

Nematodes from Schirmacher Oasis, Dronning Maud Land, East Antarctica

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Summary. Three nematode species, viz. *Plectus* cf. *acuminatus* Bastian, 1865, *Eudorylaimus* cf. *shirasei* Kito, Shishida & Ohyama, 1996, and *Chiloplacoides antarcticus* Heyns, 1994 are described from samples of moss and mineral material in the area close to the Russian station Novolazarevskaya in Schirmacher Oasis, Dronning Maud Land, East Antarctica. Identifications of the species are discussed and the records are compared with earlier findings from continental Antarctica.

Key words: Antarctica, *Chiloplacoides*, *Eudorylaimus*, morphology, *Plectus*, SEM, taxonomy.

Antarctica offers some of the harshest physical environmental conditions on earth with mean annual air temperatures down to about -60°C on the inland plateau. Much of the continent can also be described as arid because there is little free water available and low precipitation (Block, 1994). Thus, the main limiting factor of terrestrial biota is often water (Kennedy, 1993). Despite these environmental constraints, metazoan life exists in many places such as in the McMurdo Dry Valleys (Wall Freckman & Virginia, 1998) and on the nunataks in Dronning Maud Land (Sohlenius *et al.*, 1995, 1996). The fauna is often restricted to the three microscopic animal groups, nematodes, rotifers and tardigrades, which all contain species with the ability to tolerate cold and dry conditions.

The first descriptions of terrestrial nematodes from continental Antarctica were made by Steiner (1916). Maslen (1979) compiled lists of nematodes recorded from the Antarctic region (including the sub-Antarctic islands) by that time. Andrassy (1998) recently made a compilation of nematode species found in the maritime and continental regions of Antarctica with the addition of several new taxa. During the Swedish Antarctic Research Expedition (SWEDARP) in the austral summer 2001/2002, samples of terrestrial material were collected in the area close to the Russian station Novolazarevskaya in Schirmacher Oasis, Dronning Maud Land (DML), East Antarctica. The samples were analysed for the presence of microfauna

(nematodes, rotifers and tardigrades) and these results are reported elsewhere (Sohlenius *et al.*, 2004). Three nematode species belonging to three different orders (Plectida, Dorylaimida and Cephalobida) were found in the samples from Schirmacher Oasis and they are described and compared with earlier records from Antarctica.

MATERIAL AND METHODS

Samples of mosses, lichens and mineral material were collected from the Schirmacher Oasis ($70^{\circ}46'S$, $11^{\circ}48'E$) in January 2002 by Dr. K.I. Jönsson. The sites where the nematodes used for this study were sampled are listed in Table 1. The samples were dried and later extracted in Stockholm by a wet-funnel method (Sohlenius, 1979). The nematodes were killed by heat and fixed in cold TAF. For light microscopy (LM), nematodes were processed to anhydrous glycerine by a slow evaporation method. Preparation of slides was made according to Boström & Gydemo (1983). The slides are deposited in the collections of the Department of Invertebrate Zoology, Swedish Museum of Natural History, Stockholm, Sweden. For scanning electron microscopy (SEM), specimens of *Plectus* cf. *acuminatus* and *Eudorylaimus* cf. *shirasei* were processed as described in Boström (1995) and examined in an Hitachi S-4300 SEM at an accelerating voltage of 10 kV.

Table 1. Some site characteristics and presence of nematodes in samples from Schirmacher Oasis, Dronning Maud Land, East Antarctica collected during SWEDARP 2001/02.

Site number	Altitude	Soil type	Water content %	Nematodes	SMNH slide number
Novo 2	116 m a.s.l.	Green moss	1.0	<i>Plectus cf. acuminatus</i>	48029
				<i>Eudorylaimus cf. shirasei</i> juv.	48030
Novo 5	90 m a.s.l.	Mosses	0.8	<i>Plectus cf. acuminatus</i>	48031
Novo 7	90 m a.s.l.	Gravel with black lichens	2.8	<i>Plectus cf. acuminatus</i>	48033
				<i>Eudorylaimus cf. shirasei</i>	48034
Novo 8	90 m a.s.l.	Red-brownish moss	1.3	<i>Plectus cf. acuminatus</i>	56066
Novo 12	137 m a.s.l.	Mosses	3.6	<i>Plectus cf. acuminatus</i>	56067
Novo 15	41 m a.s.l.	Mosses	55.0	<i>Plectus cf. acuminatus</i>	48035
				<i>Eudorylaimus cf. shirasei</i>	48036, 56068
Novo 16	18 m a.s.l.	Mosses with black lichens	17.0	<i>Plectus cf. acuminatus</i>	48037
				<i>Eudorylaimus cf. shirasei</i>	48038
				<i>Chiloplacoides antarcticus</i>	48040
Novo 17	8 m a.s.l.	Sand with black lichens	1.2	<i>Eudorylaimus cf. shirasei</i>	48041, 56070
				<i>Chiloplacoides antarcticus</i>	48042, 56071

