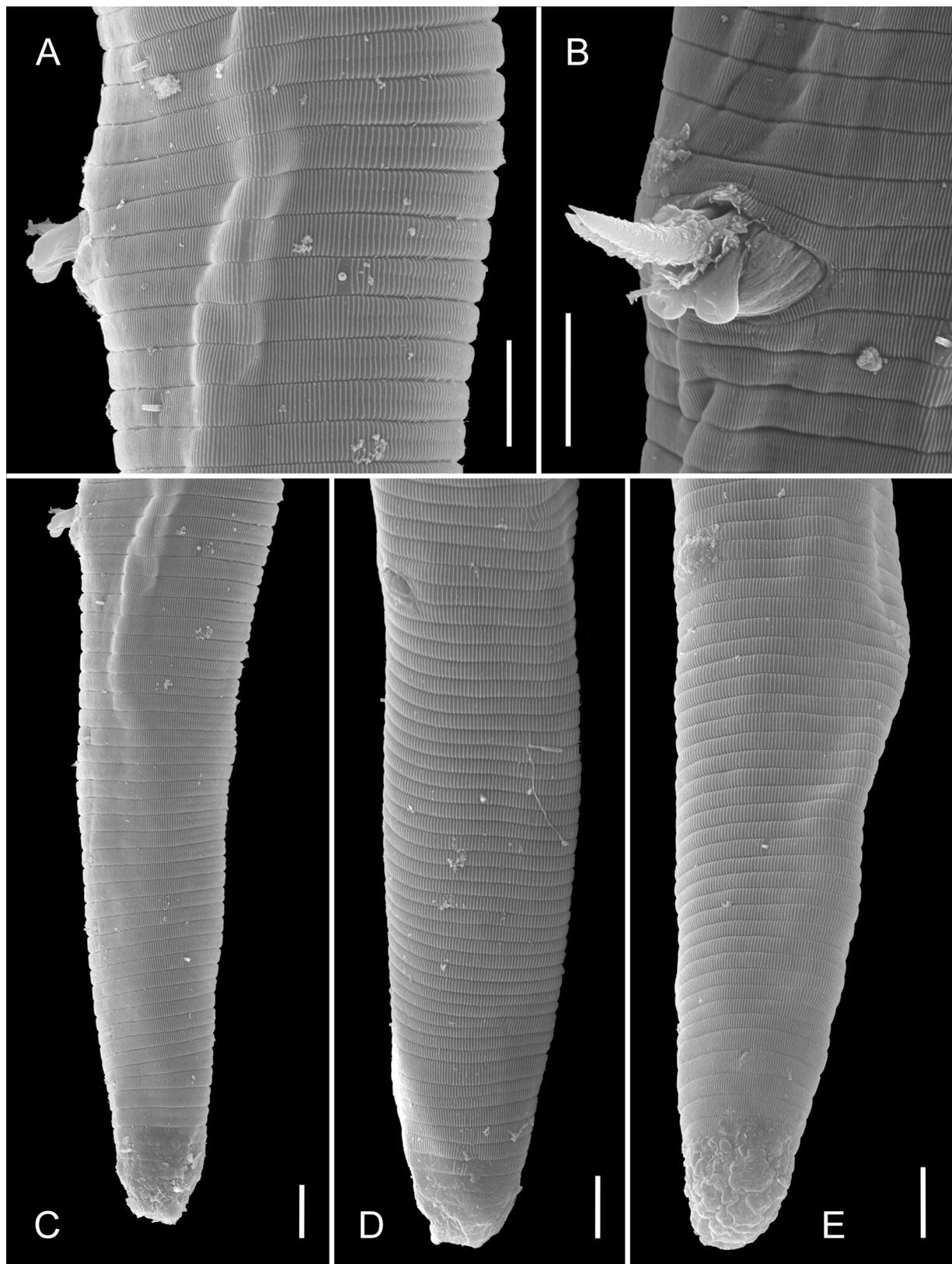


Fig. 3. *Diplopeltoides suecicus* sp. nov. SEM micrographs. **A.** Male cloacal region, lateral view. **B.** Male cloacal region, ventrosubventral view. **C.** Male tail, lateral view. **D–E.** Female tail, ventrosublateral view. Scale bars: A–E = 5 μ m.

Table 1. Measurements (in μm) of *Diplopettoides suecicus* sp. nov., presented as mean and (range).

Sex	Holotype male	Female	Male
Number of specimens	1	5	4
Body length	932	896 (821–980)	963 (932–1018)
Body diameter (BD)	23	32 (30–33)	22 (19–24)
Pharynx length	87	87 (81–92)	88 (87–90)
Tail length	67	60 (57–67)	73 (67–83)
Anal body diameter (ABD)	19	20 (18–21)	21 (19–23)
a	40.9	28.1 (24.8–33.1)	44.8 (39.1–49.8)
b	10.8	10.3 (9.6–10.9)	10.9 (10.4–11.3)
c	13.8	14.9 (14.2–15.9)	13.2 (12.2–13.9)
c'	3.5	3.1 (2.8–3.4)	3.6 (3.5–3.7)
V or T (%)	52.0	52.9 (50.0–55.3)	73.0 (52.0–92.8)
Labial region diameter	8.0	8.6 (8.0–9.0)	8.1 (7.5–8.0)
Cephalic setae length	6.0	5.0 (4.0–6.0)	5.7 (5.5–6.0)
Amphid from anterior end	7.5	5.8 (5.5–6.0)	6.7 (5.5–7.5)
Dorsal amphid branch length	17.0	15.5 (14.0–16.5)	17.9 (15.0–21.0)
Ventral amphid branch length	15.0	14.5 (13.0–17.0)	17.1 (15.0–19.0)
Amphid width	8.0	6.6 (6.0–7.0)	7.8 (6.0–9.0)
Nerve ring from anterior end	56	55 (51–63)	56
Nerve ring from anterior end as % of pharynx length	65	64 (56–73)	65
Secretory-excretory pore from ant. end	74	75 (63–82)	80 (74–84)
Secretory-excretory pore from ant. end as % of pharynx length	86	86 (78–92)	90 (86–94)
Anterior gonad length (to flexure)	–	104 (83–114)	–
Posterior gonad length (to flexure)	–	113 (93–124)	–
Vagina or spicules length	27	8 (6–10)	29 (27–31)
Rectum or gubernaculum length	9	16 (14–18)	8 (6–9)
Vagina length / BD	–	0.2 (0.2–0.3)	–
Rectum or spicules / ABD	1.4	0.8 (0.7–0.9)	1.4 (1.3–1.5)

between amphidial branches (amphidial shield) strongly cuticularised and areolated. Stoma very small, its cuticularised lining is uniform with the lining of the pharynx. Pharynx distinctly subdivided into anterior corpus and posterior postcorpus; corpus cylindrical or slightly fusiform, muscular; postcorpus consists of anterior narrow non-muscular isthmus and pear-shaped glandular basal swelling. Pharyngeal gland nuclei and orifices indistinct. Nerve ring surrounding isthmus. Secretory-excretory system present; secretory-excretory pore located along the ventral body line opposite to basal pharyngeal swelling; secretory-excretory duct very short, leading from pore to ampulla; renette cell small, its body adjacent and ventral to anterior part of intestine. Tail subcylindrical with bluntly rounded terminus. Caudal glands opening via three separate openings, spinneret absent.

Female

Reproductive system didelphic, amphidelphic, reflexed; ovary branches symmetrical. Anterior ovary situated to either right or left of intestine; posterior ovary situated to either right or left of intestine. Vulva pore-like, located at or immediately posterior to mid-body. Vagina straight, 0.2–0.3 of the vulval body diameter, with developed sphincter muscle at its proximal part; *pars refringens vaginae* absent. Intrauterine egg not seen; sperm is often present in the uterus. Rectum short, 0.7–0.9 of the corresponding body diameter long.

Male

Reproductive system diorchic, both testes outstretched. Spicules paired and symmetrical, strongly curved, with weakly defined manubrium and subcylindrical shaft. Gubernaculum plate-like, with a pair of strong closely set caudal apophyses. Caudal setae present, arranged in subventral and subdorsal rows, but difficult to observe and count.

Remarks

Diplopetoides suecicus sp. nov. is most similar to *D. axayacatli* and *D. grandis* sp. nov. in having strongly developed cuticularised plate and amphid with wide and ornamented interamphideal shield. The new species differs from *D. axayacatli* in the shape of the amphid (loop-shaped vs hook-shaped in *D. axayacatli*), shorter cephalic setae (4–6 µm vs 15–20 µm in *D. axayacatli*), gubernaculum with strong apophyses (vs without apophyses in *D. axayacatli*) and shorter tail ($c' = 2.8–3.7$ vs 5.0–6.0 in *D. axayacatli*); it differs from *D. grandis* sp. nov. in shorter body (0.82–1.02 mm vs 2.06 mm in *D. grandis* sp. nov.) and shorter cephalic setae (4–6 µm vs 18.5 µm in *D. grandis* sp. nov.).

Diplopetoides aetosus (Juario, 1974) comb. nov.

Fig. 4; Table 2

Diagnosis

Diplopetoides aetosus is characterised by a body of 0.76–1.19 mm long; cuticle without longitudinal striation; cuticularised plate absent; cephalic sensilla setiform, 3.5–7.0 µm long; amphidial fovea an inverted U-shape, 14–19 µm long and 6–9 µm wide; wide space between amphidial branches punctuated or crenate; secretory-excretory pore located opposite to basal pharyngeal swelling; tail subcylindrical with rounded terminus; testes outstretched; spicules 17–31 µm long, strongly curved, with dorsally bent manubrium and subcylindrical shaft; gubernaculum plate-like, with caudal apophyses.

Material examined

SWEDEN: 1 ♀, Skagerrak, 58°20'06" N, 11°09'24" E, muddy sediment from 53 m deep, 9 Aug. 2011, O. Holovachov leg. (SMNH-159532); 2 ♀♀, 2 ♂♂, Skagerrak, 58°15'25" N, 11°27'30" E, soft mud from 30 m deep, 11 Aug. 2011, O. Holovachov leg. (SMNH-159533-534); 1 ♀, Skagerrak, 58°15'37" N, 11°27'43" E, soft mud from 44 m deep, 11 Aug. 2011, O. Holovachov leg. (SMNH-159534).

Description

Adult

Body cylindrical, posteriorly tapering in tail region, straight or ventrally curved upon fixation, more so in the posterior part of males. Cuticle coarsely annulated along entire body, except for smooth anterior end and terminal part of the tail; annules 1.5–2.5 µm wide at mid-body region; longitudinal striation not observed under the light microscope. Somatic setae visible on tail. Labial region bluntly rounded, lips fused. Cuticularised plate underlying cephalic cuticle around amphid absent. Inner and outer labial sensilla not seen. Cephalic sensilla setiform, equal to 0.3–0.6 labial region diameters in length, their bases are located 3–3.5 µm from anterior end. Amphids similar in shape and size between

sexes: amphidial fovea an inverted U-shape with dorsal branch longer than ventral branch. Wide space between amphidial branches (amphidial shield) strongly cuticularised, punctuated or crenate. Stoma very small, its cuticularised lining is uniform with lining of pharynx. Pharynx distinctly subdivided into anterior corpus and posterior postcorpus; corpus cylindrical or slightly fusiform, muscular; postcorpus consists of anterior narrow non-muscular isthmus and pear-shaped glandular basal swelling. Pharyngeal gland nuclei and orifices indistinct. Nerve ring surrounding isthmus. Secretory-excretory system present; secretory-excretory pore located along ventral body line opposite to basal pharyngeal swelling; secretory-excretory duct very short, leading from pore to ampulla; renette cell ovoid, its body adjacent and ventrosublateral to anterior part of intestine. Tail subcylindrical with rounded terminus. Caudal glands opening via three separate openings, spinneret absent.

