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Nine new and less known nematode species from the deep-sea benthos of the Norwegian Sea

Preben Jensen
Marine Biological Laboratory, University of Copenhagen, Strandpromenaden 5, DK-3000 Helsingør, Denmark

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Abstract

Eight new and one less known nematode species are described from Vöring Plateau at 970 m to 1426 m depth and adjacent deep-sea plain at 3062 m depth in the Norwegian Sea: *Actinonema grafi* sp. nov., *Desmodora pilosa* Ditlevsen, 1926, *Leptolaimus meyer-reili* sp. nov., *Tarvaia heegeri* sp. nov., *Diplopeltoides linkei* sp. nov., *Diplopeltis bathmanni* sp. nov., *Southerniella nojii* sp. nov, *Pararaeolaimus rumohri* sp. nov. and *Theristus altenbachi* sp. nov. Differential diagnoses to the eight new species are given.

Actinonema grafi, *Leptolaimus meyer-reili* and *Theristus altenbachi* are frequently found on Vöring Plateau and belong to the most dominant species, whereas *Desmodora pilosa* and *Pararaeolaimus rumohri* are dominant species at few sites only. The other species occur sporadically, in few numbers, and belong – as do *Pararaeolaimus rumohri* – to seldomly reported nematode genera.

Introduction

A large collection of nematodes was sampled during two cruises of R/V *Meteor* in 1986 and 1988 to the Norwegian Sea because nematodes turned out to be suitable biological tools in discriminating environmental heterogeneity in the deep-sea benthos (cf. Jensen, 1988a; Jensen *et al.*, 1991). More than 100 nematode species were found of which only few species were known (cf. Jensen, 1988b, 1991a). Present study includes the descriptions of eight new species and redescription of a poorly known species, and is part of a series of papers describing nematode species from the deep-sea benthos of the Norwegian Sea (Jensen, 1988b, 1991a,b).

Material and methods

Benthos samples were collected with a box corer (50 cm × 50 cm × 50 cm) from R/V *Meteor* during a cruise from 19 June to 2 July 1986 in the Norwegian Sea. Further samples were obtained with a multicorer (a series of cylindrical tubes, 10 cm in diameter) penetrating about 30 cm deep into the sediments during a second cruise from 19 to 30 August 1988. Sediments consisted mainly of clay; results of a detailed granulometrical analysis are given by Jensen *et al.* (1991). Station data are shown in Table 1. Subsamples were immedi-

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Table 1. Station data in the Norwegian Sea (*Meteor* cruises 2/1 and 7/4)

Sta.	Date	Coordinates		Depth (m)
		Lat. (°N)	Long.	
59	22 June 1986	65°31,0′	00°07,1′W	3062
61	23 June 1986	67°43,1′	05°55,4′E	1245
66	24 June 1986	67°39,1′	05°47,7′E	1426
70	25 June 1986	66°59,9′	07°45,7′E	970
80	28 June 1986	70°15,6′	03°21,8′W	2133
84	30 June 1986	67°41,9′	03°43,0′E	1255
468	19 August 1988	67°44,1′	05°55,0′E	1245
476	21 August 1988	67°39,2′	05°47,1′E	1424
489	23 August 1988	67°46,5′	06°00,1′E	1286
504	25 August 1988	67°48,3′	06°01,2′E	1310
519	27 August 1988	67°41,4′	05°51,8′E	1325
532	30 August 1988	67°40,4′	05°49,9′E	1400

ately fixed in 4% formalin and stained with Bengal Rose. The nematode fauna was extracted and concentrated on a sieve with a mesh size of 45 µm. The nematodes were mounted in glycerol on glass slides and examined using a Leitz Orthoplan microscope with a camera lucida. For abbreviations and formula used, see Jensen (1978). The material is deposited in the nematode collection, Alfred-Wegener-Institut für Polar- und Meeresforschung, Bremerhaven, Federal Republic of Germany (NSIMB)

Results

Actinonema grafi sp. nov. (Fig. 1)

Material. Fifty-one males, sixty-five females, twenty-six juveniles.

Type locality. Deep-sea benthos of the Norwegian Sea at station 468.

Other localities. Deep-sea benthos of the Norwegian Sea at stations 59, 66, 70, 476, 519, 532.

Measurements

Holotype

σ'_1 3 – 160 M 714 / 11 – 30 34 28

L = 0.86 mm a = 25 b = 5.4 c = 5.8

(slide no. NSIMB 561.1)

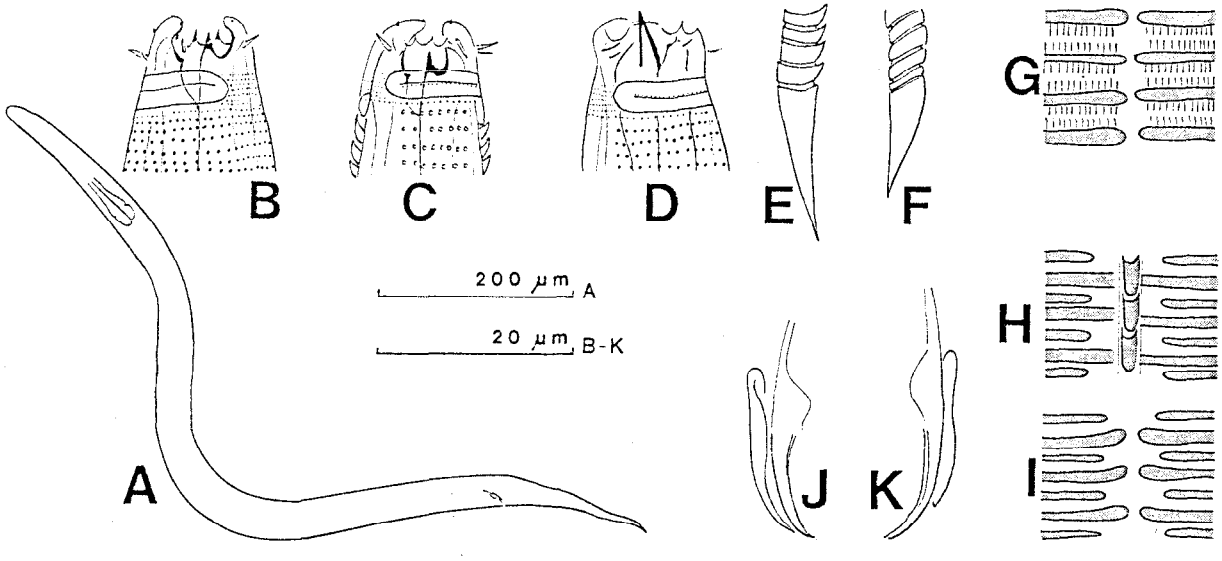

Fig. 1. Actinonema grafi sp. nov. A. Total view of σ'_1; B. Head of σ'_1; C. Head of σ'_3; D. Head of φ_2; E. Tail tip of φ_2; F. Tail tip of σ'_1; G. Lateral cuticular differentiation in low focus at pharyngeal-intestinal junction of σ'_2; H. Lateral cuticular differentiation in high focus at mid-body of σ'_2; I. Similar to H, but in low focus; J. Copulatory apparatus of σ'_1; K. Copulatory apparatus of σ'_2.

Paratypes

♂2 3 – 179 M 807
13 – 33 34 27
L = 0.95 mm a = 28 b = 5.3 c = 6.5
(slide no. NSIMB 561.2)

♂3 3 – 174 M 982
10 – 35 42 28
L = ca. 0.95 mm (tail tip broken)
a = (23) b = (5.5) c = (8.2)
(slide no. NSIMB 561.3)

♀1 3 – 224 641 1063
11 – 33 49 22
L = 1.27 mm a = 26 b = 5.7 c = 6.1
V = 51%
(slide no. NSIMB 561.4)

♀2 3 – 160 438 750
12 – 29 45 24
L = 0.90 mm a = 20 b = 5.6 c = 6.1
V = 49%
(slide no. NSIMB 561.5)

5 females L = 0.88–0.97 mm
a = 16–23 b = 4.9–5.6 c = 3.6–6.4
V = 50–57%
(Two females on slides nos NSIMB 561.6–7)

5 juveniles L = 0.56–0.67 mm
a = 25–34 b = 5.1–6.8 c = 5.1–7.2
(One juvenile on slide no. NSIMB 561.8)

Description

Males. Body slender and attenuating towards the ends. Cuticle annulated and ornamentated with dots. Lateral differentiation of dots appears in posteriormost half of pharyngeal region as an open field (Fig. 1G) which continues into a *ca.* 3 µm wide and raised lateral field through the body to tail region (Fig. 1 H-I). Body cuticle is elsewhere around the body decorated with transverse bars (Fig. 1G); cuticle without dots in front of amphids and on tail tip. Cephalic sense organs in two circles as six internal labial papillae and a circle consisting of six external labial setae 2–3 µm long and four cephalic setae 1–2 µm long. Few somatic setae in pharyngeal region and on tail. Amphids describing a transverse loop, 10–12 µm wide, or 80–85% of corresponding body diameter, anterior border situated 5 µm behind front end. Mouth opening surrounded by sclerotized rugae; buccal cavity with a prominent dorsal tooth and two small subventral projections. Pharynx slightly expanded at both ends, elsewhere cylindrical. Spicules slender, 24–31 µm along the arc, distally curved and strongly sclerotized, proximal half weakly sclerotized and with a curvature; gubernaculum as a prominently sclerotized rod, 15–23 µm long. One testis, anteriorly directed and outstretched; its location compared to intestine is variable: out of ten specimens analyzed, seven had testis to the right of intestine and three specimens had testis to the left.