DESCRIPTION

Plectus cf. acuminatus Bastian, 1865 (Fig. 1)

Measurements: See Table 2.

Female. (n = 35). Body 626-1061 µm long, arcuate ventrad when killed by heat. Scattered body setae. Lip region rounded, six lips not offset from body contour. Six inner labial sensillae close to mouth opening, six outer labial sensillae at middle part of lips. Four cephalic setae, 3-4 µm long, at 2nd to 3rd annuli, directed outward and forward. Amphids circular, diameter 2-3 µm, at 12th to 14th annuli (some annuli diverge and are difficult to count) from anterior end, occupying 15-21% of neck diameter. Stoma 20-27 µm long, 3.0-4.5 µm wide. Corpus 87-127 µm long, isthmus 58-83 µm long, bulb 24-34 µm long and 18-24 µm wide, cardia 8.5-13.5 µm long. Lateral field with three incisures, extending to the subventral caudal papilla on the right hand side, occupying 12-18% of midbody diameter. Genital organs didelphic, amphidelphic, reflexed, ovaries extending two to three times BD anteriorly and posteriorly, respectively. Vulva equatorial (V = 45-51%), vulval lips not or slightly protruding. Vagina

straight, encircled by two sphincter muscles, 7.0-10.5 µm long, occupying 19-36% of vulval body diameter. Single intrauterine egg, 62-67 µm long and 33-34 µm wide. Rectum 18-26 µm long, 1.0-1.4 times ABD. Tail 75-118 µm long, arcuate ventrad with 5-6 caudal setae, posterior-most papilla (spur) at 11.5-18.0 µm from tail terminus. Spinneret tubular surrounded by a circle of 'ridges'.

Male. Not found

Remarks. The identification of *Plectus* species is a matter of great concern and offers many difficulties because of the large number of species descriptions [about 50 valid species and about 30 *species inquirendae* and *incertae sedis* according to Zell (1993)] and the intra- and interspecific variability defying unequivocal separation of species entities. The problem is enhanced by the large number of all-female populations/species and the general rarity of males further restricting the number of characters available for species diagnoses.

Morphometrics of the populations from Schirmacher Oasis are generally within the ranges established for the populations described as *P. acuminatus* Bastian, 1865 from the nunatak Basen in Vestfjella, Dronning Maud Land (Boström, 1995, 1997). Some morphological differences are

found, e.g. a somewhat more anterior position of cephalic setae (on 2nd-3rd annuli vs on 3rd-5th annuli), spinneret surrounded by a circle of 'ridges' vs a circle of 'papillae'.

The specimens described here also generally agree with those described as *P. antarcticus* de Man, 1904 from the Soya Coast (Kito *et al.*, 1991) and Robertsollen (Heyns, 1995), both sites in Dronning Maud Land.

According to Andr ssy (1998) only some of the populations or specimens described as *P. antarcticus*, subsequent to the original description by de Man (1904), are representatives of this species for which he appointed a neotype in the collection from the type locality. In the view of Andr ssy (1998), *P. antarcticus* occurs only in the maritime Antarctica, while *P. murrayi* is frequent in the continental region. Thus, all populations or specimens described as *P. antarcticus* by Kirjanova (1958), Timm (1971), Yeates (1979), Kito *et al.* (1991), Vinciguerra (1994) and Heyns (1995), and as *P. acuminatus* by Bostr m (1995, 1997) represent *P. murrayi* Yeates, 1970.