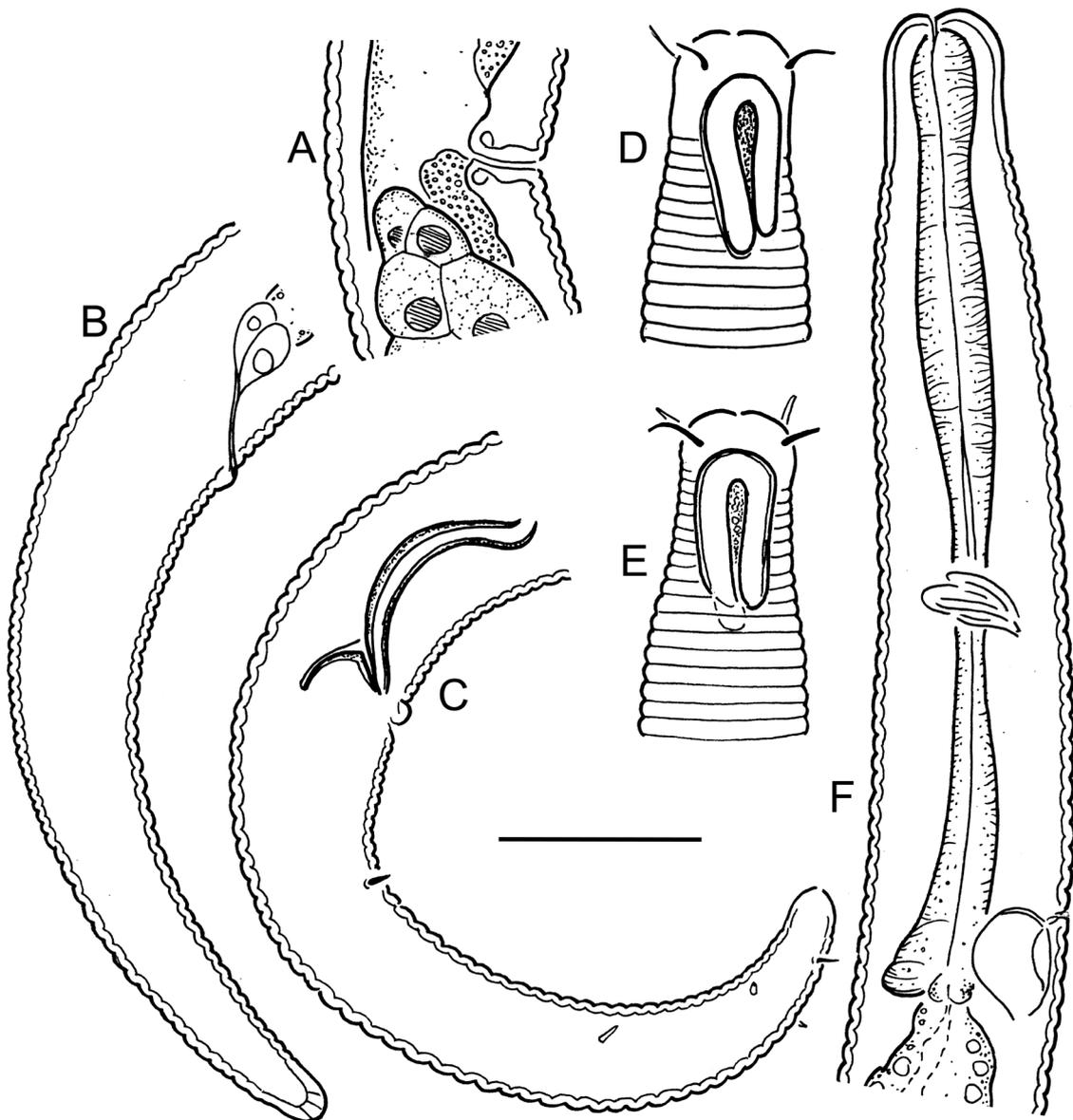


Fig. 4. *Diplopetooides asetosus* (Juario, 1974) comb. nov. **A.** Vulval region. **B.** Female tail. **C.** Male tail. **D.** Female anterior end, surface view. **E.** Male anterior end, surface view. **F.** Female pharyngeal region, optical median section. Scale bar = 20 μ m.

Table 2. Measurements (in μm) of *Diplopeltoides aetosus* (Juario, 1974) comb. nov., presented as mean and (range) for females and each male individual measurement separated with a semicolon; “?” indicates that the character can not be observed or measured.

Sex	Female	Male
Number of specimens	4	2
Body length	993 (866–1190)	1050; 1064
Body diameter (BD)	24 (21–28)	21; 21
Pharynx length	103 (100–107)	104; 100
Tail length	84 (71–96)	83; 89
Anal body diameter (ABD)	16 (15–17)	16; 18
a	42.0 (31.7–52.2)	51.2; 51.9
b	9.6 (8.6–11.1)	10.1; 10.6
c	11.9 (10.6–12.4)	12.6; 12.0
c'	5.1 (4.1–5.7)	5.2; 4.9
V or T (%)	52.8 (50.9–54.5)	?; 51.5
Labial region diameter	10.7 (10.0–12.0)	11.0; 10.5
Cephalic setae length	4.8 (3.5–5.5)	6.0; 5.0
Amphid from anterior end	4.8 (4.0–6.0)	3.5; 5.5
Dorsal amphid branch length	16.6 (14.0–18.5)	18.0; 16.5
Ventral amphid branch length	14.5 (12.0–16.5)	16.0; 14.5
Amphid width	7.4 (6.0–8.0)	7.5; 7.5
Nerve ring from anterior end	61 (58–64)	?; 55
Nerve ring from anterior end as % of pharynx length	60 (58–62)	?; 55
Secretory-excretory pore from ant. end	90 (87–94)	96; 86
Secretory-excretory pore from ant. end as % of pharynx length	87 (85–91)	92; 85
Anterior gonad length (to flexure)	112 (46–154)	–
Posterior gonad length (to flexure)	121 (60–159)	–
Vagina or spicules length	7 (7–8)	31; 26
Rectum or gubernaculum length	14 (12–17)	4; 5
Vagina length / BD	0.3	–
Rectum or spicules length / ABD	0.8 (0.7–1.0)	1.9; 1.4

Female

Reproductive system didelphic, amphidelphic, reflexed; ovary branches symmetrical. Anterior ovary situated to right of intestine; posterior ovary situated to left of intestine. Vulva at or immediately posterior to mid-body. Vagina straight, 0.3 of the vulval body diameter, with developed sphincter muscle at its proximal part; *pars refringens vaginae* absent. Intrauterine egg not seen; sperm is visible in the uterus. Rectum short, 0.7–1 of the corresponding body diameter long.

Male

Reproductive system diorchic, both testes outstretched. Spicules paired and symmetrical, strongly curved, with dorsally bent manubrium and subcylindrical shaft. Gubernaculum plate-like, with a pair of strong closely set caudal apophyses. Caudal setae present, arranged in subventral and subdorsal rows but difficult to observe and count.

Remarks

The recently collected population of *D. aetosus* is similar to the type specimens in general morphology and measurements, except for the relatively broader amphid and longer spicules (26–31 µm vs 17 µm (along chord) in the text of the original description or 21 µm as re-measured along curved median line using the original drawing).

Diplopetooides bulbosus (Vitiello, 1972) comb. nov.

Figs 5–6, 11A; Table 3

Diagnosis

Diplopetooides bulbosus is characterised by a body of 1.12–1.58 mm long; cuticle with longitudinal striation visible only under SEM; cuticularised plate absent; cephalic sensilla papilliform, 1–2 µm long; amphidial fovea an inverted U-shape, 21–28 µm long and 7–11 µm wide, with fine striation; narrow space between amphidial branches not cuticularised; secretory-excretory pore located opposite to basal pharyngeal swelling; tail cylindrical or clavate with bluntly rounded terminus; testes outstretched; spicules 34–50 µm long, strongly curved, with dorsally bent manubrium and subcylindrical, gradually narrowing shaft; gubernaculum plate-like, with or without caudal apophysis.

Material examined

SWEDEN: 3 ♀♀, 2 ♂♂, Skagerrak, 58°19'15.6"–20.9" N, 10°29'33.5"–34.0" E, soft bottom 352–374 m deep, 10 Oct. 2012, "Inventering Bratten" leg. (SMNH-159537); 1 ♂, soft bottom 232–240 m deep, Skagerrak, 58°27'36.7"–43.3" N, 10°32'52.0"–59.4" E, 12 Oct. 2012, "Inventering Bratten" leg. (SMNH-159538); 7 ♀♀ (used for SEM), Skagerrak, 58°22'17.8"–19.4" N, 10°23'50.8"–24'03.2" E, soft bottom 351–387 m deep, 10 Oct. 2012, "Inventering Bratten" leg.

Description

Adult

Body cylindrical, posteriorly tapering in the tail region, straight or variously curved upon fixation. Cuticle coarsely annulated along entire body, except for smooth anterior end and terminal part of tail; annules 2.5–3 µm wide at mid-body region; longitudinal striation not observed under light microscope, but distinct under scanning electron microscope, covers annules over most of body length, except for anteriormost and posteriormost parts. Somatic setae present along pharyngeal region and on tail. Labial region bluntly rounded. Cuticularised plate underlying cephalic cuticle around amphid absent. Inner and outer labial sensilla not seen. Cephalic sensilla papilliform, equal to 0.1 labial region diameter in length, their bases are located 3.5–6 µm from anterior end. Amphids similar in shape and size between sexes: amphidial fovea an inverted U-shape with ventral branch longer than dorsal branch; tip of ventral branch bent to dorsal side. Interior of amphidial fovea with fine striation visible under light and scanning electron microscopes. Narrow space between amphidial branches (amphidial shield) not cuticularised. Stoma very small, its cuticularised lining uniform with lining of pharynx. Pharynx distinctly subdivided into anterior corpus and posterior postcorpus; corpus cylindrical or slightly fusiform, muscular; postcorpus consists of anterior narrow non-muscular isthmus and pear-shaped glandular basal swelling. Pharyngeal gland nuclei and orifices indistinct. Nerve ring surrounding isthmus. Secretory-excretory system present; secretory-excretory pore located along ventral body line opposite to basal pharyngeal