Females. Similar to males in most respects. Tail relatively longer and more slender with a longer tail tip. Ovaries opposite and reflexed; their position compared to intestine is variable: out of ten specimens analyzed, seven had anterior branch to the right and posterior branch to the left of the intestine, two specimens had anterior branch to the left and posterior branch to the right of the intestine, and one specimen had both branches to the left of the intestine.

Juveniles. Resemble females.

Discussion

Actinonema grafi sp. nov. (named for Dr G. Graf, co-worker in the SFB 313 team) differs from the other four known species of the genus by the combination of its very anteriorly located amphids and weakly sclerotized proximal portion of spicules. *A. celtica* Boucher, 1976 has a copulatory apparatus similar to *A. grafi*, but in addition the somatic setae and lateral cuticular differentiation are much different.

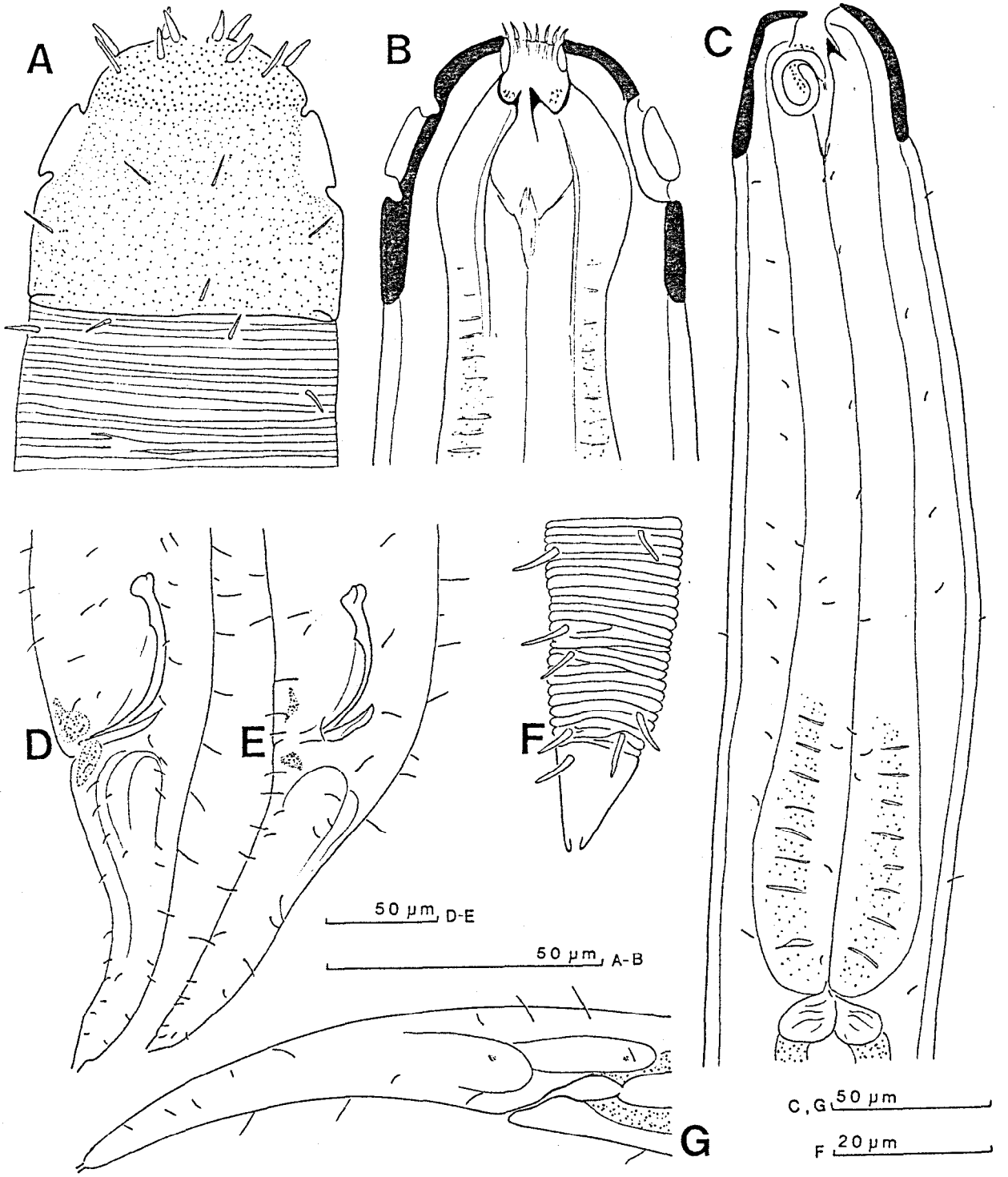

Fig. 2. Desmodora (Desmodora) pilosa Ditlevsen, 1926. A. Head in subdorsal surface view of ♂$_1$; B. Head in subdorsal longitudinal view of ♂$_1$; C. Pharyngeal region of ♂$_2$; D. Posterior end of ♂$_2$. E. Posterior end of ♂$_1$; F. Tail tip in surface view of ♂$_1$; G. Posterior end of juvenile.

Desmodora (Desmodora) pilosa Ditlevsen, 1926 (Figs. 2–3) *Desmodora* sp. in Jensen (1988a)

Material. Two males, two females, twenty-one juveniles

Localities. Deep-sea benthos of the Norwegian Sea at stations 59, 61, 70, 80, 468, 489.

Measurements

δ_1 6 – 323 M 2980
31 – 74 93 60
L = 3.18 mm a = 34 b = 9.8 c = 16.2
(slide no. NSIMB 561.9)

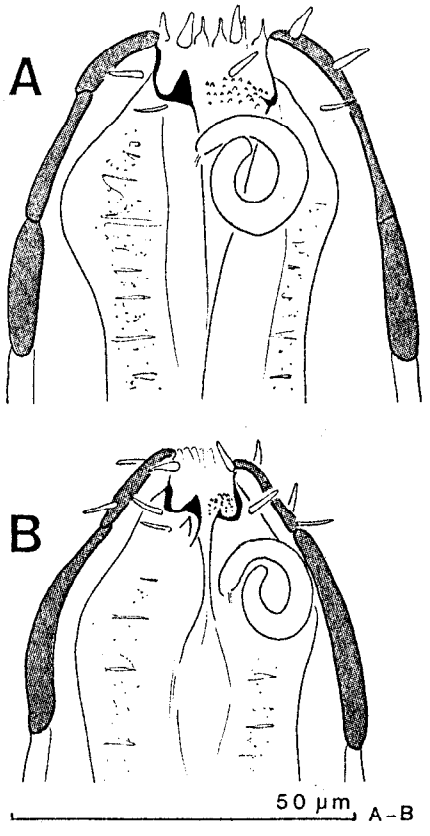

Fig. 3. Desmodora (Desmodora) pilosa Ditlevsen, 1926. A. Head end in longitudinal view of φ_1; B. Head end in longitudinal view of juvenile.

δ_2 – – 346 M 2672
– – 75 93 60
L = 2.82 mm a = 30 b = 8.1 c = 19.2
(slide no. NSIMB 561.10)

1 female (only anteriormost half present)
(slide no. NSIMB 561.11)

8 juveniles L = 0.89–1.74 mm
a = 28–36 b = 4.6–8.6 c = 7.1–11.1
(slides nos NSIMB 561.12–14)

Description

Males. Body relatively slender and attenuating towards the ends. Cuticle annulated from basis of cephalic capsule to tail tip, each annule about 1.5 µm wide and cuticle up to 5 µm thick. Somatic setae in four submedian rows, a ventral row and a dorsal row, setae varying between 5 µm and 14 µm in length. Cephalic capsule decorated with dots. Cephalic sense organs setose and in three separate crowns: six internal labial stout setae 6 µm long, six stout external labial setae 9 µm long, and four slender cephalic setae 9 µm long; front end of δ_2 is damaged, hence cephalic sense organs can not be observed clearly. Subcephalic setae 7 µm long as four submedian setae 26 µm behind front end and four sublateral setae 35 µm behind front end. Amphids slightly elongated in longitudinal direction and describing a 1¼-turned spiral, 21 µm long and 20 µm wide, i.e. 23% of corresponding body diameter. Mouth opening surrounded by sclerotized rugae; buccal cavity with one dorsal tooth, small subventral teeth and a large area of denticles along ventral sector. Pharynx expanded around the buccal cavity, elsewhere cylindrical, posteriorly slightly enlarged. Spicules slender and curved, proximally cephalated, 85–96 µm along the arc, 71–78 µm from tip to tip; gubernaculum rod-shaped, 36–45 µm long. Copulatory gland cells present at cloacal opening. Reproductive system indistinct.

Females. Only anteriormost half of bodies present. They are in accord with males.

Juveniles. The juveniles resemble adults, but with more slender tails than in males. Some juveniles have a replacement tooth posterior to the dorsal tooth.

Discussion

Desmodora (Desmodora) pilosa was described by Ditlevsen (1926) based on a single female from the deep-sea benthos of Davis Strait (NE Greenland Sea). The description is not very good, but the body shape, cephalic sense organs, somatic setae and amphids are similar to my material. Moreover, since I have found only present desmodorid species among several thousands of nematodes from the deep-sea benthos of the Norwegian Sea I prefer to identify my material as *D. pilosa*. My material is in accord with the detailed descriptions of *D. gorbunovi* Filipjev, 1946 and *D. gorbunovi* subsp. *perforata* Filipjev, 1946 based on material from New Siberian Islands; both species were synonymized with *D. pilosa* by Gerlach (1963). Present redescription gives new information on the presence of denticles in the buccal cavity and the structure of the copulatory apparatus.