Andr ssy (1998: Table 4) listed some differences between *P. antarcticus* and *P. murrayi*, but a check of the published data reveals that the characters overlap more than is shown in that table. Some updated examples: body length = 0.84-1.35 vs 0.60-1.19 mm, $c' = 2.8-4.0$ vs 4.0-7.0, cuticle thickness = 2-3 vs 1-2 μm , and number of intrauterine eggs = 1-4 vs 1-3. There are also other morphological differences that may seem arbitrary and doubtful, e.g. lips slightly offset vs not offset and tail slightly bent vs strongly bent. Regarding the latter character, the tail in *P. antarcticus* is slightly to moderately bent (Andr ssy, 1998: Figs 4D-G), whilst in *P. murrayi* it varies from almost straight to strongly bent (Andr ssy, 1998: Figs 12-13). However, there seem to be at least some reliable separating characters, especially between the males of *P. antarcticus* and *P. murrayi*, viz. lateral field with two vs three incisures, spicule length 38-45 vs 19-27 μm , presence vs absence of gubernaculum, and male tubular organs three vs one-two. The last character may, however, be rather variable and in e.g. *P. paracuminatus* Zell, 1993, the number of supplements varies between one and three (Holovachov *et al.*, 2001). The male characters *per se* are of limited use because of the general rarity of males.

The next identification problem is how to distinguish *P. murrayi* from *P. acuminatus*. Andr ssy (1984) keyed out *murrayi* as having amphids at level with the base of stoma (a flaw in the original description due to contraction of

specimens) and in 1985, Andr ssy synonymized *murrayi* with *acuminatus*. Andr ssy (1998: 147) stated that 'the tail of *murrayi* is nearly cylindrical in posterior half while it narrows rapidly to the **almost pointed terminus** [my bold] in *acuminatus*'. If this is true, it seems that the *P. acuminatus* populations described in the major revisions of *Plectus* (Maggenti, 1961; Andr ssy, 1985; Zell, 1993) do not agree with this diagnosis. On the other hand, the SEM pictures in Bostr m (1995: Fig. 3F; 1997: Figs 4F & G; here: Fig. 1E) show an evenly tapering tail. Another difference between them as stated by Andr ssy (1998) is that the labial region is lowly rounded in *P. murrayi* vs highly conoid in *P. acuminatus*. The lip region in *P. acuminatus* has been variously described by different authors: rounded (Bastian, 1865); conoid-connate lips, one-half as high as width of lip region (Maggenti, 1961); lips separate, fairly high, conoid (Andr ssy, 1985); and rounded (Zell, 1993). However, the lips may be more or less attenuated depending on whether the mouth is opened or closed. For the male, Andr ssy (1998) pointed to the differences in spicule shape: almost straight in *P. murrayi* vs arcuate in *P. acuminatus*; and the number and position of tubular supplements: one-two (if two, they lie close together) in *P. murrayi* vs two widely spaced in *P. acuminatus*. Kito *et al.* (1991) described the spicule shape in the male of *P. murrayi sensu* Andr ssy (1998) from the Soya Coast as arcuate. Vinciguerra (1994) did not mention the shape of the spicules in the description of the male of *P. murrayi sensu* Andr ssy (1998) from Victoria Land and the drawings are too sketchy to be reliable. The spicule shape of *P. acuminatus* was not specifically mentioned either by Andr ssy (1985) or Zell (1993) but in Fig. 2 of the former it is drawn distinctly arcuate, whilst in Tafel 41 of the latter it is less arcuate. Regarding the distance between the two supplements in *P. acuminatus*, Andr ssy (1985: Fig. 2) showed them to be well separated, whilst Zell (1993: Taf. 41) showed them to lie less well separated and more similar to the illustrations by Vinciguerra (1994: Figs 5 & 7). The males of *P. acuminatus* described by Brzeski (1963) and Vinciguerra (1984) both have moderately arcuate spicules and the two tubular supplements lie closer together than in what is considered the true *P. acuminatus* by Andr ssy (1985, 1998).

The aim of this discussion is neither to state that *P. antarcticus* and *P. murrayi* are conspecific (there appears to be separating characters at least in the males), nor that *P. acuminatus* and *P. murrayi* are conspecific (although the separating

characters may be discussed), but merely to point at the difficulties in species identification within the genus *Plectus* and that things are not always what they seem to be.

Eudorylaimus* cf. *shirasei
Kito, Shishida & Ohyama, 1996
(Fig. 2)

Measurements: See Table 3.