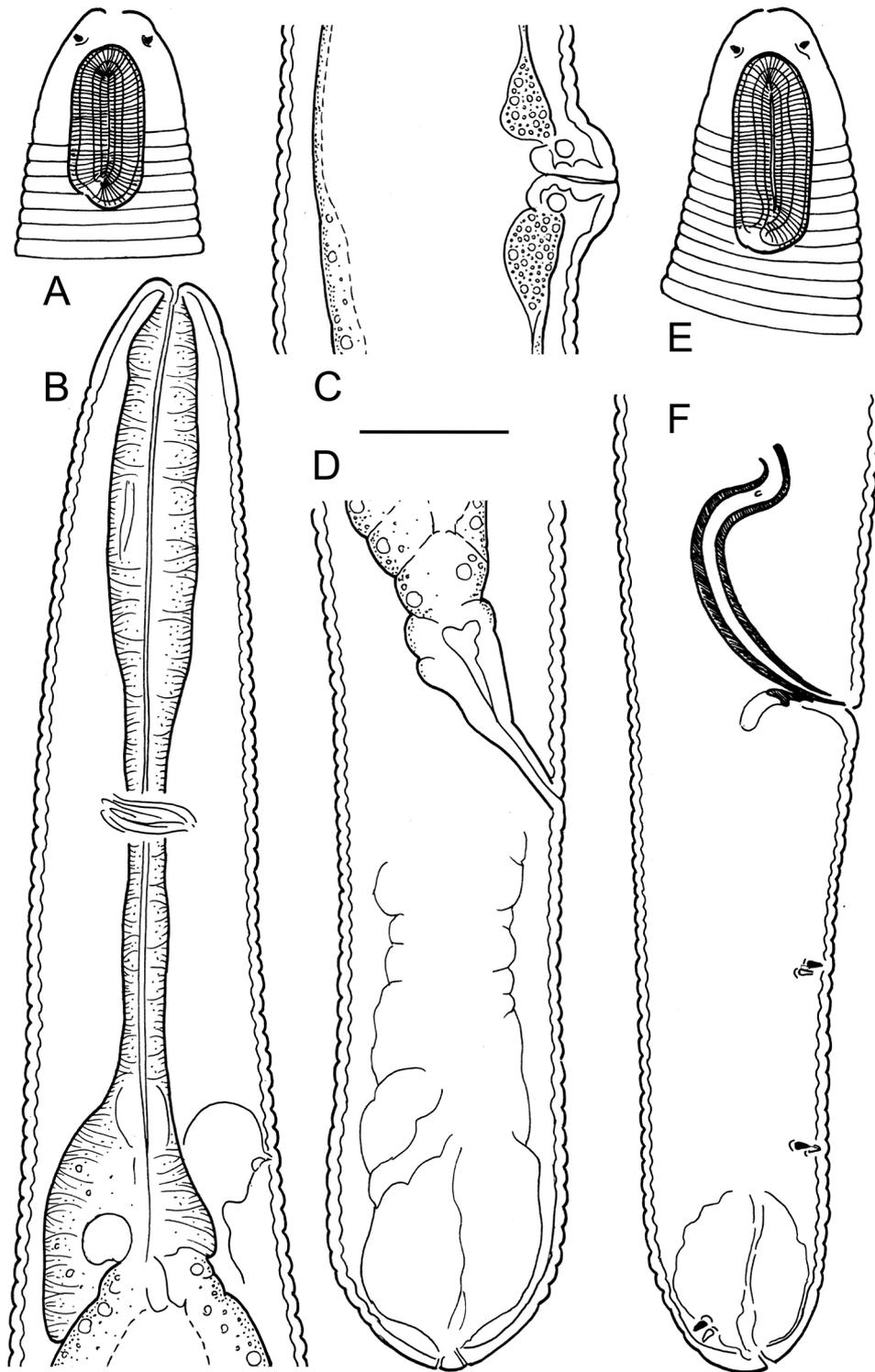


Fig. 5. *Diplopeltoides bulbosus* (Vitiello, 1972) comb. nov. **A.** Female anterior end, surface view. **B.** Female pharyngeal region, optical median section. **C.** Vulval region. **D.** Female tail. **E.** Male anterior end, surface view. **F.** Male tail. Scale bar = 20 μ m.

swelling; secretory-excretory duct very short, leading from pore to ampulla; renette cell obscure. Tail cylindrical or clavate, with bluntly rounded terminus. Caudal glands opening via three separate openings, spinneret absent.

Female

Reproductive system didelphic, amphidelphic, reflexed; ovary branches symmetrical. Anterior ovary situated to either right (usually) or left (rarely) of intestine; posterior ovary situated to either left (usually) or right (rarely) of intestine. Vulva pore-like, located posterior to mid-body. Vagina straight, 0.3–0.4 of vulval body diameter, with thick walls and developed sphincter muscle at proximal part; *pars*

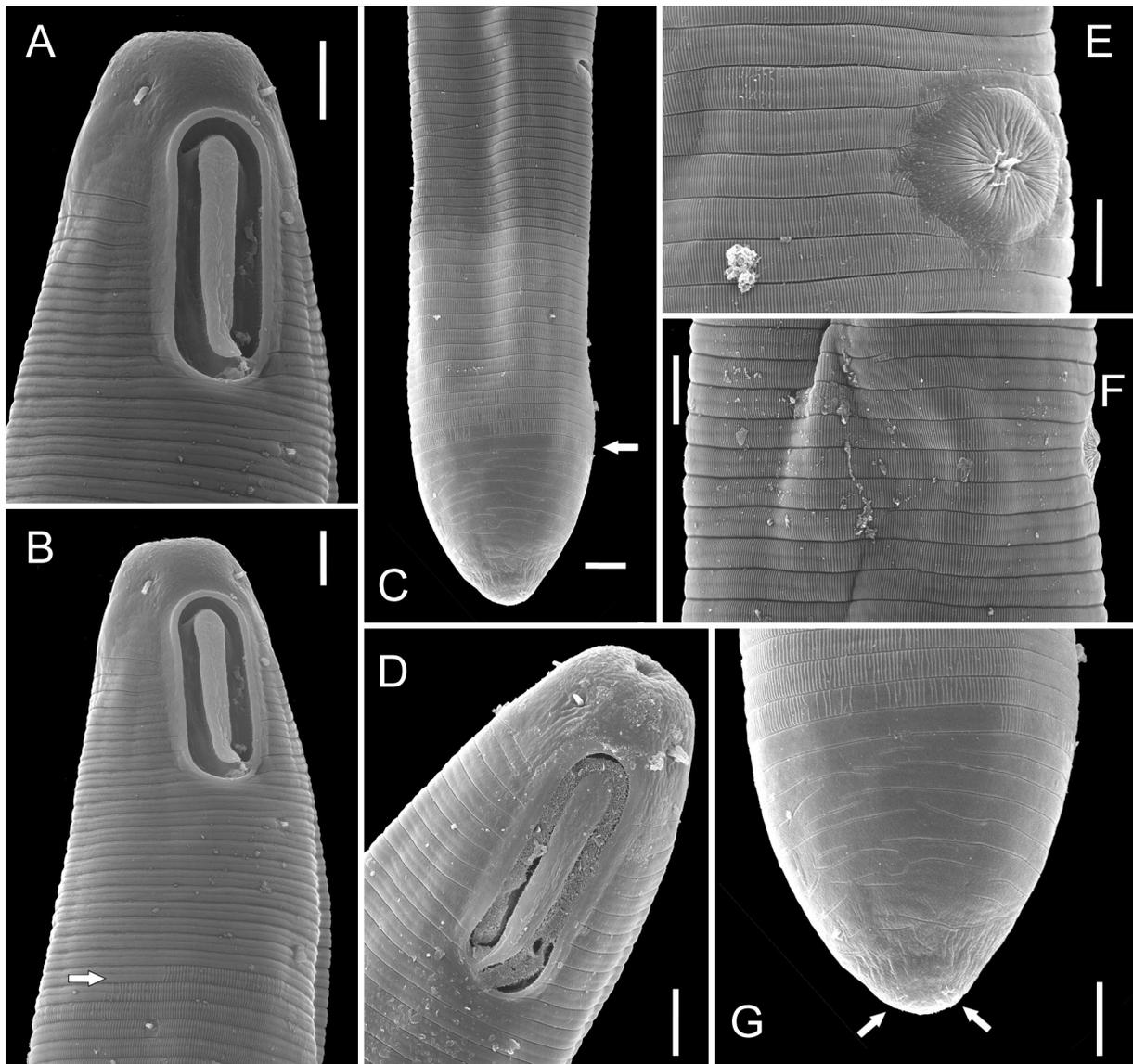


Fig. 6. *Diplopetooides bulbosus* (Vitiello, 1972) comb. nov. SEM micrographs of females. **A–B.** Anterior end, right sublateral view (arrow points at the anterior edge of longitudinal striation of cuticle). **C.** Female tail (arrow points at the posterior edge of the longitudinal striation of the cuticle). **D.** Anterior end, left sublateral view. **E.** Vulval region, ventrosublateral view. **F.** Vulval region, lateral view. **G.** Tail terminus (arrows point at openings of caudal glands. Scale bars: A–G = 5 μ m).

Table 3. Measurements (in μm) of *Diplopetloides bulbosus* (Vitiello, 1972) comb. nov., presented as mean \pm s.d. (standard deviation) and (range) or mean and (range).

Sex	Female	Male
Number of specimens	10	3
Body length	1411 \pm 82 (1277–1573)	1363 (1159–1501)
Body diameter (BD)	41 \pm 3 (38–45)	33 (29–38)
Pharynx length	131 \pm 6 (122–140)	133 (124–140)
Tail length	79 \pm 5 (72–86)	86 (75–94)
Anal body diameter (ABD)	30 \pm 2 (26–34)	29 (26–32)
a	34.8 \pm 2.4 (31.6–38.6)	40.8 (39.9–41.8)
b	10.8 \pm 0.8 (9.1–11.8)	10.3 (9.3–11.3)
c	18.0 \pm 1.4 (16.1–20.3)	15.9 (15.3–16.9)
c'	2.6 \pm 0.3 (2.3–3.0)	3.0 (2.8–3.3)
V or T (%)	60.2 \pm 2.5 (56.2–64.3)	44.7 (43.2–45.9)
Labial region diameter	13.4 \pm 0.9 (12.5–14.5)	13.6 (13.0–14.0)
Cephalic setae length	1.4 \pm 0.3 (1.0–2.0)	1.5
Amphid from anterior end	6.7 \pm 1.1 (5.0–8.0)	5.5 (5.0–6.0)
Dorsal amphid branch length	22.3 \pm 0.9 (21.5–24.0)	26.7 (25.5–27.5)
Ventral amphid branch length	22.1 \pm 1.3 (21.0–25.0)	26.2 (25.5–27.0)
Amphid width	9.3 \pm 0.8 (8.0–10.5)	10.7 (10.5–11.0)
Nerve ring from anterior end	74 \pm 3 (68–79)	79 (78–81)
Nerve ring from anterior end as % of pharynx length	56 \pm 2 (54–60)	58
Secretory-excretory pore from ant. end	115 \pm 5 (106–120)	119 (107–128)
Secretory-excretory pore from ant. end as % of pharynx length	88 \pm 2 (84–91)	90 (86–92)
Anterior gonad length (to flexure)	122 \pm 24 (86–159)	–
Posterior gonad length (to flexure)	127 \pm 26 (93–155)	–
Vagina or spicules length	13 \pm 2 (10–15)	47 (45–50)
Rectum or gubernaculum length	26 \pm 3 (21–30)	10
Vagina length / BD	0.3 (0.3–0.4)	–
Rectum or spicules length / ABD	0.8 \pm 0.1 (0.7–0.9)	1.6 (1.5–1.9)

refringens vaginae absent. Intrauterine egg not seen; sperm is visible in uterus. Rectum short, 0.7–0.9 of corresponding body diameter long.