Leptolaimus (Tubulaimus) meyer-reili sp. nov. (Figs. 4–5) *Leptolaimus* sp. 2 in Jensen (1988a)

Material. Twenty-one males, two hundred and eighty females, one hundred and sixty-four juveniles.

Type locality. Deep-sea benthos of the Norwegian Sea at station 468.

Other localities. Deep-sea benthos of the Norwegian Sea at stations 59, 61, 66, 70, 80, 84, 476, 489, 504, 512, 532.

Measurements

Holotype

♂1 $\frac{3 - 137\ M\ 444}{5 - 19\ 20\ 17}$
L = 0.54 mm a = 24 b = 4.0 c = 5.6
(slide no. NSIMB 561.15)

Paratypes

♂2 $\frac{3 - 123\ M\ 491}{6 - 20\ 20\ 18}$
L = 0.55 mm a = 28 b = 4.5 c = 6.2
(slide no. NSIMB 561.16)

♂3 $\frac{3 - 135\ M\ 471}{5 - 20\ 21\ 18}$
L = 0.58 mm a = 28 b = 4.2 c = 5.7
(slide no. NSIMB 561.17)

♀1 $\frac{3 - 143\ 351\ 563}{5 - 21\ 24\ 17}$
L = 0.66 mm a = 27 b = 4.7 c = 6.5
V = 53%
(slide no. NSIMB 561.18)

♀2 $\frac{2 - 135\ 301\ 452}{6 - 23\ 24\ 14}$
L = 0.52 mm a = 21 b = 3.8 c = 8.3
V = 59%
(slide no. NSIMB 561.19)

♀3 $\frac{3 - 145\ 335\ 533}{5 - 21\ 24\ 15}$
L = 0.62 mm a = 26 b = 4.3 c = 6.8
V = 54%
(slide no. NSIMB 561.20)

2 females L = 0.54–0.56 mm
a = 28 b = 4.1–4.3 c = 5.9–6.7
V = 54%
(slides nos NSIMB 561.21–22)

1 juvenile L = 0.51 mm a = 27 b = 4.1 c = 6.2

Description

Males. Body slender and attenuating towards the ends with a sclerotized, conical tail tip. Cuticle annulated from head to tail tip, each annule about 1 µm wide, but slightly wider on posteriormost portion of tail. A 1.5 µm wide lateral field raised above the cuticle from midpharyngeal region to anteriormost half of tail. Sublateral cuticular pores present, each with a minute seta; up to four 2–3 µm long subventral setae on tail and anal region. Four cephalic setae, 2 µm long. Amphids ventrally wounded and circular in outline, 5 µm in

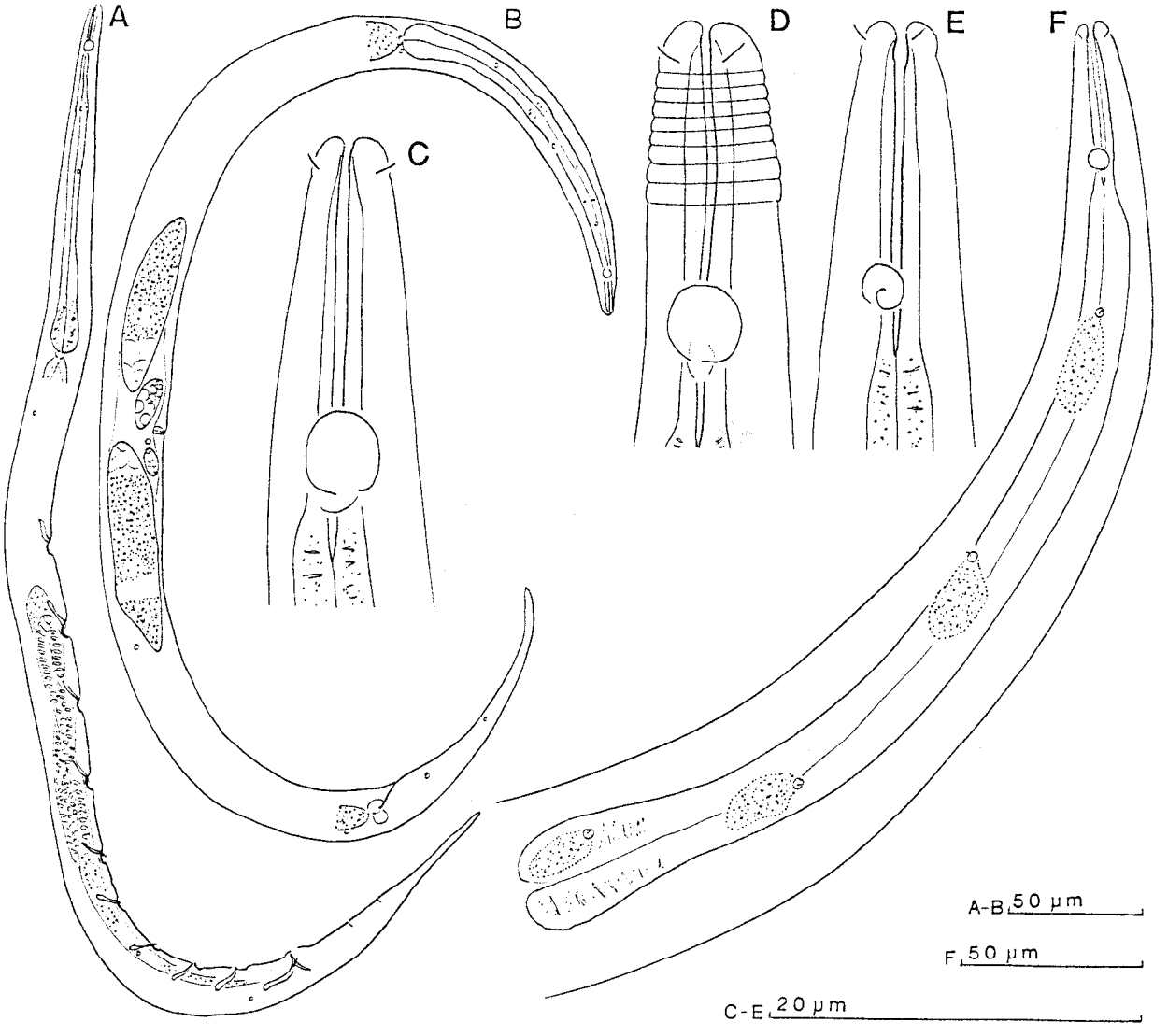

Fig. 4. Leptolaimus (Tubulaimus) meyer-reili sp. nov. A. Total view of ♂$_1$; B. Total view of ♀$_1$; C. Anterior end of ♂$_1$; D. Anterior end of ♂$_2$; E. Anterior end of juvenile; F. Pharyngeal region of ♀$_2$.

diameter or 53–60% of corresponding body diameter, anterior border situated 13–15 µm behind front end. Buccal cavity narrow and tubular continuing in a 19–23 µm long tubular pharyngeal region surrounded by a thin sheet of musculature; mid-pharyngeal region 6–7 µm wide and slightly expanded 39–43 µm behind front end; posteriormost portion of pharynx expanded to a pyriform bulb. Spicules bent, proximally cephalated, 19–22 µm along the arc, 16–18 µm from tip to tip; gubernaculum with a 8–9 µm long dorso-caudal apophyses, lateral sclerotization present. One testis present, outermost half reflexed and mostly right of intestine. Nine almost equi-distant precoacal supplements present appearing as sclerotized tubes, proximally cephalated, distally dentated and surrounded by a sickle-shaped sclerotization; anteriormost supplement 220–240 µm from anal opening.

Females. Similar to males in most respects. Amphids smaller, 3–4 µm in diameter or 40% of cor-