Female (n = 8). Body 1168-2256 µm long; curved ventrad, especially posteriorly, when killed by heat; almost cylindrical, tapering posteriorly and more so anteriorly, somewhat wider at vulva. Cuticle with fine transverse striae, about 0.5-1.0 µm apart; cuticle thickness about 3-4 µm at midbody, with two main layers. Lateral field (chord) 20-24 µm wide, occupying about 30-40% of midbody diameter. Lip region offset by a constriction, somewhat angular in outline; lip region diameter 15-19 µm. Six rounded lips, amalgamated posteriorly, bearing an anterior circle of six inner labial papillae and a posterior circle of six outer labial papillae plus four cephalic papillae. Six liplets surrounding mouth opening. Amphids stirrup-shaped; aperture just posterior to lip region constriction, 7.5-9.5 µm wide, about 38-53% of corresponding body diameter. Odontostyle 16.5-22.0 µm long, about as long as lip region diameter. Odontophore less well demarcated, 24-31 µm long. Guiding ring single, located at 6-8 µm from anterior end, at level with the labial constriction. Anterior part of pharynx narrow, gradually expanding at about half of its length. Gland nuclei and their outlets not discernible in shape and location in most specimens, DN observed in only a few specimens. Cardia conoid-elongate, blunt, 15.5-38.5 µm long and 14.5-31.0 µm in diameter. Nerve ring situated posterior to middle of slender part of pharynx, at 111-172 µm from anterior end. Hemizonid somewhat anterior to nerve ring, at 106-164 µm from anterior end. Intestinal wall having large multinucleate cells with two to four nuclei. Green or yellowish contents seen in intestine of some specimens. Prerectum 44-91 µm or 1.9-2.9 times ABD long. Rectum 24-35 µm or 0.9-1.1 times ABD long. Tail 31-49 µm long, curved ventrad, conoid, tapering to a rounded terminus. Hyaline tip 8-14 µm long. Two pairs of caudal papillae. Reproductive system didelphic, amphidelphic: anterior ovary on left side and posterior ovary on right side in four specimens, anterior ovary on right side and posterior ovary on left side in one specimen, both ovaries on right

side in two specimens and both ovaries on left side in one specimen; uterus and oviduct joined by a sphincter. No eggs present in uteri, numerous spindle-shaped sperms observed in uteri and oviducts. Vulva transverse, located at midbody (V = 45-52%). Vagina well developed, occupying 43-51% of corresponding body diameter. *Pars distalis vaginae* (terminology according to De Ley *et al.*, 1993) generally short with rounded walls; *pars refringens vaginae* with well developed sclerotisations, rounded-triangular-trapezoid in shape; *pars proximal vaginae* 14-20 µm long with sigmoid or concave contours, encircled by a sphincter.

Male (n = 7). Body 1223-2336 µm long, habitus and many general features similar to female. Lateral field (chord) 13-17 µm wide, occupying 28-36% of midbody diameter. Lip region offset by a constriction, lip region diameter 14.5-19.0 µm. Amphids 8.5-9.5 µm wide, about 43-50% of corresponding body diameter. Odontostyle 15.5-18.0 µm long, about equal to lip region diameter. Odontophore 27-31 µm long, less well demarcated. Guiding ring single, at 6-8 µm from anterior end. Cardia 11.5-29.0 µm long, 7.5-19.5 µm in diameter. Nerve ring at 112-149 µm and hemizonid at 102-154 µm from anterior end. Tail 35-47 µm long, curved ventrad, conoid, tapering to a rounded terminus. Hyaline tip 9-14 µm long. Two pairs of caudal papillae. Reproductive system diorchic: anterior testis on right side and posterior testis on left side of intestine in four specimens, anterior testis on left side and posterior testis on right side of intestine in three specimens. Spicules paired, stout, curved ventrad, 56-63 µm long; lateral guiding piece somewhat wedge-shaped, 14-20 µm long. One pair subventral supplements just anterior (about 10 µm) to cloacal opening. Five to seven precloacal midventral supplements irregularly spaced from about 55 to 180 µm anterior to cloaca, the posteriormost one is located well anterior to the spicule head in four specimens (from sites 15 and 16) and close to the spicule head in three specimens (from sites 7 and 17). There is also a number of irregularly spaced ventro-lateral pairs of small precloacal papillae which are less visible in the LM, but seen by SEM (Fig. 2C).