Male

Reproductive system diorchic, both testes outstretched. Spicules paired and symmetrical, strongly curved, with dorsally bent manubrium and subcylindrical, gradually narrowing shaft. Gubernaculum plate-like, with caudal apophysis that is variable in size and can be indistinct in some specimens. Caudal setae present, arranged in subventral and subdorsal rows, but difficult to observe.

Remarks

The recently collected population of *D. bulbosus* is similar to type specimens in general morphology, measurements and shape of amphids, except for the spicule length. Vitiello (1972) stated in the original description that the spicules are 25 µm long, compared to 45–50 µm in our specimens. Measured from the drawings in the original description, the spicule length of the type specimen appears to be closer to 34 µm.

Diplopetooides nudus (Gerlach, 1956)

Fig. 7; Table 4

Diagnosis

Diplopetooides nudus is characterised by a body of 0.94–1.35 mm long; cuticle without longitudinal striation; cuticularised plate absent; cephalic sensilla papilliform, 1–1.5 µm long; amphidial fovea an inverted U-shape, 17–28 µm long and 6–8 µm wide; narrow space between amphidial branches with crenated edge; secretory-excretory pore located opposite to basal pharyngeal swelling; tail subcylindrical with bluntly rounded terminus; testes outstretched; spicules 29–38 µm long, strongly curved, with dorsally bent manubrium and subcylindrical, gradually narrowing shaft; gubernaculum plate-like, with or without caudal apophyses.

Material examined

SWEDEN: 2 ♀♀, 1 ♂, Skagerrak, 58°23'00.8"–22'00.8" N, 10°20'28.8"–38.3" E, soft bottom 390–428 m deep, 10 Oct. 2012, "Inventering Bratten" leg. (SMNH-159566); 2 ♂♂, Skagerrak, 58°22'17.8"–19.4" N, 10°23'50.8"–24'03.2" E, soft bottom 351–387 m deep, 10 Oct. 2012, "Inventering Bratten" leg. (SMNH-159567).

Description**Adult**

Body cylindrical, posteriorly tapering in the tail region, straight or curved upon fixation. Cuticle coarsely annulated along entire body, except for smooth anterior end and terminal part of tail; annules 2–2.5 µm wide at mid-body region; longitudinal striation not observed under light microscope. Somatic setae present on tail. Labial region bluntly rounded. Cuticularised plate underlying cephalic cuticle around amphid absent. Inner and outer labial sensilla not seen. Cephalic sensilla papilliform, equal to 0.1 labial region diameter in length, their bases are located 3.5–4 µm from anterior end. Amphids similar in shape and size between sexes: amphidial fovea an inverted U-shape with dorsal branch longer than ventral branch. Narrow space between amphidial branches (amphidial shield) cuticularised with crenated edge. Stoma very small, its cuticularised lining uniform with lining of the pharynx. Pharynx distinctly subdivided into anterior corpus and posterior postcorpus; corpus cylindrical or slightly fusiform, muscular; postcorpus consists of anterior narrow non-muscular isthmus and pear-shaped glandular basal swelling. Pharyngeal gland nuclei and orifices indistinct. Nerve ring surrounding isthmus. Secretory-excretory system present; secretory-excretory pore located along ventral body line opposite to basal pharyngeal swelling; secretory-excretory duct very short, leading from pore to ampulla; renette cell obscure. Tail subcylindrical with bluntly rounded terminus. Caudal glands opening via three separate openings, spinneret absent.

Female

Reproductive system didelphic, amphidelphic, reflexed; ovary branches symmetrical. Anterior ovary situated to either right or left of intestine; posterior ovary situated to left of intestine. Vulva located immediately posterior to mid-body. Vagina straight, 0.3 of vulval body diameter, with thick walls and

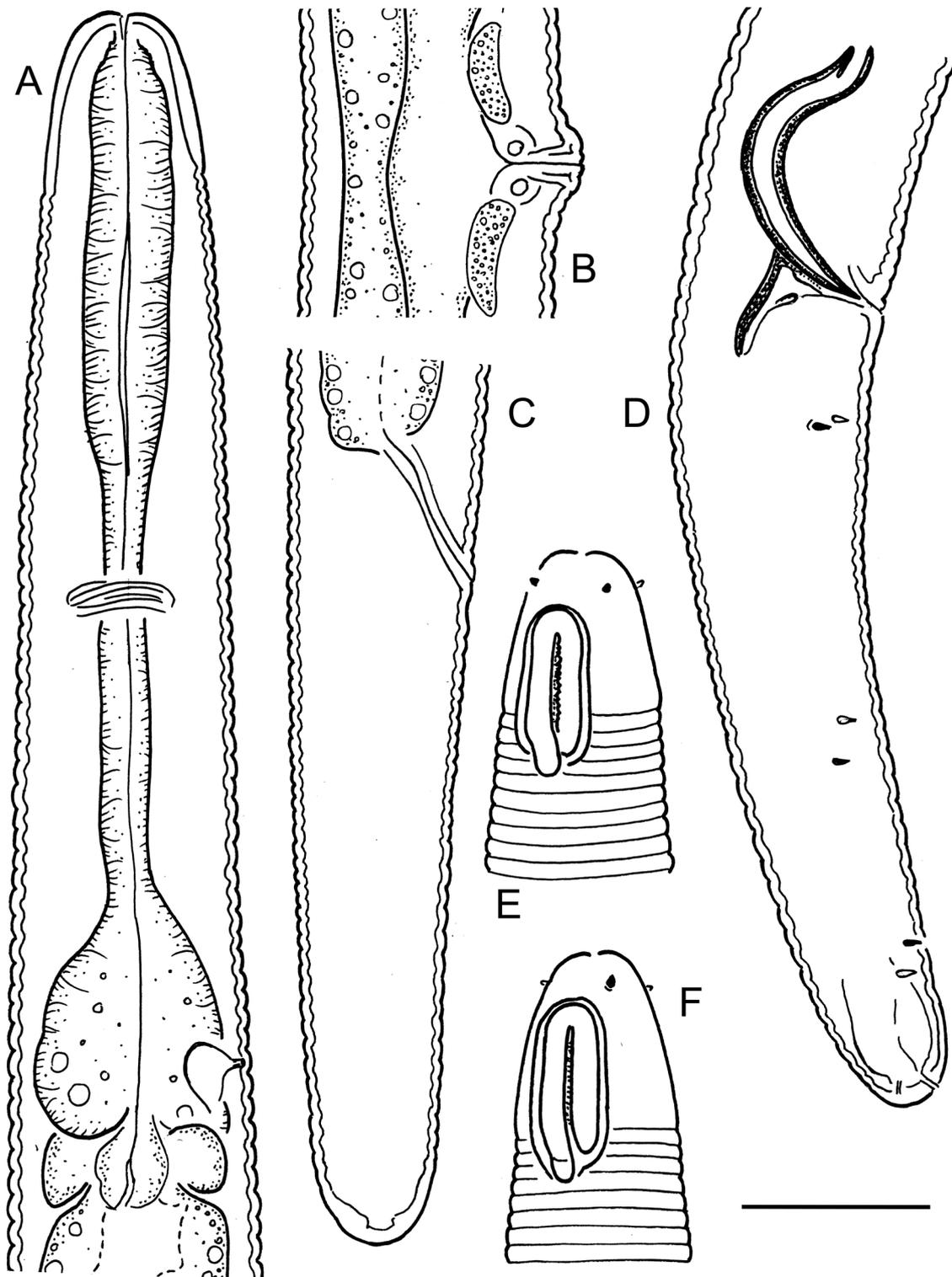


Fig. 7. *Diplopeltoides nudus* (Gerlach, 1956). A. Female pharyngeal region, optical median section. B. Vulval region. C. Female tail. D. Male tail. E. Female anterior end, surface view. F. Male anterior end, surface view. Scale bar = 20 μ m.

Table 4. Measurements (in μm) of *Diplopettoides nudus* (Gerlach, 1956), presented as mean and (range) for males and each female individual measurement separated with a semicolon.

Sex	Female	Male
Number of specimens	2	3
Body length	1135; 1004	1179 (1152–1225)
Body diameter (BD)	26; 27	23 (21–25)
Pharynx length	121; 117	119 (114–125)
Tail length	72; 71	81 (76–90)
Anal body diameter (ABD)	19; 18	21 (21–22)
a	43.3; 36.7	51.4 (45.9–59.7)
b	9.4; 8.6	9.9 (9.8–10.2)
c	15.8; 14.2	14.6 (13.6–15.2)
c'	3.7; 3.9	3.8 (3.5–4.2)
V or T (%)	54.7; 54.3	48.7 (47.9–49.5)
Labial region diameter	12.0; 10.5	10.8 (10.5–11.0)
Cephalic setae length	1.5; 1.5	1.0 (1.0–1.5)
Amphid from anterior end	5.5; 5.5	5.8 (5.0–7.0)
Dorsal amphid branch length	18.5; 17.0	18.9 (16.5–20.0)
Ventral amphid branch length	16.0; 14.5	17.3
Amphid width	6.0; 6.0	6.9 (6.0–7.5)
Nerve ring from anterior end	65; 63	65 (64–66)
Nerve ring from anterior end as % of pharynx length	54; 53	54 (53–55)
Secretory-excretory pore from ant. end	111; 102	108
Secretory-excretory pore from ant. end as % of pharynx length	92; 86	86
Anterior gonad length (to flexure)	124; 114	–
Posterior gonad length (to flexure)	152; 90	–
Vagina or spicules length	9; 9	37 (35–38)
Rectum or gubernaculum length	17; 12	10 (9–11)
Vagina length / BD	0.3; 0.3	–
Rectum or spicules length / ABD	0.9; 0.6	1.7 (1.6–1.8)

developed sphincter muscle at its proximal part; *pars refringens vaginae* absent. Intrauterine egg not seen; sperm is visible in the uterus. Rectum short, 0.6–0.9 of the corresponding body diameter long.

Male

Reproductive system diorchic, both testes outstretched. Spicules paired and symmetrical, strongly curved, with dorsally bent manubrium and subcylindrical, gradually narrowing shaft. Gubernaculum plate-like, with a pair of strong closely set caudal apophyses. Caudal setae present, arranged in subventral and subdorsal rows but difficult to observe and count.

Remarks

The recently collected population of *D. nudus* is similar to the type specimens in general morphology and measurements, including the characteristic spicule shape, except for the somewhat longer spicules (35–38 μm vs 29 μm in type specimens) and the presence of gubernaculum apophyses (vs absent in type specimens). As noted in the redescription of *D. bulbosus*, gubernaculum apophyses may be indistinct or absent in some specimens and should not be used as the sole diagnostic character.