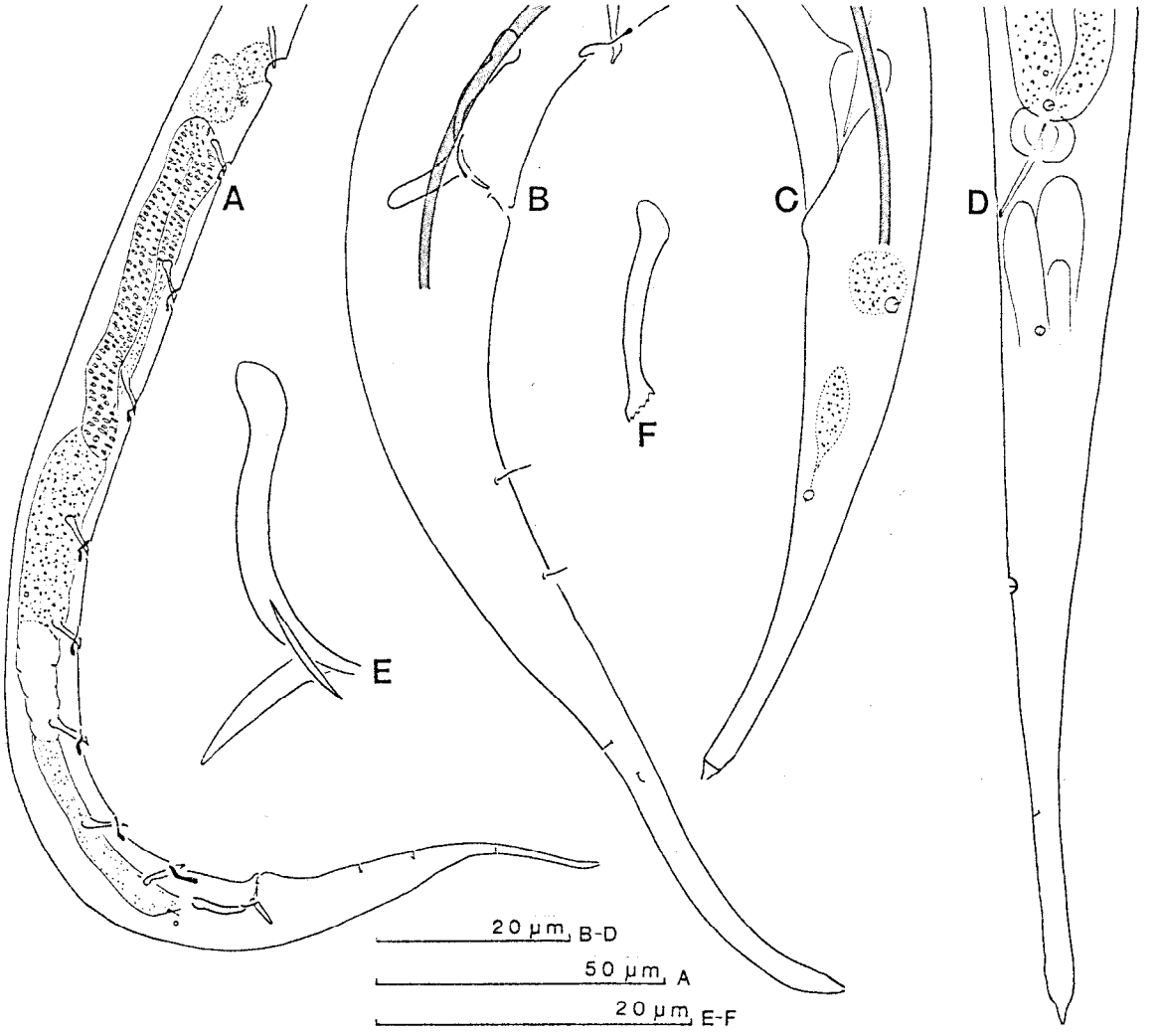

Fig. 5. Leptolaimus (Tubulaimus) meyer-reili sp. nov. A. Posterior body half of ♂$_2$; B. Posterior end of ♂$_3$; C. Posterior end of ♀$_2$; D. Posterior end of juvenile; E. Copulatory apparatus of ♂$_2$; F. Dentated preanal tubulus of ♂$_3$.

responding body diameter. Ovaries opposite and reflexed, each ovary with a spermatheca in the vicinity of uterus, anteriormost branch to the right of intestine, posterior branch to the left.

Juveniles. Similar to females.

Discussion

Leptolaimus (Tubulaimus) meyer-reili sp. nov. (named) for Dr. L.-A. Meyer-Reil, co-worker in the SFB 313 team) differs from most other *Leptolaimus* species by the combination of amphids located at posterior end of tubular portion of pharynx, only small setose cephalic setae present and precloacal supplements consisting of tubuli. Three *Leptolaimus* species do also share these characteristics with *L. meyer-reili*, i.e. *L. acicula* Lorenzen, 1966, *L. puccinelliae* Gerlach, 1959, *L. venustus* Lorenzen, 1972. All three species, however, have only three preanal tubuli vs. nine tubuli in *L. meyer-reili*, and *L. acicula* and *L. puccinelliae* differ also by their very slender tail.

Tarvaia heegeri sp. nov. (Fig. 6)

Material. Two males, one female.

Type locality. Deep-sea benthos of the Norwegian Sea at station 468.

Other locality. Deep-sea benthos of the Norwegian Sea at station 489.

Measurements

Holotype

δ_1 2 – 139 M 1034
8 – 18 18 18

L = 1.19 mm a = 65 b = 8.4 c = 7.5
(slide no. NSIMB 561.23)

Paratypes

δ_2 2 – 143 M 1186
8 – 23 19 19
L = 1.35 mm a = 59 b = 9.4 c = 8.4
(slide no. NSIMB 561.24)

φ_1 2 – 166 763 1270
8 – 23 32 21
L = 1.45 mm a = 45 b = 8.7 c = 8.1
V = 50%
(slide no. NSIMB 561.25)

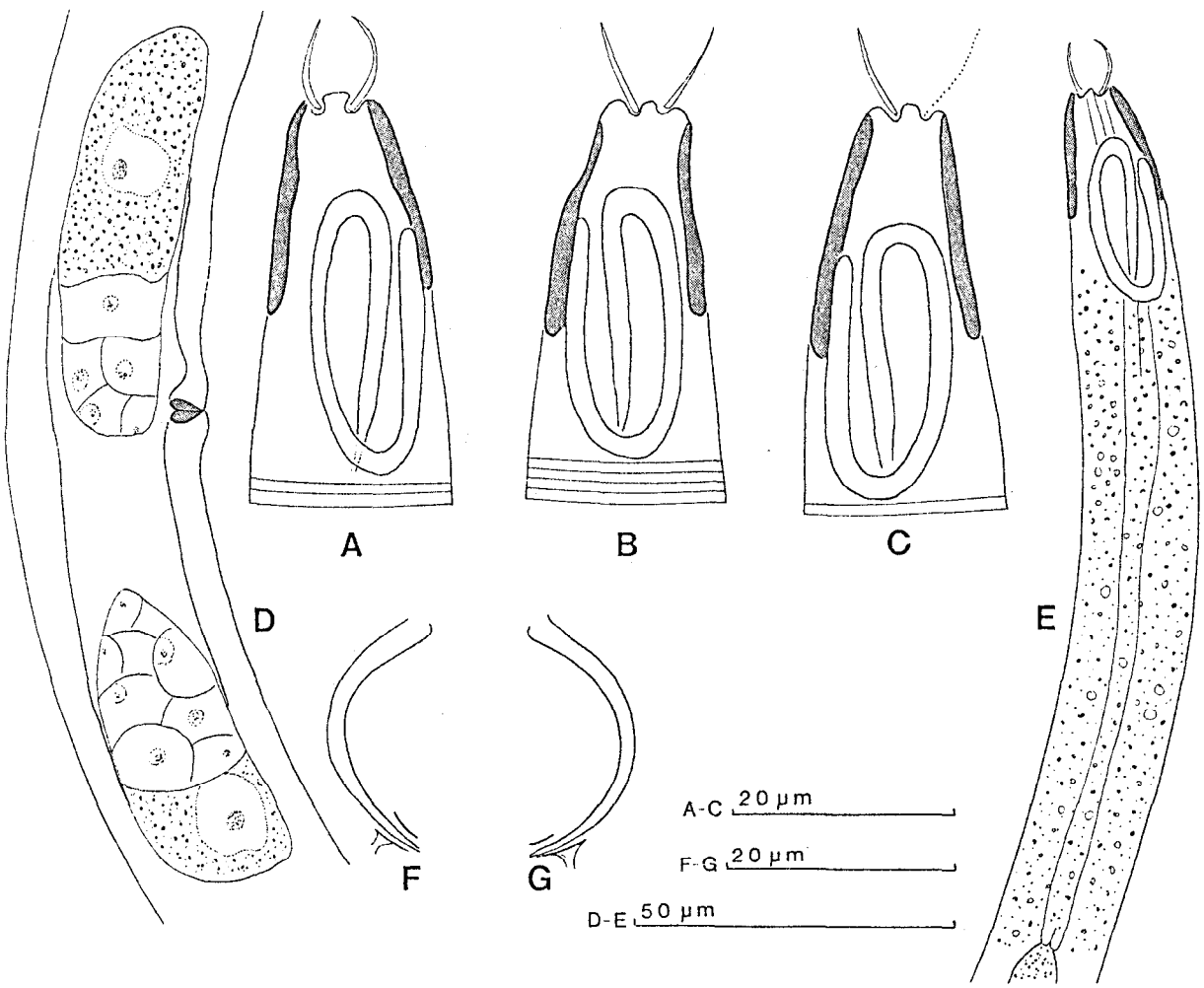

Fig. 6. Tarvaia heegeri sp. nov. A. Head end of δ_1; B. Head end of δ_2; C. Head end of φ_1; D. Gonad of φ_1; E. Pharyngeal region of δ_1; F. Copulatory apparatus of δ_2; G. Copulatory apparatus of δ_1.

Description

Males. Body slender and attenuating towards the ends. Cuticle annulated from base of amphids to tail tip; head and tail tip smooth. Cephalic capsule about 20 µm long. Cephalic setae 10 µm long, each inserted in a groove at the front end. Somatic setae extremely scarce. Amphids elongated as a ventrally wound 1½-turned spiral, 25 µm long and 10 µm wide; anterior border situated 8–9 µm behind front end. Buccal cavity indistinct. Pharyngeal musculature proximally enlarged, otherwise indistinct. Ventral gland cell and caudal gland cells not observed. Tail tip narrow and cut-off. Spicules slender and curved, 30 µm along the arc, 20 µm from tip to tip; gubernaculum with a sclerotized basis of a caudal apophysis. Two testes, outstretched and in tandem in δ_1, the anteriormost branch to the left of intestine, posterior branch to the right; only one outstretched testis observed in δ_2.

Female. Similar to males in most respects. Ovaries opposite and reflexed, anterior branch to the left of intestine, posterior branch to the right.