Remarks. Several species of *Eudorylaimus* have been described from the maritime and continental regions of Antarctica (Loof, 1975; Andrásy, 1998). For the continental region, Maslen (1979) listed only *E. antarcticus* (Steiner, 1916) Yeates, 1970, and Andrásy (1998) added three more species, *viz.* *E. nudicaudatus* Heyns, 1993, *E. shirasei*

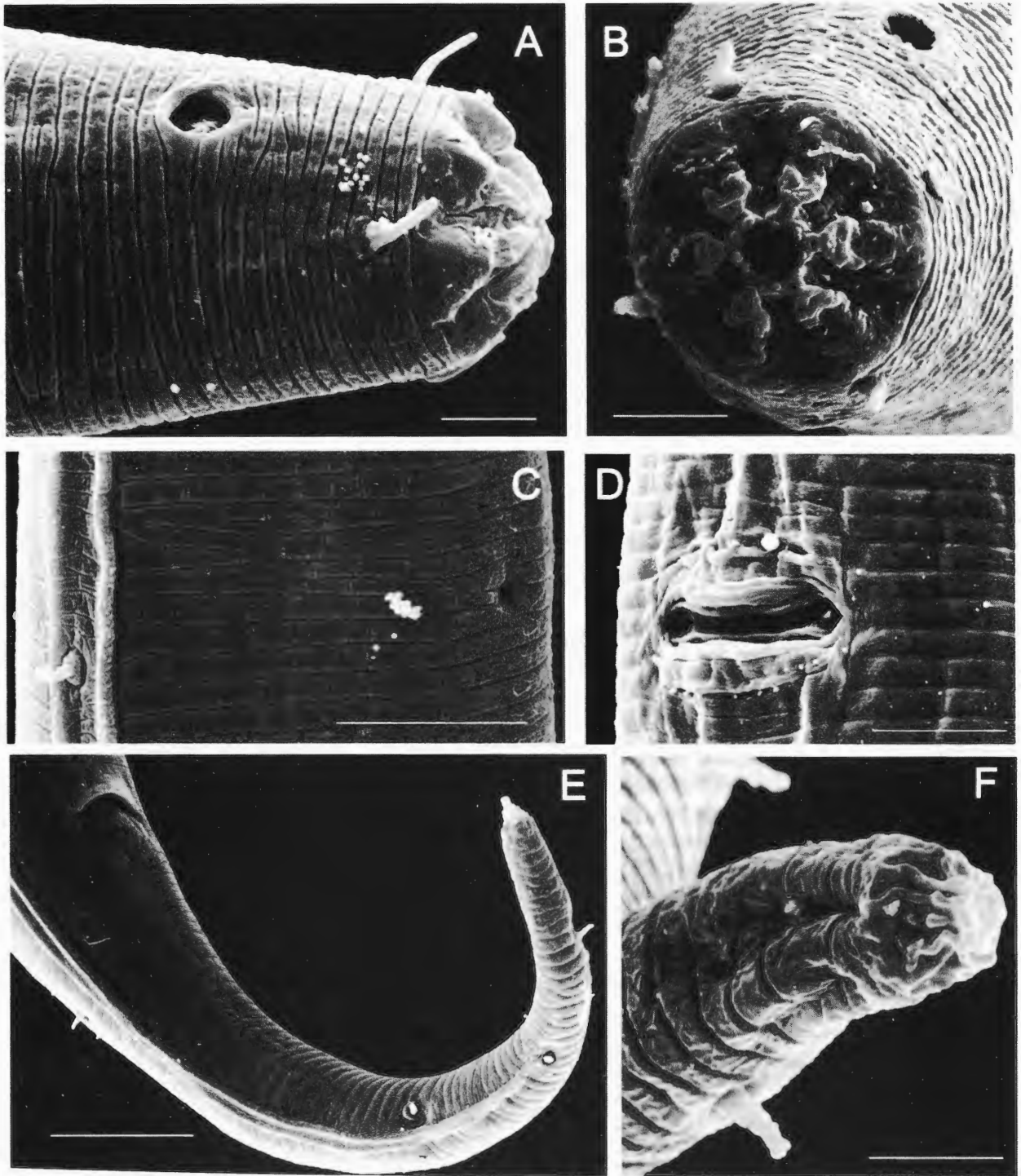


Fig. 1. *Plectus* cf. *acuminatus* Bastian, 1865 (SEM). Females from Schirmacher Oasis, Dronning Maud Land, East Antarctica (A-F). A: Labial region, ventro-lateral view; B: Labial region, *en face* view (ventral side down to the left); C: Lateral field, deirid and excretory pore; D: Vulva; E: Tail, ventro-lateral view; F: Tail terminus showing spur and spinneret. Scale bars: A-B, F – 2.5 μ m; C-D – 5 μ m; E – 10 μ m.