Diplopetooides pumilus (Vincx & Gourbault, 1992) comb. nov.

Fig. 8; Table 5

Diagnosis

Diplopetooides pumilus is characterised by a body of 0.43–0.58 mm long; cuticle with longitudinal striation; cuticularised plate absent; cephalic sensilla setiform, 2–3 μm long; amphidial fovea an inverted U-shape, 8–17 μm long and 8–11 μm wide in female and 13–19 μm long and 8–9 μm wide in male; narrow space between amphidial branches not ornamented; secretory-excretory pore indistinct; tail conoid; testes opposed; spicules 24–27 μm long, strongly curved, with weakly defined manubrium and conoid shaft; gubernaculum plate-like, without apophyses.

Material examined

SWEDEN: 1 ♂, 1 ♀, Gullmarn Fjord near Fiskebäckskil, 58°15'13" N, 11°27'31" E, mud from 30–39 m deep, 21 Aug. 2010, M. Clément leg. (SMNH-159551); 1 ♂, Skagerrak, 58°20'06" N, 11°09'24" E, muddy sediment from 53 m deep, 9 Aug. 2011, O. Holovachov leg. (SMNH-159549); 2 ♀♀, Gullmarn Fjord near Fiskebäckskil, 58°15'09" N, 11°27'54" E, muddy sand from 8–15 m deep, 11 Aug. 2011, O. Holovachov leg. (SMNH-159550).

Description

Adult

Body cylindrical, posteriorly tapering in tail region, straight or curved upon fixation. Cuticle coarsely annulated along entire body, except for smooth anterior end (annulation starts at level of anterior $\frac{1}{4}$ of amphid) and terminal part of tail; annules 2.5 μm wide at mid-body region; longitudinal striation is distinct under light microscope, covers annules over entire body length. Somatic setae present on tail. Labial region bluntly rounded. Cuticularised plate underlying cephalic cuticle around amphid absent. Inner and outer labial sensilla not seen. Cephalic sensilla setiform, equal to 0.2–0.3 labial region diameters in length, their bases are located 2–5 μm from anterior end. Amphids similar in shape and size between sexes: amphidial fovea an inverted U-shape with branches equal in length. Narrow space between amphidial branches (amphidial shield) not cuticularised and not ornamented. Stoma very small, its cuticularised lining is uniform with lining of pharynx. Pharynx distinctly subdivided into anterior corpus and posterior postcorpus; corpus cylindrical or slightly fusiform, muscular; postcorpus consists of anterior narrow non-muscular isthmus and pear-shaped glandular basal swelling. Pharyngeal gland nuclei and orifices indistinct. Nerve ring surrounding isthmus. Secretory-excretory system indistinct. Tail conoid. Caudal glands opening via three separate openings, spinneret absent.

Female

Reproductive system didelphic, amphidelphic, reflexed; ovary branches symmetrical. Anterior ovary situated to either right or left of intestine; posterior ovary situated to either left or right of intestine. Vulva located immediately posterior to mid-body. Vagina straight, 0.2 of the vulval body diameter, with thick walls; *pars refringens vaginae* absent. Intrauterine egg not seen; sperm is sometimes visible in the uterus. Rectum short, 0.7–0.8 of corresponding body diameter long.

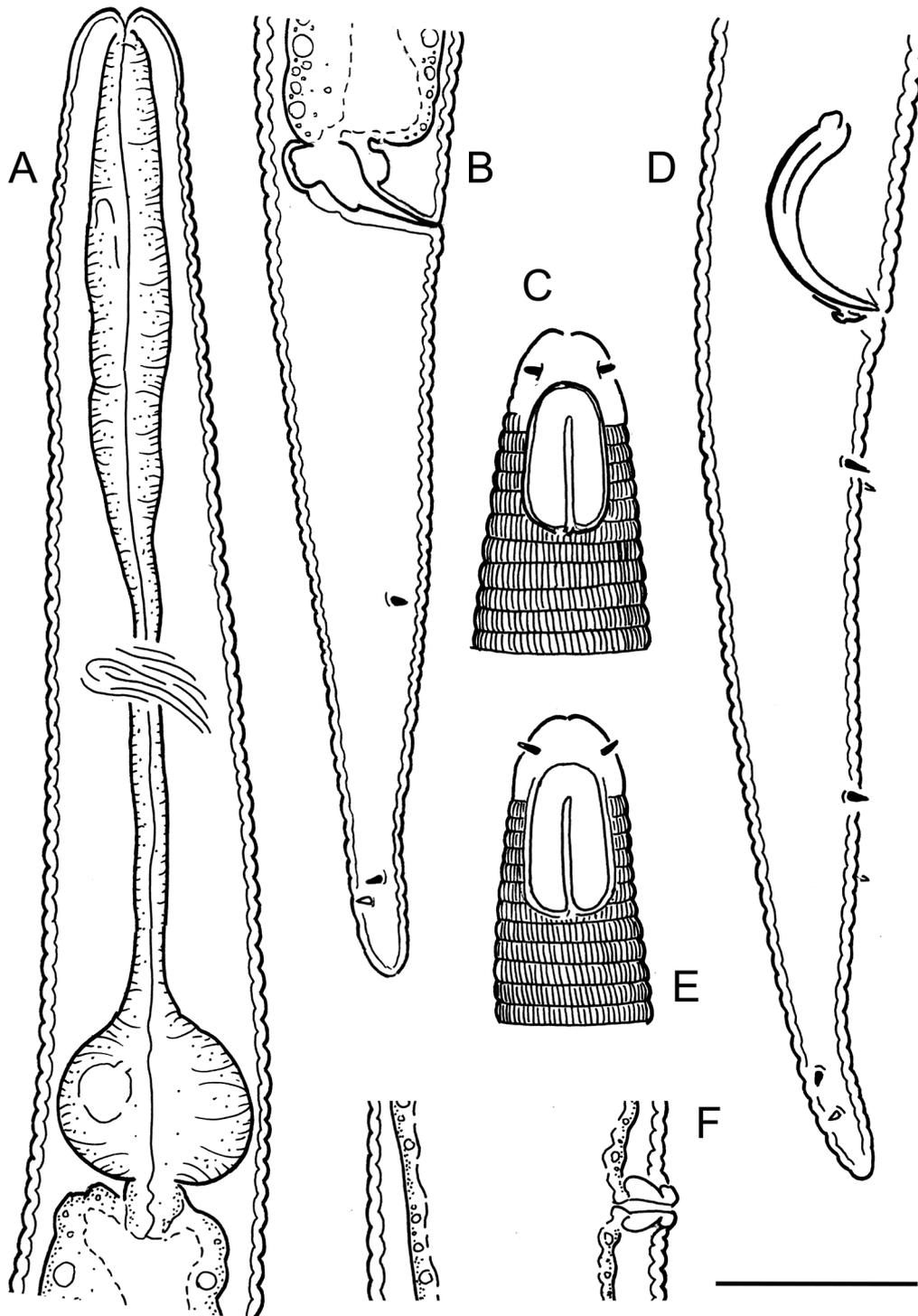


Fig. 8. *Diplopettoides pumilus* (Vincx & Gourbault, 1992) comb. nov. A. Female pharyngeal region, optical median section. B. Female tail. C. Female anterior end, surface view. D. Male tail. E. Male anterior end, surface view. F. Vulval region. Scale bar = 20 µm.

Table 5. Measurements (in μm) of *Diplopetaloides pumilus* (Vincx & Goubault, 1992) comb. nov., presented as mean and (range) for females and each male individual measurement separated with a semicolon; “?” indicates that the character can not be observed or measured.

Sex	Female	Male
Number of specimens	3	2
Body length	543 (520–564)	504; 578
Body diameter (BD)	36 (32–38)	22; 28
Pharynx length	115 (107–121)	121; 119
Tail length	81 (77–85)	77; 91
Anal body diameter (ABD)	20 (19–21)	17; 21
a	15.3 (14.6–16.4)	22.8; 20.4
b	4.7 (4.6–4.9)	4.2; 4.8
c	6.7 (6.6–6.8)	6.5; 6.3
c'	4.0 (4.0–4.1)	4.5; 4.4
V or T (%)	52.4 (52.1–52.9)	?; 44.5
Labial region diameter	10.4 (10.0–12.0)	8.0; 10.5
Cephalic setae length	2.5 (2.0–3.0)	3.0; 2.0
Amphid from anterior end	6.7 (6.0–7.0)	6.0; 5.0
Dorsal amphid branch length	16.3 (16.0–16.5)	19.0; 16.0
Ventral amphid branch length	16.1 (15.0–16.5)	19.0; 16.0
Amphid width	9.0 (7.5–10.5)	9.0; 8.0
Nerve ring from anterior end	65 (62–68)	65; 68
Nerve ring from anterior end as % of pharynx length	58 (56–58)	53; 57
Anterior gonad length (to flexure)	107 (95–130)	–
Posterior gonad length (to flexure)	97 (77–119)	–
Vagina or spicules length	8 (7–9)	24; 26
Rectum or gubernaculum length	14 (14–15)	4; 8
Vagina length / BD	0.2	–
Rectum or spicules / ABD	0.7 (0.7–0.8)	1.4; 1.3

Male

Reproductive system diorchic, testes opposed: anterior testis outstretched and posterior testis reflexed. Spicules paired and symmetrical, strongly curved, with weakly defined manubrium and conoid shaft. Gubernaculum plate-like, without apophyses. Caudal setae present, arranged in subventral and subdorsal rows but difficult to observe and count.

Remarks

The recently collected population of *D. pumilus* is similar to the type specimen in general morphology and measurements, structure of cuticle and anterior end, differing only in the larger body size (0.50–0.58 mm vs 0.29 mm in the type specimen), the longer amphid (16–19 μm vs 10 μm in the type specimen),

the longer tail ($c' = 4.0\text{--}4.5$ vs $c' = 3.5$ in the type specimen) and the longer spicules ($24\text{--}26\ \mu\text{m}$ vs $19\ \mu\text{m}$ in the type specimen). It is also similar to *D. holovachovi* from the Sea of Japan in general morphology, structure of cuticle and anterior end, except for the longer body ($0.50\text{--}0.58\ \text{mm}$ vs $0.43\text{--}0.50\ \text{mm}$ in *D. holovachovi*) and less pronounced sexual dimorphism in the shape of the amphid (more elongated in females vs more rounded in females from the type population).

***Diplopetooides linkei* Jensen, 1991**

Fig 9. A–C; Table 6

Diagnosis

Diplopetooides linkei is characterised by a body of $0.48\text{--}0.63\ \text{mm}$ long; cuticle with longitudinal striation; cuticularised plate underlying cephalic cuticle around amphid present; cephalic sensilla setiform, $2\text{--}3\ \mu\text{m}$ long; amphidial fovea an inverted U-shape, $14\text{--}19\ \mu\text{m}$ long and $7\text{--}8\ \mu\text{m}$ wide; narrow space between amphidial branches not ornamented; secretory-excretory pore located opposite to isthmus; tail conoid; testes opposed; spicules $29\text{--}36\ \mu\text{m}$ long, strongly curved, with round manubrium and subcylindrical shaft; gubernaculum plate-like, without apophyses.