Discussion

Lambshead (1981) revised *Tarvaia* Allgen, 1934 and considered six valid species, all known in few individual numbers from shallow waters. *Tarvaia heegeri* sp. nov. (named for Dr. T. Heeger, coworker in the SFB 313 team) differs from the other species by the presence of grooves in the head cuticle in which the cephalic setae insert. *T. heegeri* is most closely related to *T. jenseni* Lambshead, 1981 and *T. gerlachi* Lambshead, 1981 (only female known) based on general morphometrics, cephalic capsule, and amphids. *T. jenseni* has a well-developed gubernacular apophysis opposed to *T. heegeri*. *Tarvaia* shows affinities to Ceramonematidae with regard to the smooth cuticle on the head (Vitiello, 1974; Lorenzen, 1981). The grooves in which the cephalic setae insert, and the narrow and cut-off tail tip in *T. heegeri* are two other characteristics shared with many Ceramonematidae.

Diplopeltoides linkei sp. nov. (Fig. 7)

Material. One male, four females.

Type locality. Deep-sea benthos of the Norwegian Sea at station 468.

Measurements

Holotype

φ_1 $\frac{3 - 109\ 265\ 414}{9 - 21\ 24\ 18}$

L = 0.49 mm a = 20 b = 4.4 c = 7.0

V = 55%

(slide no. NSIMB 561.26)

Paratypes

φ_2 $\frac{4 - 118\ 260\ 404}{10 - 25\ 26\ 20}$

L = 0.48 mm a = 19 b = 4.1 c = 6.3

V = 54%

(slide no. NSIMB 561.27)

δ_1 $\frac{3 - 115\ M\ 422}{10 - 28\ 30\ 24}$

L = 0.50 mm a = 17 b = 4.3 c = 6.6

Description

Females. Body stout and slightly attenuating towards the ends. In lateral view head with a compact sclerotization at ventral and dorsal borders 10 µm behind front end. Cuticle annulated, each annule about 3 µm wide along the body, but 4 µm wide on posteriormost part of tail; each annule with a longitudinal striation from compact head sclerotization to tail tip; tail tip surrounded by a weakly sclerotized cap. Four cephalic setae, 2–3 µm long, situated 3–4 µm behind front end. Amphids ventrally wound and describing a loop, 14–17 µm long and situated immediately behind cephalic setae. Amphids of φ_2 on a weakly sclerotized plate. Buccal cavity tiny. Pharynx differentiated into a cylindrical muscular portion 50–56 µm long continuing in an extremely narrow 44–50 µm long portion and terminating in a swollen glandular portion appearing as a bulb. Three

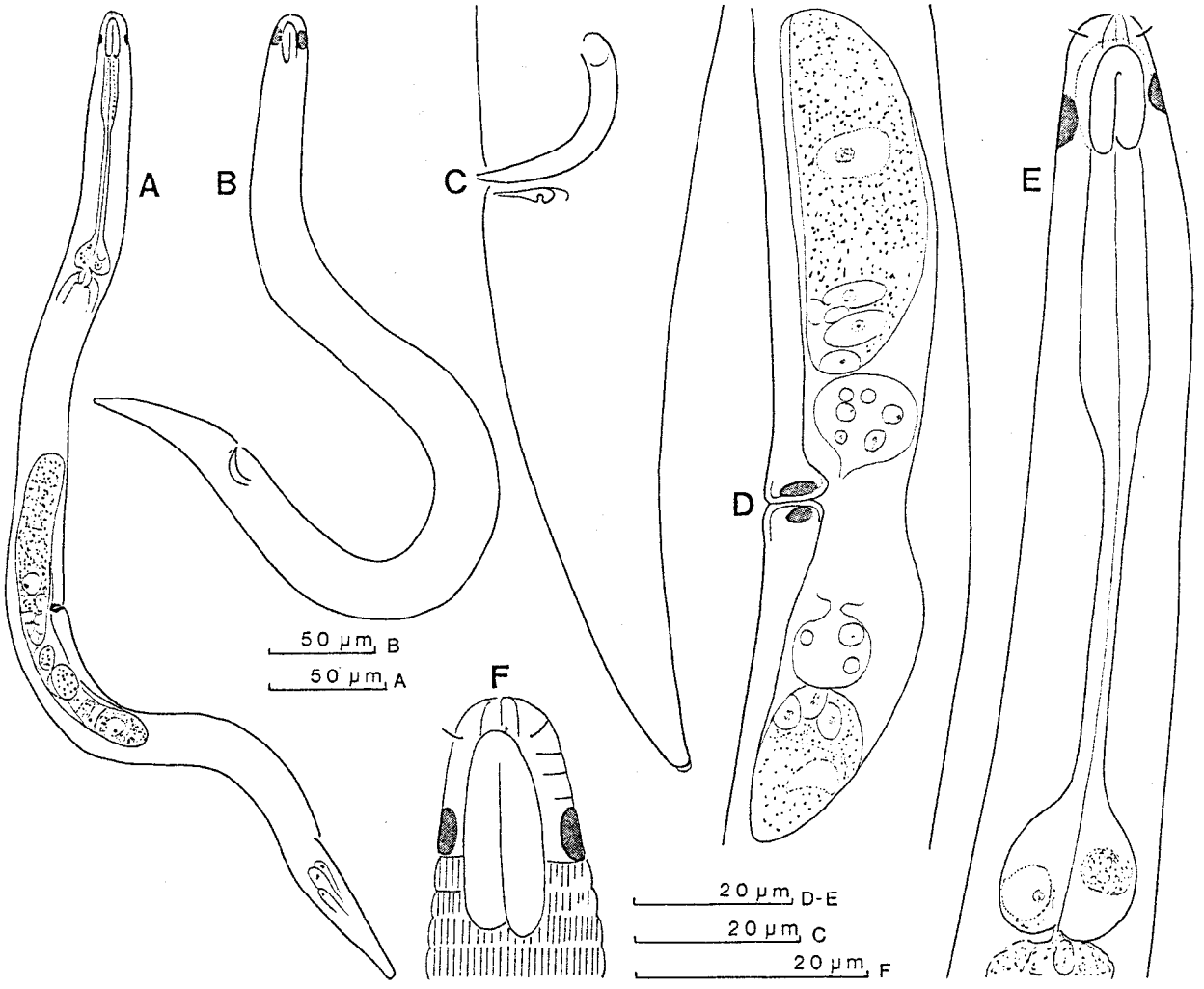

Fig. 7. Diplopeltoides linkei sp. nov. A. Total view of ♀$_1$; B. Total view of ♂$_1$; C. Posterior end of ♂$_1$; D. Gonad of ♀$_2$; E. Pharyngeal region of ♀$_2$; F. Head of ♀$_1$.

caudal gland cells within tail. Vagina distinctly sclerotized; ovaries opposite and reflexed, both ovaries to the right of intestine in ♀$_1$, in ♀$_2$ the anterior branch is to the right of intestine and posterior branch to the left; right and left of uterus there is a pair of spermathecae.

Male. The single male was lost during a preparation prior to some detailed observations of the gonad system. In other respects the male is similar to females. Spicules bent, 29 µm along the arc and 22 µm from tip to tip; gubernaculum distinctly sclerotized appearing as a rod with a narrow notch.

Discussion

Diplopeltoides linkei sp. nov. (named for Dr. P. Linke, co-worker in the SFB 313 team) is in many respects remarkable similar to the only other known species of the genus *D. ornatus* (Gerlach, 1950) from the shallow waters of Kiel Bight: body shape, cuticle, sclerotization on head, amphids, pharynx structure and spicules (cf. descriptions by Gerlach, 1950; Timm, 1961; Loren-

zen, 1981). *D. linkei* differs from *D. ornatus* by its rod-shaped gubernaculum vs. triangular plate, and more plumb tail.

Diplopeltis bathmanni sp. nov. (Fig. 8)

Material. Two males, two females, one juvenile.

Type locality. Deep-sea benthos of the Norwegian Sea at station 61.

Other localities. Deep-sea benthos of the Norwegian Sea at stations 70, 468, 532.

Measurements

Holotype

δ_1 $\frac{10\text{–}13 - 154\ M\ 1073}{16 - 47\ 47\ 43}$
L = 1.15 mm a = 24 b = 7.4 c = 15.7
(slide no. NSIMB 561.28)

Paratypes

φ_1 $\frac{12\text{–}13 - 150\ 931\ 1212}{15 - 43\ 52\ 40}$
L = 1.30 mm a = 25 b = 8.7 c = 14.2
V = 71%
(slide no. NSIMB 561.29)

δ_2 L = 1.24 mm a = 29 b = 7.3 c = 13.6
(slide no. NSIMB 561.30)

φ_2 L = 1.42 mm a = 25 b = 7.5 c = 17.3
V = 73%
(slide no. NSIMB 561.31)

1 juvenile L = 0.97 mm
a = 25 b = 6.6 c = 12.4
(slide no. NSIMB 561.32)

Description

Males. Body stout and attenuating towards the head end. Cuticle appearing smooth. Four cephalic setae, 2 µm long and each inserted in a depression; ventro-median setae 10 µm from head end, dorso-median setae 13 µm from head end and at level with mouth opening; nerve insertions through the frontal head cuticle suggest the presence of four labial papillae, insertions of lateral pair not observed. Amphids ventrally wound and describing a narrow loop, 20 µm long and 4 µm wide; anterior border at level with mouth opening; amphids situated on an oval plate, 23 µm long and 13 µm wide. Mouth opening 6 µm wide and located on the dorsal border of the body, 13 µm from the head end; buccal cavity shallow and unarmed. Pharynx cylindrical, posteriorly slightly enlarged. Ventral gland cell at base of pharynx and opening through a pore 47 µm behind front end. Anteriormost half of intestinal cells densely packed with brown granules giving the body a dark appearance. Three caudal gland cells with separate subterminal outlets. Tail tip rounded. Spicules stout and curved, 63 µm along the arc, 50 µm from tip to tip; gubernaculum weakly sclerotized with a distinctly sclerotized 10 µm long dorso-caudal apophysis. Two testes, opposite and outstretched, the anterior branch to the left of intestine, posterior branch to the right in δ_1, in δ_2 the location is opposite. Sperm cells oval, 12–15 µm long and 7–11 µm wide. Three pairs of copulatory gland cells present: one long and slender pair in front of copulatory apparatus, one pair along, and one pair posterior to copulatory apparatus.