Material examined

SWEDEN: 1 ♂, Skagerrak, $58^{\circ}28'22.1''\text{--}19.2''\ \text{N}$, $10^{\circ}29'35.6''\text{--}43.6''\ \text{E}$, soft bottom $248\text{--}316\ \text{m}$ deep, 11 Oct. 2012, “Inventering Bratten” leg. (SMNH-159564); 1 ♂, Gullmarn Fjord near Lysekil, $58^{\circ}15.73'\ \text{N}$, $11^{\circ}26.10'\ \text{E}$, mud from $53\ \text{m}$ deep, 14 Aug. 2014, O. Holovachov and U. Jondelius leg. (SMNH-159565).

Description

Adult male

Body cylindrical, posteriorly tapering in tail region, weakly curved upon fixation. Cuticle coarsely annulated along entire body, except for smooth anterior end (annulation starts at level of posterior $\frac{1}{4}$ of amphid) and terminal part of tail; annules $3\text{--}4\ \mu\text{m}$ wide at mid-body region; longitudinal striation is distinct under the light microscope, covers annules over entire body length. Somatic setae not observed. Labial region bluntly rounded. Cuticularised plate underlying cephalic cuticle around amphid strongly developed, extending from level of anteriormost edge of amphid to level of posteriormost edge, $18.5\text{--}19\ \mu\text{m}$ long and $13\text{--}14.5\ \mu\text{m}$ wide at base; cuticular plates connected with each other on ventral and on dorsal sides. Inner and outer labial sensilla not seen. Cephalic sensilla setiform, equal to 0.3 labial region diameters in length, their bases are located $3.5\text{--}4\ \mu\text{m}$ from anterior end. Amphidial fovea an inverted U-shape with ventral branch longer than dorsal branch. Narrow space between amphidial branches (amphidial shield) not cuticularised and not ornamented. Stoma very small, its cuticularised lining is uniform with lining of the pharynx. Pharynx distinctly subdivided into anterior corpus and posterior postcorpus; corpus cylindrical or slightly fusiform, muscular; postcorpus consists of anterior narrow non-muscular isthmus and pear-shaped glandular basal swelling. Pharyngeal gland nuclei large, orifices of pharyngeal glands indistinct. Nerve ring surrounding isthmus. Secretory-excretory system present; secretory-excretory pore located along ventral body line opposite to isthmus; secretory-excretory duct very short; renette cell not observed. Tail conoid. Caudal glands opening via three separate openings, spinneret absent. Reproductive system diorchic, testes opposed: anterior testis outstretched and posterior testis reflexed. Spicules paired and symmetrical, strongly curved, with round manubrium and subcylindrical shaft. Gubernaculum plate-like, without apophyses. Caudal setae: two subventral pairs and single subdorsal.

Female

Not found.

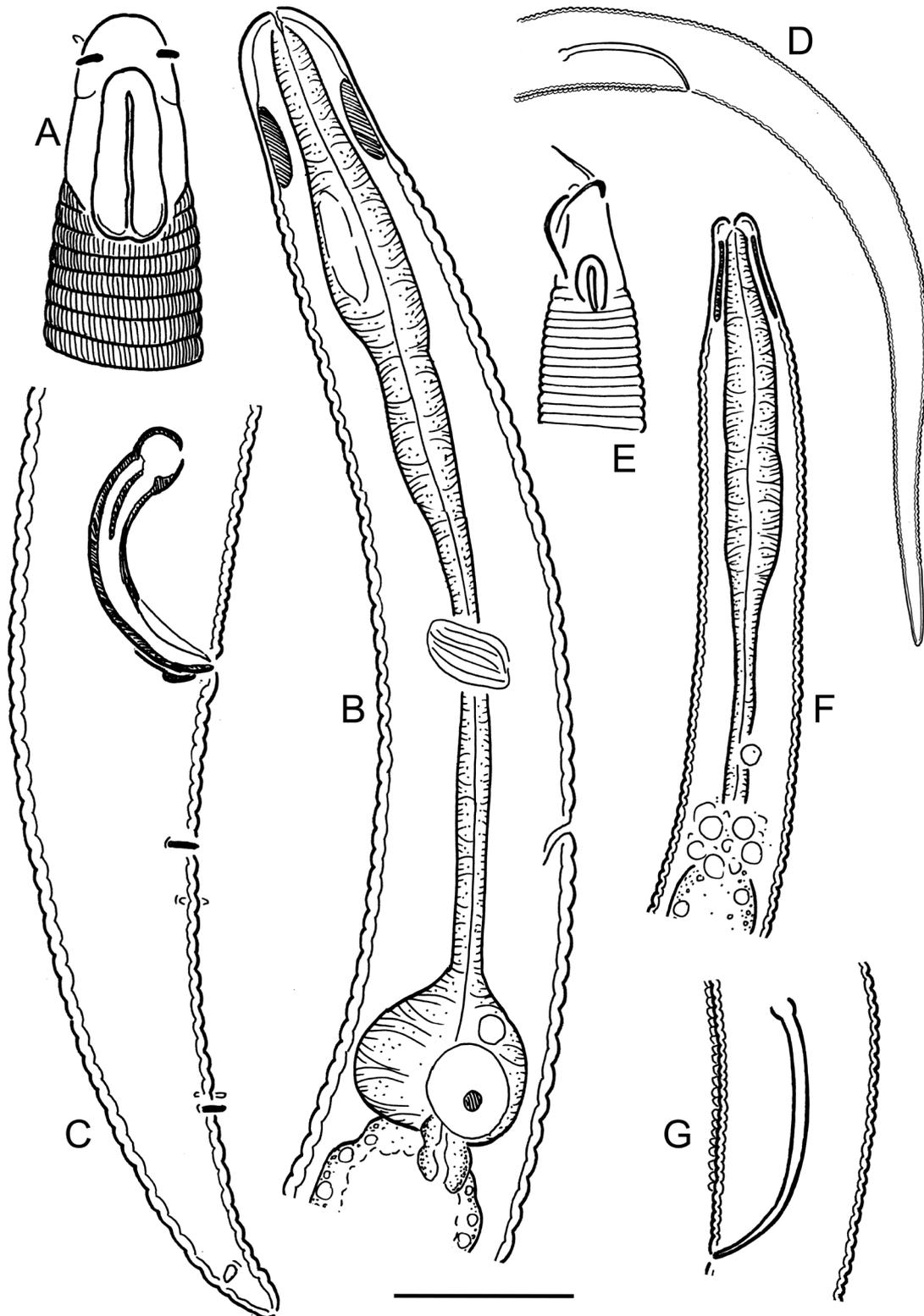


Fig. 9. A–C. *Diplopettoides linkei* Jensen, 1991, male. A. Anterior end, surface view. B. Pharyngeal region, optical median section. C. Tail. — D–G. *Diplopettoides longicaudatus* sp. nov., male. D. Tail. E. Anterior end, surface view. F. Pharyngeal region, optical median section. G. Cloacal region. Scale bar: A–C, E–G = 20 μ m, D = 40 μ m.

Table 6. Measurements (in μm) of *Diplopettoides linkei* Jensen, 1991, *Diplopettoides longicaudatus* sp. nov. and *Diplopettoides grandis* sp. nov. (for *D. linkei*: each male individual measurement separated with a semicolon; “?” indicates that the character can not be observed or measured).

Species	<i>linkei</i>	<i>longicaudatus</i> sp. nov.	<i>grandis</i> sp. nov.
Sex	male	holotype male	holotype female
Number of specimens	2	1	1
Body length	639; 623	1031	2063
Body diameter (BD)	28; 32	20	44
Pharynx length	128; 133	67	131
Tail length	86; 81	93	125
Anal body diameter (ABD)	24; 24	15	30
a	23.1; 19.6	51.5	47.5
b	5.0; 4.7	15.4	15.7
c	7.4; 7.7	11.1	16.5
c'	3.7; 3.3	6.4	4.2
V or T (%)	52.5; 53.6	38.1	58.7
Labial region diameter	10.0; 10.5	5.0	14.0
Cephalic setae length	3.0; 3.0	13.0	18.5
Amphid from anterior end	6.0; 7.0	8.0	12.5
Dorsal amphid branch length	17.0; 18.5	6.0	30.0
Ventral amphid branch length	18.0; 19.0	5.0	25.0
Amphid width	7.5; 8.0	4.0	14.0
Nerve ring from anterior end	75; 81	?	97
Nerve ring from anterior end as % of pharynx length	59; 61	?	74
Secretory-excretory pore from ant. end	95	53	99
Secretory-excretory pore from ant. end as % of pharynx length	74	79	76
Anterior gonad length (to flexure)	–	–	310
Posterior gonad length (to flexure)	–	–	262
Vagina or spicules length	32; 36	27/31	10
Rectum or gubernaculum length	7; 4	?	18
Vagina length / BD	–	–	0.2
Rectum or spicules / ABD	1.4; 1.5	1.9/2.1	0.6

Remarks

The recently collected population of *D. linkei* is similar to the type specimens from the Norwegian Sea in general morphology, structure of cuticle and anterior end, except for the somewhat longer body (0.62–0.63 mm vs 0.48–0.50 mm in type specimens) and longer spicules (32–36 μm vs 29 μm).

Diplopettoides longicaudatus sp. nov.

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Fig. 9 D–G; Table 6

Diagnosis

Diplopettoides longicaudatus sp. nov. is characterised by a body of 1.03 mm long; cuticle without longitudinal striation; cuticularised plate underlying cephalic cuticle around amphid present; cephalic sensilla setiform, 13 µm long; amphidial fovea an inverted U-shape, 6 µm long and 4 µm wide; narrow space between amphidial branches not ornamented; excretory pore indistinct; tail elongate conoid; spicules unequal in size, 27–31 µm long, arcuate, with small ovoid manubrium and subcylindrical shaft; gubernaculum absent; midventral precloacal cuticular ridge present.

Etymology

The specific epithet refers to the characteristic long tail in this species.

Type material

Holotype

SWEDEN: ♂, Skagerrak, 58°20.32'–20.38' N, 11°12.73'–12.68' E, coarse shell sand 14–17 m deep, 19 Aug. 2014, O. Holovachov and U. Jondelius leg. (SMNH Type-8843).

Description

Adult male

Body cylindrical, posteriorly tapering in tail region, strongly ventrally curved upon fixation. Cuticle finely annulated along entire body, except for smooth anterior end and terminal part of tail; annules 1.5 µm wide at mid-body region; longitudinal striation not observed under light microscope. Somatic setae indistinct. Labial region truncate conoid; lips fused. Cuticularised plate underlying cephalic cuticle around amphid weakly developed, extending from level of cephalic setae bases to posteriormost edge of amphid, 9 µm long and 7.5 µm wide at base; cuticular plates connected with each other on ventral and on dorsal sides. Inner and outer labial sensilla not observed. Cephalic sensilla setiform, equal to 2.7 labial region diameters in length, their bases are located 1.5 µm from anterior end. Amphidial fovea an inverted U-shape with dorsal branch longer than ventral branch. Narrow space between amphidial branches (amphidial shield) not cuticularised and not ornamented. Stoma very small, its cuticularised lining uniform with lining of the pharynx. Pharynx distinctly subdivided into anterior corpus and posterior postcorpus; corpus fusiform, muscular; postcorpus consists of anterior narrow non-muscular isthmus and weakly developed basal swelling. Pharyngeal gland nuclei and orifices indistinct. Nerve ring not observed. Secretory-excretory system not observed. Tail elongate conoid. Caudal glands opening via three separate openings, spinneret absent. Reproductive system obscure. Spicules paired and somewhat unequal in size, arcuate, with small ovoid manubrium and subcylindrical shaft. Gubernaculum absent. Midventral cuticular ridge extending anteriorly from about level of middle of spicules for 150 µm towards mid-body. Caudal setae not observed.