Females. Similar to males in most respects. Cuticle in pharyngeal region appears weakly striated. Vagina strongly sclerotized. Ovaries opposite and outstretched, the anterior branch to the right of intestine, posterior branch to the left.

Juvenile. Similar to adults. Six labial papillae present.

Discussion

Diplopeltis bathmanni sp. nov. (named for Dr. U. Bathmann, co-worker in the SFB 313 team) is most closely related to *D. incisus* (Southern, 1914) in the redescription by Vitiello (1970a); i.e. head end, amphids, and buccal cavity. *D. bathmanni* differs from *D. incisus* and the other four species of the genus by its very short gubernacular apo-

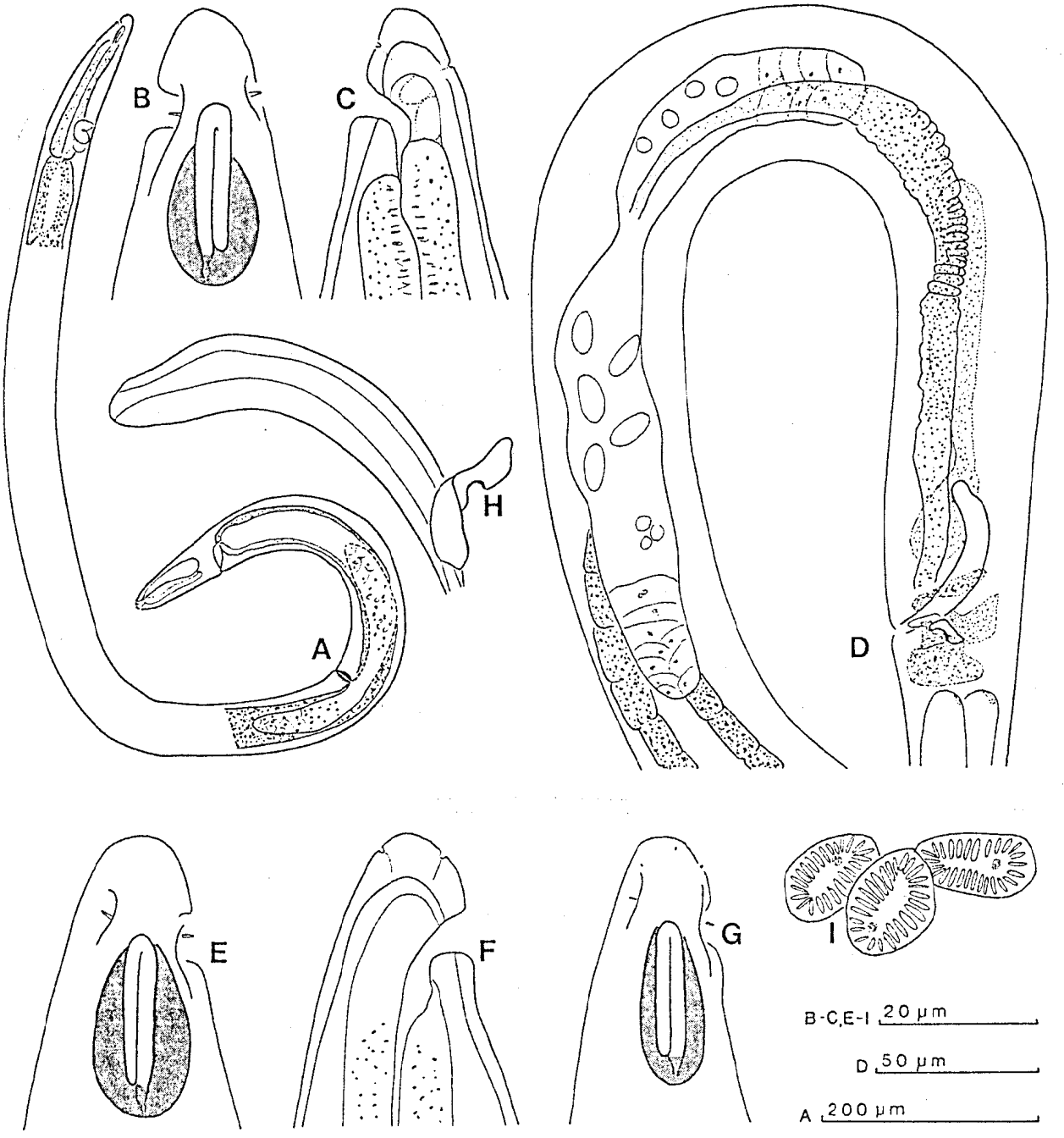

Fig. 8. Diplopeltis bathmanni sp. nov. A. Total view of ♀$_1$; B. Head in surface view of ♀$_1$; C. Head in longitudinal view of ♀$_1$; D. Gonad of ♂$_1$; E. Head in surface view of ♂$_1$; F. Head in longitudinal view of ♂$_1$; G. Head in surface view of juvenile; H. Copulatory apparatus of ♂$_1$; I. Sperm cells of ♂$_2$.

physis, and depressions in which the very short cephalic setae insert.

Southerniella nojii sp. nov. (Fig. 9)

Material. Three males, two females, one juvenile.

Type locality. Deep-sea benthos of the Norwegian Sea at station 59.

Other locality. Deep-sea benthos of the Norwegian Sea at station 468.

Measurements
Holotype

δ_1 5 74 115 M 615
7 19 20 22 20
L = 0.69 mm a = 31 b = 6.0 c = 9.2
(slide no. NSIMB 561.33)

Paratypes

δ_2 5 94 138 M 703
8 20 22 28 22
L = 0.79 mm a = 28 b = 5.7 c = 9.1
(slide no. NSIMB 561.34)

δ_3 6 – 143 M 740
8 – 26 27 27
L = 0.83 mm a = 31 b = 5.8 c = 9.0

φ_1 5 – 148 552 707
5 – 24 33 25
L = 0.80 mm a = 24 b = 5.4 c = 8.6
V = 69%
(slide no. NSIMB 561.35)

φ_2 6 – 157 818/858 1046
8 – 30 40 40 23
L = 1.15 mm a = 29 b = 7.3 c = 11.4
V_1 = 71% V_2 = 75%
(slide no. NSIMB 561.36)

1 juvenile L = 0.58 mm a = 26 b = 4.6
c = 8.9
(slide no. NSIMB 561.37)

Description

Males. Body slender and attenuating towards the ends. Head surrounded by a weakly sclerotized cap; tail tip surrounded by a weakly sclerotized cap at a subterminal constriction. Cuticle finely striated anterior to amphids and on posterior part of tail, elsewhere the cuticle appears smooth. Six small labial setae on head and 5–6 µm behind head end four cephalic setae insert, 4–6 µm long. Amphids spiralized ventrally with marginal border distinctly sclerotized and describing a circle, 8–9 µm in diameter, i.e. 67–71% of corresponding body diameter; anterior border of amphids 16–20 µm behind front end. Buccal cavity narrow, 4–5 µm deep and unarmed, continuing into a 27–33 µm long tubular portion surrounded by a thin sheet of musculature; further posteriorly the pharynx extends to a 7 µm wide cylindrical portion, posteriorly slightly enlarged. Cardia surrounded by four large, nongranular cells ('progaster' sensu Steiner (1958) see also Riemann (1970) and Jensen (1991a). Ventral gland cell present, pore opening not observed. Lumen of intestine distinctly sclerotized in anteriormost part. Caudal gland cells present within tail. Spicules sigmoidal, 28–36 µm along the arc, 23–26 µm from tip to tip; gubernaculum distinctly sclerotized with a caudal differentiation appearing as the basis of an apophysis, weakly sclerotized dorsal apophysis present. Copulatory gland cells present. Testes opposite and outstretched, in δ_1 the anterior branch is to the left of intestine and posterior branch to the right, in δ_2 and δ_3 the location is opposite. Two small precloacal papillae present in δ_1, 27 µm and 48 µm from cloaca.

Females. Females are similar to males in most respects. The reproductive system of φ_1 includes a vulva located at 69% of the body length, a vagina with thick sclerotized walls, an uterus with one egg and sperm cells, one anteriorly directed and outstretched ovary to the left of intestine, and finally a large spermatheca posterior to vagina and right of intestine. The reproductive system of φ_2 is more complicated and is regarded as an

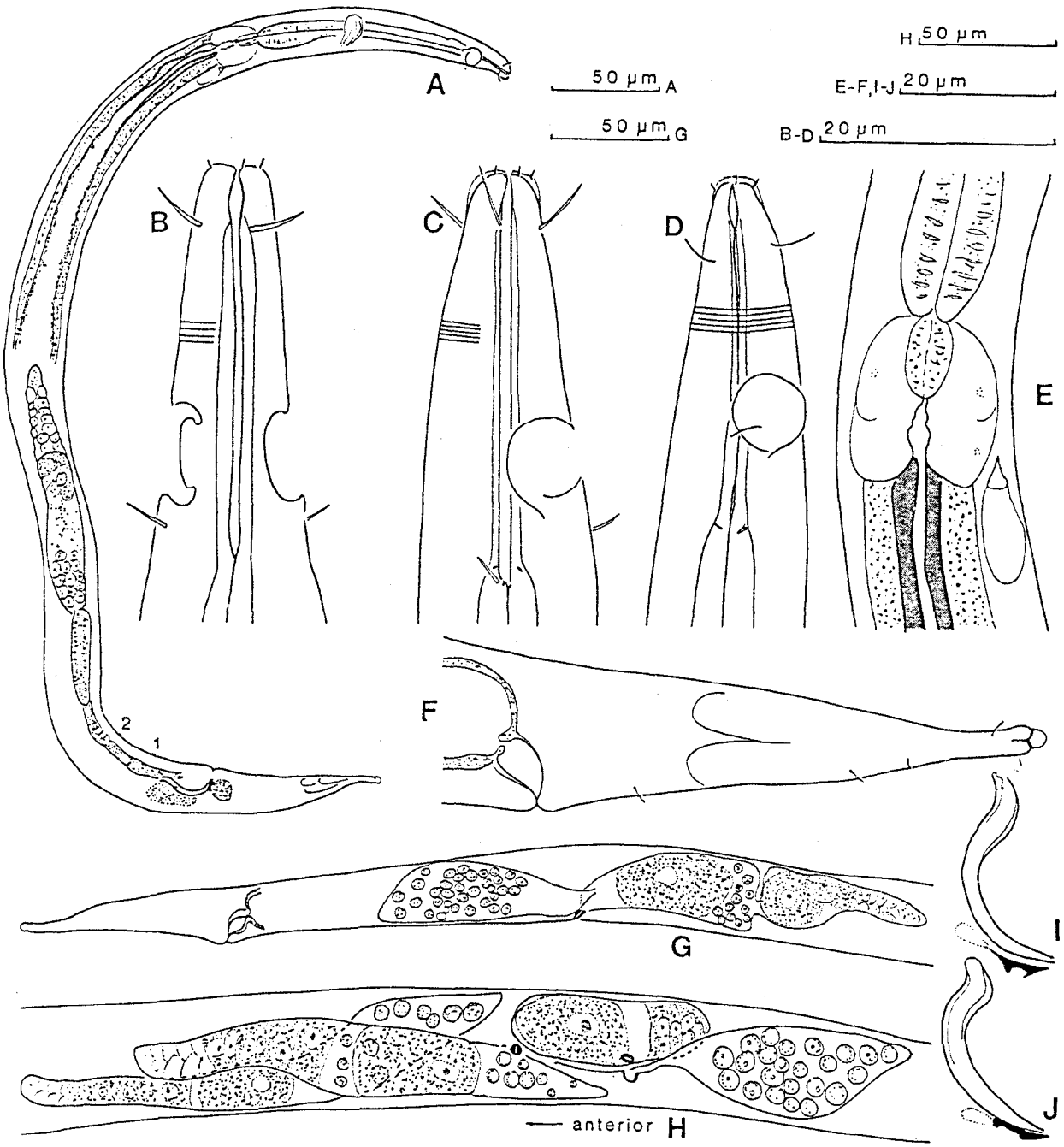

Fig. 9. Southerniella nojii sp. nov. A. Total view of ♂$_1$; B. Head of ♂$_2$; C. Head of ♀$_1$; D. Head of juvenile; E. Progaster of ♂$_1$; F. Posterior end of juvenile; G. Posterior body half of ♀$_1$; H. Gonad in ventral view of ♀$_2$; I. Copulatory apparatus of ♂$_1$; J. Copulatory apparatus of ♂$_3$.

aberrant system. It appears as two vulva-vaginas located 40 µm from each other at 71% and 75% of the body length. There are 1) two anteriorly directed and outstretched ovaries, right and left of intestine, each with an uterus including sperm cells, 2) a posteriorly directed and outstretched

ovary to the right of intestine without uterus and without distinct connection to the other uteri although the ovary is adjacent to the uterus of the right ovary, and 3) one large spermatheca posterior to posteriormost vagina. Both vaginas appear to be connected with the spermatheca, however, it is not evident to what ovary(ies) the individual vaginas are connected.

Juvenile. The single juvenile resembles the adults except the lack of a reproductive system and smaller-sized body regions, amphids and cephalic setae.

Discussion

Southerniella nojii sp. nov. (named for Dr. T. Noji, co-worker in the SFB 313 team) shares the general structure of pharynx and tail with *L. conicauda* (Stekhoven, 1950) (see also redescription by Vitiello (1970b). The two species differ by the much longer cephalic setae and more posteriorly located amphids in *S. nojii.* Stekhoven (1950) depicted the anteriormost part of intestine in *L. conicauda* as a glandular portion (expanded and non-granular) rather similar to what I regard as a progaster in *S. nojii.* Vitiello (1970b), however, could not verify the presence of this structure, but depicted a cardia-like structure typical for many linhomoeids.

Pararaeolaimus rumohri sp. nov. (Fig. 10)

Material. Four males, five females, three juveniles.

Type locality. Deep-sea benthos of the Norwegian Sea at station 532.

Other locality. Deep-sea benthos of the Norwegian Sea at station 476.

Measurements

Holotype

δ_1 7–9 – 125 M 475
17 – 31 33 31
L = 0.61 mm a = 19 b = 4.9 c = 4.5
(slide no. NSIMB 561.38)

Paratypes

δ_2 7–9 – 96 M 352
13 – 19 20 17
L = 0.43 mm a = 20 b = 4.8 c = 4.8
(slide no. NSIMB 561.39)

φ_1 8–10 – 89 241 367
15 – 22 33 19
L = 0.45 mm a = 13 b = 5.1 c = 4.8
V = 54%
(slide no. NSIMB 561.40)

2 males L = 0.51 mm a = 16 b = 4.6–4.7 c = 4.7–4.8

3 juveniles L = 0.45–0.47 mm a = 15–17 b = 3.7–3.9 c = 4.7–4.8
(slides nos. NSIMB 561.41–42)

Description

Males. Body stout with a slender tail, bent to the left, except in δ_1. Cuticle smooth. Four cephalic setae present, 1–2 µm long; ventro-median pair 7–8 µm behind front end, dorso-median pair 8–9 µm behind front end. Amphids ventrally wound and describing a loop with a circular outline, 15–17 µm in diameter; i.e. 71–75% of corresponding body diameter. δ_2 has smaller amphids, 10 µm in diameter or 64% of corresponding body diameter. Amphids shifted slightly to the ventral body half, anterior border 20–23 µm behind front end. Mouth opening in δ_2 shifted slightly to the dorsal body half. Buccal cavity shallow. Pharynx cylindrical, slightly expanded at both ends. Ventral gland cells appearing as four pairs of cells (right and left of intestine) and opening through a pore at the base of pharynx. Three caudal gland cells with separate terminal outlets. Spicules bent, proximally with a cephalated cap, 25–27 µm along the arc, 19–20 µm from tip to tip; gubernaculum and lateral sclerotization present. Spicules of δ_2 measure 22 µm along the arc and

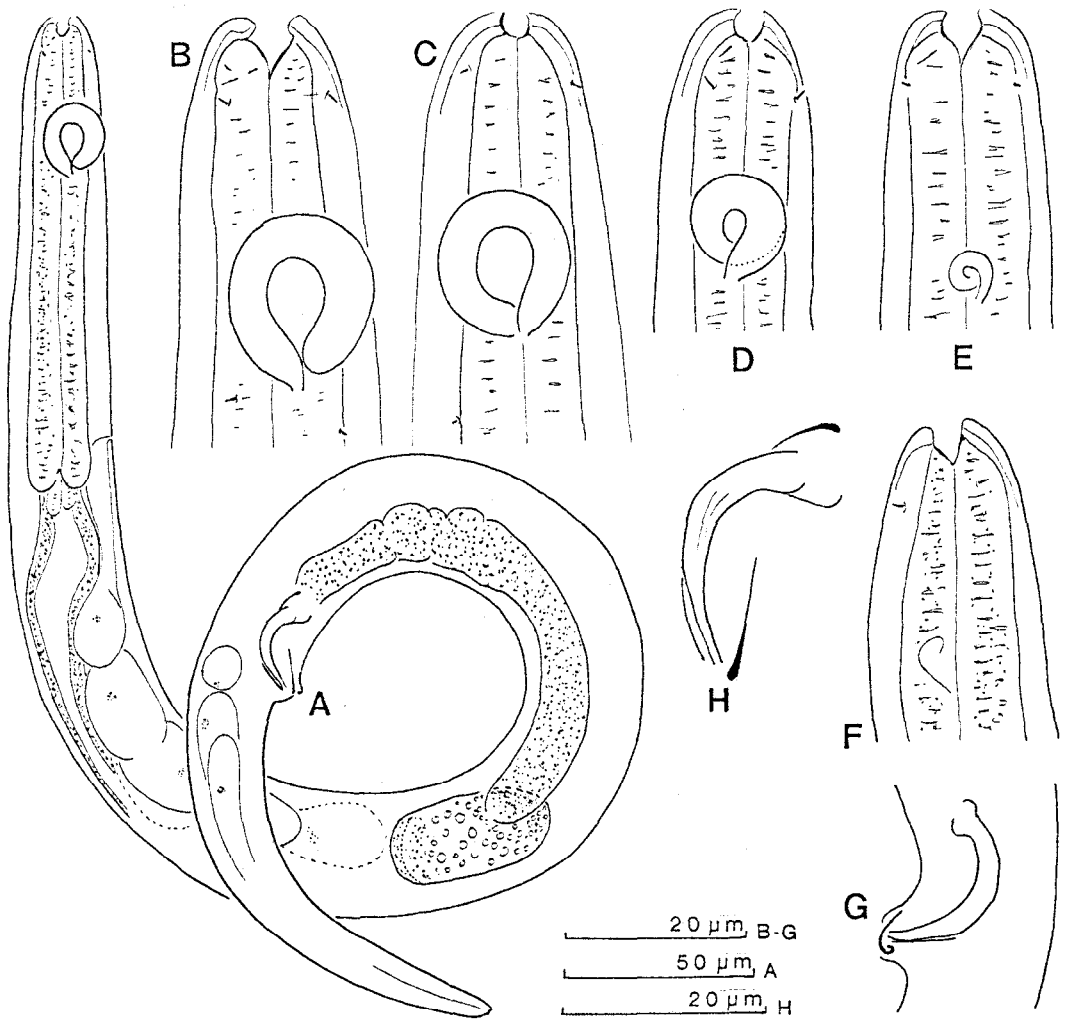

Fig. 10. Pararaeolaimus rumohri sp. nov. A. Total view of ♂1; B. Head of ♂1; C. Head of ♂3; D. Head of ♂2; E. Head of juvenile; F. Head of ♀1; G. Copulatory apparatus of ♂2; H. Copulatory apparatus of ♂1.