Female

Not found.

Remarks

Diplopettoides longicaudatus sp. nov. is unique among known species of *Diplopettoides* in having a precloacal cuticular ridge in males – a feature found in several species of the related genus *Tarvaia* Allgén, 1934 (Holovachov *et al.* 2012). In having a cuticularised plate underlying the cuticle of the anterior end, the new species is similar to *D. ornatus*, *D. linkei*, *D. axayacatli*, *D. grandis* sp. nov. and *D. suecicus*

sp. nov. The new species further differs from *D. ornatus* and *D. linkei* in the structure of cuticle (smooth vs striated under the light microscope); a body length of 1.03 mm vs 0.43–0.63 mm, the length of the cephalic setae (13 µm vs 2–4 µm) and tail ($c' = 6.4$ vs 3.2–4.2); it differs from *D. axayacatli*, *D. grandis* sp. nov. and *D. suecicus* sp. nov. in having no interamphideal shield (vs present and ornamented).

Diplopetooides grandis sp. nov.

[urn:lsid:zoobank.org:act:1954B3FA-0622-45CD-AF8C-EA3954F9EE3C](https://zoobank.org/urn:lsid:zoobank.org:act:1954B3FA-0622-45CD-AF8C-EA3954F9EE3C)

Figs 10, 11B–C; Table 6

Diagnosis

Diplopetooides grandis sp. nov. is characterised by a body of 2.06 mm long; cuticle with longitudinal striation; cuticularised plate underlying cephalic cuticle around amphid present; cephalic sensilla setiform, 18.5 µm long; amphidial fovea an inverted U-shape, 30 µm long and 14 µm wide; wide space between amphidial branches punctate; excretory pore indistinct; tail conoid.

Etymology

The specific epithet refers to the large body size in this species.

Type material

Holotype

SWEDEN: ♀, Skagerrak, 58°20.32'–20.38' N, 11°12.73'–12.68' E, coarse shell sand 14–17 m deep, 19 Aug. 2014, O. Holovachov and U. Jondelius leg. (SMNH Type-8844).

Description

Adult female

Body cylindrical, posteriorly tapering in tail region, curved upon fixation. Cuticle coarsely annulated along entire body, except for smooth anterior end and terminal part of the tail; annules 3 µm wide at mid-body region; longitudinal striation is distinct under light microscope, covers annules over entire body length. Somatic setae indistinct. Labial region truncate conoid, lips fused. Cuticularised plate underlying cephalic cuticle around amphid strongly developed, extending from the level of cephalic setae bases to the posteriormost edge of amphid, 38 µm long and 23 µm wide at base; cuticular plates connected with each other on ventral and on dorsal sides. Inner labial sensilla not seen, outer labial sensilla small papilliform, located on the anterior surface of lips. Cephalic sensilla setiform, equal to 1.4 labial region diameters in length, their bases located 4 µm from anterior end. Amphidial fovea an inverted U-shape with dorsal branch longer than ventral branch. Wide space between amphidial branches (amphidial shield) heavily cuticularised and punctate. Stoma very small, its cuticularised lining uniform with lining of the pharynx. Pharynx distinctly subdivided into anterior corpus and posterior postcorpus; corpus fusiform, muscular; postcorpus consists of anterior narrow non-muscular isthmus and pear-shaped glandular basal swelling. Pharyngeal gland nuclei and orifices indistinct. Nerve ring surrounding isthmus. Secretory-excretory system not observed. Tail conoid. Caudal glands opening via three separate openings, spinneret absent. Reproductive system didelphic, amphidelphic, reflexed; ovary branches symmetrical. Anterior ovary situated to right of intestine; posterior ovary situated to left of intestine. Vulva a transverse slit, located immediately posterior to mid-body. Vagina straight, 0.2 of the vulval body diameter, with thick walls; *pars refringens vaginae* absent. Intrauterine egg or sperm not observed. Rectum short, 0.6 of the corresponding body diameter long.

Male

Not found.

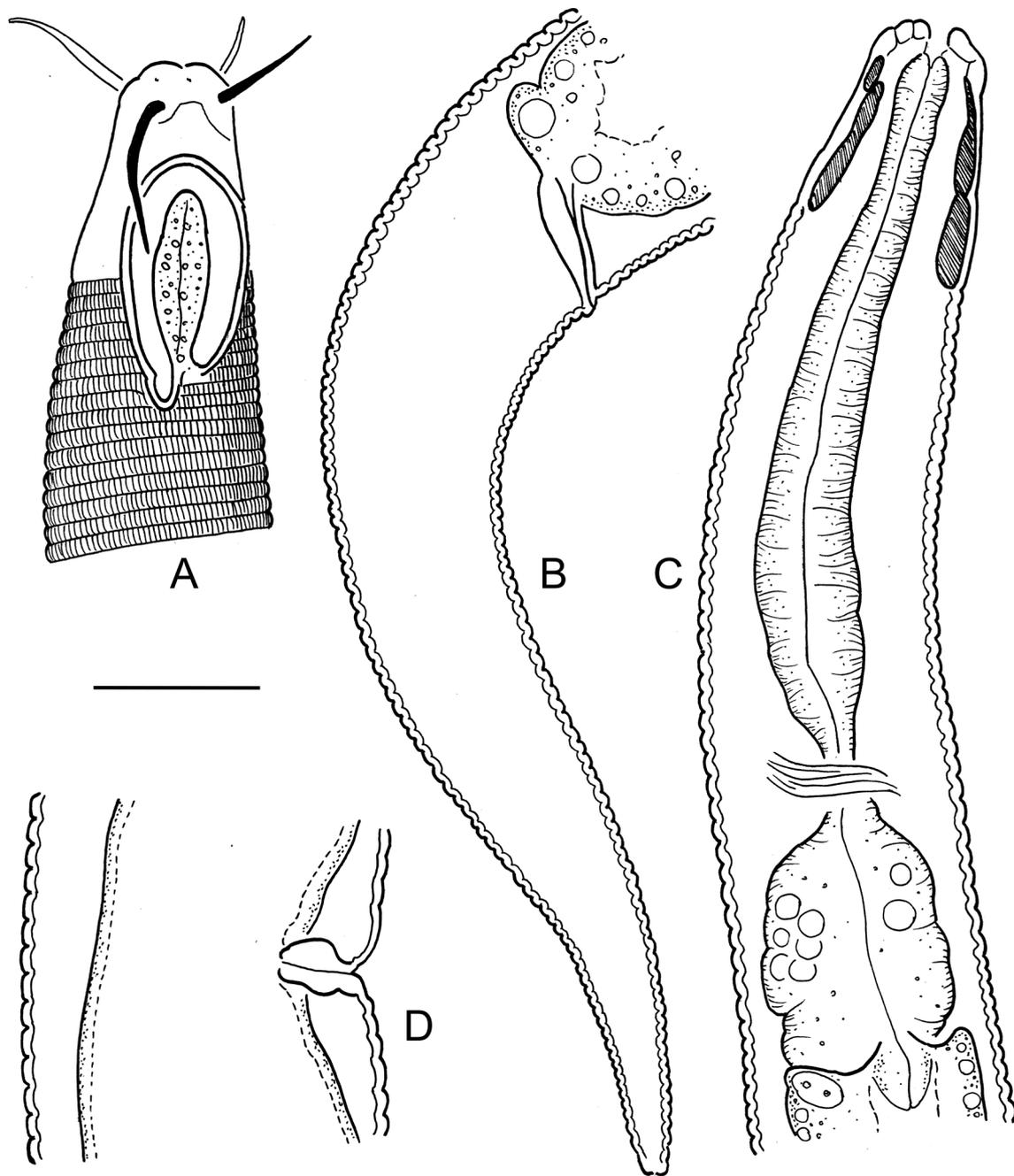


Fig. 10. *Diplopeltoides grandis* sp. nov. **A.** Female anterior end, surface view. **B.** Female tail. **C.** Female pharyngeal region, optical median section. **D.** Vulval region. Scale bar = 20 μ m.

Remarks

Diplopetooides grandis sp. nov. is most similar to *D. axayacatli* in having a relatively large body size, a distinctly striated cuticle and a developed cuticularised plate. The new species differs from *D. axayacatli* in the shape of the amphid (loop-shaped, with parallel branches vs hook-shaped, with one of the branches bent inward, in *D. axayacatli*) and its size ($30 \times 14 \mu\text{m}$ vs $11\text{--}15 \times 8\text{--}9 \mu\text{m}$ in *D. axayacatli*).

Key to species of *Diplopetooides*

See Table 7 for additional diagnostic characters.

- 1. Body shorter than 0.7 mm; testes opposed 2
 - Body longer than 0.8 mm; testes outstretched 4
- 2. Cuticularised plate present; annulation starts at the posterior $\frac{1}{4}$ th of amphid 3
 - Cuticularised plate absent; annulation starts at the anterior $\frac{1}{4}$ th of amphid
 *D. pumilus* (Vincx & Gourbault, 1992) comb. nov.
- 3. Spicules $22 \mu\text{m}$ long; gubernaculum triangular *D. ornatus* (Gerlach, 1950)
 - Spicules $29\text{--}36 \mu\text{m}$ long; gubernaculum plate-like *D. linkei* Jensen, 1991
- 4. Cuticular annules with longitudinal striation distinctly visible under the light microscope 5
 - Cuticular annules visually smooth under light microscope, longitudinal striation may be visible under scanning electron microscope 9
- 5. Cuticularised plate present 6
 - Cuticularised plate absent 7

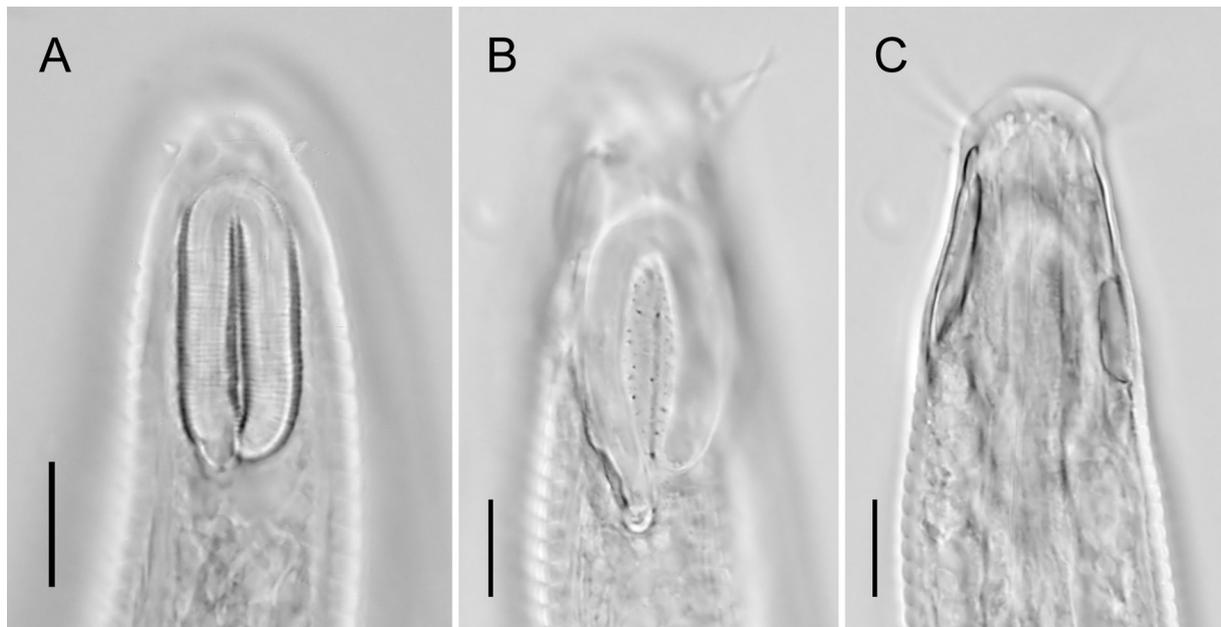


Fig. 11. Light microscopy images of anterior ends. **A.** *Diplopetooides bulbosus* (Vitiello, 1972) comb. nov., female, amphid. — **B–C.** *Diplopetooides grandis* sp. nov., holotype, female. **B.** Amphid. **C.** Cuticularised plate. Scale bars: A–C = $20 \mu\text{m}$.

6. Amphid hook-shaped
 *D. axayacatli* Holovachov, Tandingan De Ley, Mundo-Ocampo, Gingold & De Ley, 2009
 – Amphid an inverted U-shaped *D. grandis* sp. nov.
7. Interamphideal shield crenate
 *D. santaclarae* Holovachov, Tandingan De Ley, Mundo-Ocampo, Gingold & De Ley, 2009
 – Interamphideal shield smooth 8
8. Body 1.7 mm long; spicules 17 µm long *D. striatus* (Gerlach, 1956) comb. nov.
 – Body 1.0–1.2 mm long; spicules 25 µm long *D. pulcher* (Vincx & Gourbault, 1992)
9. Amphidial fovea with fine transverse striation *D. bulbosus* (Vitiello, 1972) comb. nov.
 – Amphidial fovea without fine transverse striation 10
10. Cuticular plate present 11
 – Cuticular plate absent 12
11. Cephalic setae 4–6 µm long; amphid 14–21 µm long; precloacal ridge absent
 *D. sueticus* sp. nov.
 – Cephalic setae 13 µm long; amphid 6 µm long; precloacal ridge present
 *D. longicaudatus* sp. nov.
12. Amphid with wide interamphideal area 13
 – Amphid with narrow interamphideal area 16
13. Interamphideal area smooth, without ornamentation 14
 – Interamphideal area punctated, areolated or crenated 15
14. Cephalic setae 17 µm long *D. botulus* (Wieser, 1959) comb. nov.
 – Cephalic setae 5 µm long *D. sundensis* (Jensen, 1978)
15. Cephalic setae 12–18 µm long; amphid 21–26 µm long
 *D. paramastigia* Holovachov, Tandingan De Ley, Mundo-Ocampo, Gingold & De Ley, 2009
 – Cephalic setae 6.5–8.5 µm long; amphid 40–45 µm long *D. mastigia* Tchesunov, 1990
16. Cephalic setae longer than 10 µm *D. lucanicus* (Boucher & Helléouët, 1977) comb. nov.
 – Cephalic setae shorter than 10 µm 17
17. Cephalic setae 3.5–7 µm long *D. aetosus* (Juario, 1974) comb. nov.
 – Cephalic setae less than 1–2 µm long 18
18. Spicules with dorsally bent manubrium; amphid 17–28 µm long
 *D. nudus* (Gerlach, 1956)
 – Spicules with straight manubrium; amphid 26–33 µm long
 *D. anatolii* (Voronov, 1982)

Discussion

When proposing the new genus *Diplopeltoides*, Gerlach (1962) traditionally did not provide a proper differential diagnosis for his new taxon, merely stating that the type species of the new genus, *Diplopeltis ornatus*, had “complicated cuticular structure and a ring-shaped cephalic capsule”. The exact meaning of the phrase “complicated cuticular structure” is unclear and the utility of this character for a generic

Table 7 (continued on next page). Selected diagnostic characters of species of the genus *Diplopetloides* based on literature data supplemented with recent observations (NA = data not available).

	Body length (mm)	Cuticle under light microscope	Amphid shape	Interamphideal shield	Cuticularised plate	Cephalic setae length (µm)	Amphid length × width	Secretory-excretory pore (%)	Spicules (µm)	Gubernaculum apophysis	Tail (c°)	Special features
<i>D. anatolii</i>	0.78-1.12	smooth	narrow loop	absent	absent	2	26-33 × 7	?	40 (chord)	present	2-3	
<i>D. asetosus</i> comb. nov.	0.76-1.19	smooth	wide loop	punctate	absent	3.5-7	14-19 × 6-8	85-92	17-31	present	4.1-5.7	
<i>D. axyacatli</i>	1.45-1.82	striated	wide hook	crenate or punctate	present	15-20	11-15 × 8-9	89-91	31-32	absent	5.0-6.0	
<i>D. botulus</i> comb. nov.	1.66	smooth	wide loop	smooth	absent	17	23 × ?	~60	NA	NA	6.8	
<i>D. bulbosus</i> comb. nov.	1.12-1.58	smooth	narrow loop	absent	absent	1-2	21-28 × 7-11	84-92	34-50	absent or present	2.3-3.8	amphid striated
<i>D. grandis</i> sp. nov.	2.06	striated	wide loop	punctate	present	19	30 × 14	76	NA	NA	4.2	
<i>D. linkei</i>	0.48-0.63	striated	narrow loop	absent	present	2-3	14-19 × 7-8	75	29-36	absent	3.2-4.2	rod-like gubernaculum
<i>D. longicaudatus</i> sp. nov.	1.03	smooth	narrow loop	absent	present	13	6 × 4	79	27-31	absent	6.4	precloacal ridge
<i>D. lucanicus</i> comb. nov.	1.22-1.50	smooth	narrow loop	crenate	absent	11-16	33-39 × 10-11	?	27-28	present	7-8	
<i>D. mastigia</i>	1.54-2.48	smooth	wide loop	punctate	absent	6.5-8.5	40-45 × 14-17	?	25-37	absent	7.2-7.6	spicules asymmetrical

	Body length (mm)	Cuticle under light microscope	Amphid shape	Interamphideal shield	Cuticularised plate	Cephalic setae length (µm)	Amphid length × width	Secretary- excretory pore (%)	Spicules (µm)	Gubernaculum apophysis	Tail (c')	Special features
<i>D. nudus</i>	0.94–1.35	smooth	narrow loop	crenate	absent	1–1.5	17–28 × 6–8	86–92	29–38	absent or present	3.5–5.0	
<i>D. ornatus</i>	0.43–0.49	striated	narrow loop	absent	present	4	20 × 7	55	22	absent	3.5	triangular gubernaculum
<i>D. paramastigia</i>	1.18–1.79	smooth	narrow loop	punctate to crenate	absent	12–18	21–26 × 10–13	82–99	28	present	6.2–12.3	
<i>D. pumilus</i> comb. nov.	0.29–0.58	striated	narrow loop	absent	absent	2–3	♀ 8–17 × 8–11 ♂ 10–19 × 8–9	absent	19–27	absent	3.5–4.5	plate-like gubernaculum
<i>D. pulcher</i>	1.07–1.15	striated	wide loop	smooth	absent	16	♀ 15 × 9 ♂ 23 × 14	90–95	25	absent	6.0–7.6	amphid dimorphic
<i>D. santaclarae</i>	1.63–2.04	striated	narrow loop	crenate	absent	16–19	27–33 × 10–14	92–96	30	present	5.7–6.9	
<i>D. striatus</i> comb. nov.	1.74	striated	wide loop	smooth	absent	12–15	22 × 10	~90	17	absent	4.8–5.5	spicule shape
<i>D. suecicus</i> sp. nov.	0.82–1.02	smooth	wide loop	punctate	present	4–6	14–21 × 6–9	78–94	27–31	present	2.8–3.7	
<i>D. sundensis</i>	1.12	smooth	wide loop	smooth	absent	5	17 × 8	~95	25	present	4.5	two supplements

diagnosis is questionable. In the original description, the cuticle of *D. ornatus* is described as having a fine longitudinal striation (Gerlach 1950). The same character is typical of *Diplopettula striata* (Gerlach 1956) and maintained in the description of the genus *Diplopettula* (Gerlach 1962). None of the original distinguishing characters were mentioned by Lorenzen (1981), who removed the genus *Diplopetooides* from the family Diplopettidae based on the morphology of the female reproductive system (antidromously reflexed ovaries) as one of the main diagnostic characters. The other diagnostic character was the structure of the pharynx, with “thin walls and no muscle in the middle section” and a basal swelling. Tchesunov (1990) used these characters further to support the creation of the monotypic family Diplopetooididae. He also suspected that many species of the genus *Diplopettula* would be transferred to *Diplopetooides* when new data on the morphology of the digestive and reproductive structures came to light. Subsequent publications (Tchesunov 2006; Holovachov *et al.* 2009) proved him to be correct.

The genus *Diplopettula* was retained in the family Diplopettidae by both Lorenzen (1981) and Tchesunov (1990); one of the diagnostic characters of this family being the presence of outstretched ovaries. The problem, however, is that the original description of the type species *Diplopettula breviceps* Gerlach, 1950 does not include clear descriptions of the pharynx or of the female reproductive system – features that are used not only to distinguish *Diplopetooides* from *Diplopettula*, but also from the recently proposed *Mudwigglus* Leduc, 2013 (Leduc 2013). Thus, even though the majority of species currently placed in the genus *Diplopettula* by Leduc (2017) are characterized by a cylindrical pharynx (with or without posterior bulb) and outstretched ovaries, both characters are unknown for the type species of the genus (Gerlach 1950) and cannot be used as diagnostic for the genus. By ignoring the female morphology in his descriptions, and not preserving any type material of his new species, S. Gerlach left marine nematology with a number of unresolved taxonomic issues, such as the taxonomic status of the genus *Diplopettula*. Until new specimens of *Diplopettula breviceps* are collected from the type locality and re-described in detail, the status of the genus *Diplopettula* and its species will remain uncertain. The most logical approach would be to consider *Diplopettula breviceps* a *species inquirenda*, consider *Diplopettula* a *genus inquirendum* and transfer all other species currently placed in it into other well defined existing or newly proposed genera.

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