15 µm from tip to tip only, and they lack the enlarged proximal cap present in ♂1. Two testes, opposite and outstretched, anterior branch to the left of intestine, posterior branch to the right; in ♂1 both branches are to the left of intestine.

Females. Similar to males in most respects. Amphids only sclerotized at the marginal border and only partly describing a loop, 17–20% of corresponding body diameter, and anterior border 25–27 µm behind front end. Vagina protruding. Ovaries opposite and outstretched, anterior branch to the left of intestine, posterior branch to the right.

Juveniles. Similar to females in most respects; amphids are elongate loop-shaped

Discussion

Pararaeolaimus rumohri sp. nov. (named for Dr. J. Rumohr, co-worker in the SFB 313 team) is remarkable similar to *P. nudus* (Gerlach, 1950) from the shallow waters of Kiel Bight and the

North Sea in male, female and juvenile characteristics (cf. redescription by Lorenzen (1973). The male of *P. rumohri* has larger and more posteriorly located amphids, and more slender gubernaculum than present in *P. nudus*. It is more difficult to compare present material with the second species of the genus *P. megoloamphidus* Timm, 1961 because this description is based on a immature female only.

Theristus altenbachi sp. nov. (Fig. 11)

Material. Fourteen males, twelve females, twelve juveniles.

Type locality. Deep-sea benthos of the Norwegian Sea at station 468.

Other localities. Deep-sea benthos of the Norwegian Sea at stations 61, 66, 70.

Measurements

Holotype

δ_1 4 – 244 M 1239
8 – 43 47 32
L = 1.44 mm a = 31 b = 5.9 c = 7.2
(slide no. NSIMB 561.43)

Paratypes

δ_2 4 – 266 M 1466
9 – 48 54 36
L = 1.74 mm a = 33 b = 6.6 c = 6.2
(slide no. NSIMB 561.44)

$♀_1$ 4 – 174 524 731
9 – 39 69 53
L = 0.89 mm a = 13 b = 5.1 c = 5.6
V = 59%
(slide no. NSIMB 561.45)

2 males L = 1.39–1.59 mm
a = 33–37 b = 5.3–7.1 c = 4.2–5.6
(slides nos NSIMB 561.46–47 together with one female)

1 female L = 1.54 mm
a = 33 b = 6.2 c = 5.8 V = 59%
(slide no. NSIMB 561.48)

Description

Males. Body slender and attenuating towards the ends. Cuticle weakly annulated. Cephalic sense organs in two circles as six internal labial setae, 1 µm long and a circle of six external labial setae and four cephalic setae, 5–7 µm long. Few somatic setae in pharyngeal region and on tail; tail tip without setae. Amphids describing a circle, 12–14 µm in diameter or 44–63% of corresponding body diameter, anterior border 51–56 µm behind front end. Buccal cavity shallow and unarmed. Pharyngeal musculature weakly developed, pharynx cylindrical and posteriorly slightly enlarged with three gland cells (one dorsal and two subventral). Epithel of intestine in anteriormost part densely packed with brown granules giving the body a dark appearance. Ventral gland cell and caudal gland cells not observed. Spicules slender and curved, 43–49 µm along the arc, 38–43 µm from tip to tip. A long and slender copulatory gland cell present on each side of vas deferens. Vas deferens left of intestine with an enlarged glandular region in posteriormost half. Testes opposite and outstretched, anterior branch to the left of intestine, posterior branch to the right; posterior branch with packets of sperm cells.

Females. Similar to males in most respects. Amphids smaller, 6–9 µm in diameter, and situated more towards the head end, 28–37 µm from front end. Ovary outstretched and left of intestine; large spermatheca present between uterus and intestine, and in some females filled with dense packets of sperm cells; prae- and postvulvar gland cells present.

Discussion

Theristus altenbachi sp. nov. (named for Dr. A. Altenbach, co-worker in the SFB 313 team) differs from all other *Theristus* species (and Xyalidae species in general) by the presence of sperm cells in packets which is a prominent feature in both males and females even at low magnification.

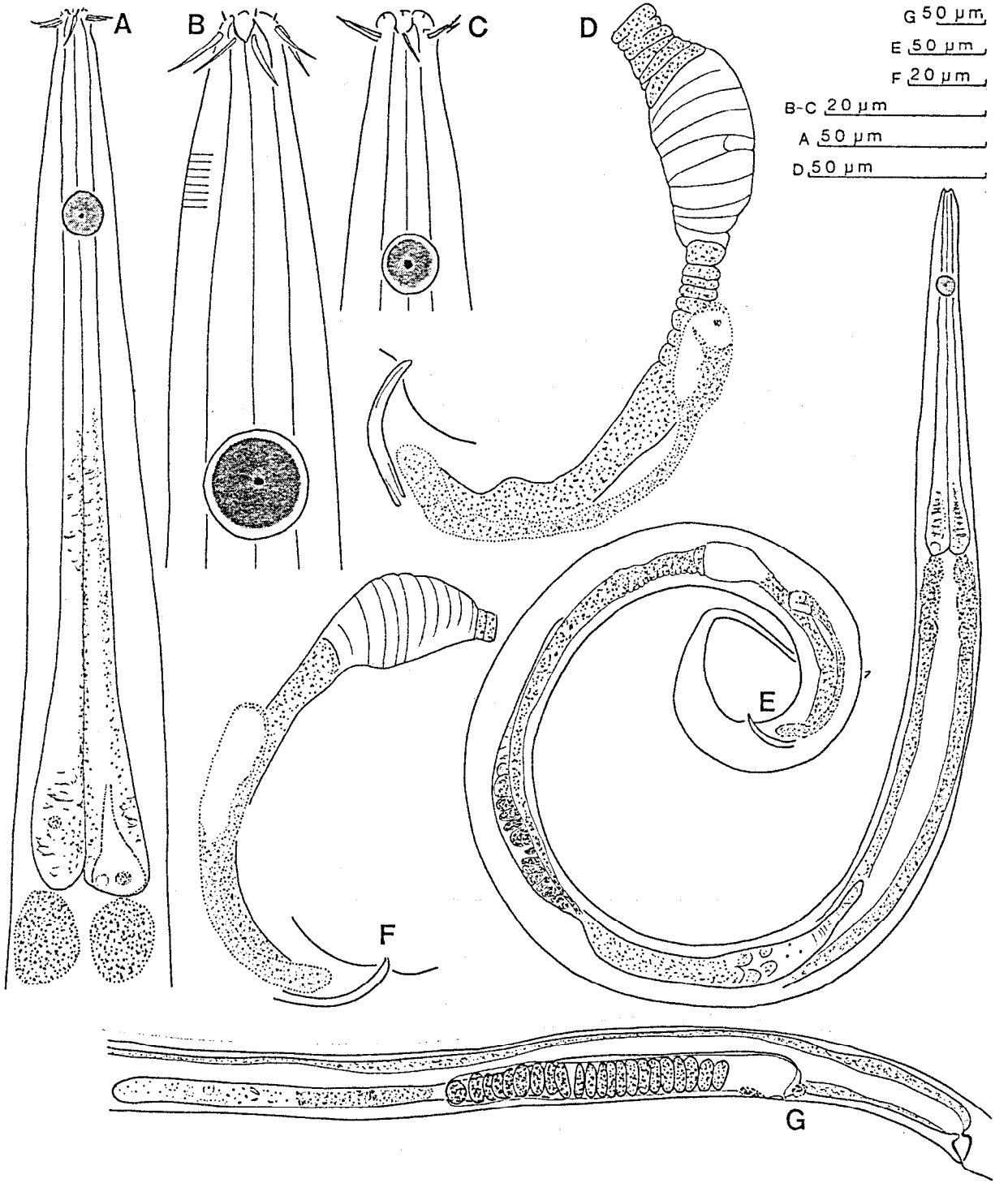

Fig. 11. Theristus altenbachi sp. nov. A. Pharyngeal region of ♂$_2$; B. Anterior end of ♂$_1$; C. Anterior end of ♀$_1$; D. Posterior end of gonad of ♂$_1$; E. Total view of ♂$_1$; F. Posterior end of gonad of ♂$_2$; G. Gonad of ♀$_1$.

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