Table 2. Measurements in μm of *Plectus cf. acuminatus* Bastian, 1865 from the area around the Russian station Novolazarevskaya, Schirmacher Oasis, Dronning Maud Land, East Antarctica (presented as mean \pm S.E. (range) or only range).

Site	Novo 2	Novo 5	Novo 7	Novo 8	Novo 12	Novo 15	Novo 16
n	5	5	5	5	6	5	4
Body length	778 \pm 11 (743-808)	724 \pm 31 (626-741)	979 \pm 35 (862-1061)	776 \pm 10 (758-803)	919 \pm 33 (804-1020)	946 \pm 15 (894-984)	836 \pm 35 (752-921)
Body diameter (BD)	32 \pm 0.4 (31-33)	34 \pm 0.2 (28-40)	44 \pm 2 (35-49)	33 \pm 1 (31-35)	40 \pm 1 (35-45)	46 \pm 2 (38-51)	38 \pm 2 (35-42)
Pharynx length	197 \pm 4 (188-208)	185 \pm 5 (169-199)	224 \pm 4 (212-244)	200 \pm 2 (191-204)	212 \pm 3.5 (199-225)	213 \pm 3 (208-225)	202 \pm 5 (193-216)
Tail length	88 \pm 2 (85-94)	82 \pm 2 (75-89)	108 \pm 4 (101-118)	88 \pm 2 (82-94)	104 \pm 2 (98-110)	104 \pm 3 (94-113)	95 \pm 3 (87-101)
Distance to vulva	380 \pm 7 (358-399)	361 \pm 15 (315-407)	463 \pm 17 (418-518)	384 \pm 5 (373-396)	444 \pm 15 (386-488)	464 \pm 5 (450-474)	411 \pm 18 (371-459)
Dist. vulva-anus/tail	3.4 \pm 0.1 (3.1-3.6)	3.3 \pm 0.1 (3.0-3.5)	3.5 \pm 0.1 (3.1-3.8)	3.3 \pm 0.1 (3.2-3.5)	3.5 \pm 0.1 (3.2-3.7)	3.6 \pm 0.1 (3.4-3.9)	3.4 \pm 0.1 (3.2-3.5)
Anal body diameter (ABD)	19 \pm 0.4 (17-19)	17 \pm 0.7 (15-19)	23 \pm 1 (19-25)	17 \pm 0.2 (17-18)	19.5 \pm 0.5 (18-21)	24 \pm 0.7 (21-25)	21 \pm 1 (19-24)
A	24 \pm 0.3 (23-25)	22 \pm 0.7 (20-24)	23 \pm 0.7 (21-25)	23 \pm 0.4 (22-24)	23 \pm 0.4 (21-24)	21 \pm 0.8 (19-24)	23 \pm 1 (20-24)
B	4.0 \pm 0.1 (3.7-4.1)	3.9 \pm 0.1 (3.7-4.0)	4.4 \pm 0.1 (4.1-4.6)	3.9 \pm 0.1 (3.7-4.0)	4.3 \pm 0.1 (4.0-4.7)	4.4 \pm 0.1 (4.2-4.6)	4.1 \pm 0.1 (3.8-4.3)
C	8.9 \pm 0.1 (8.5-9.3)	8.9 \pm 0.2 (8.3-9.2)	9.1 \pm 0.4 (8.2-10.2)	8.8 \pm 0.1 (8.5-9.3)	8.9 \pm 0.2 (8.2-9.3)	9.2 \pm 0.2 (8.9-9.6)	8.8 \pm 0.2 (8.4-9.1)
c'	4.8 \pm 0.1 (4.5-5.1)	4.8 \pm 0.1 (4.5-5.0)	4.8 \pm 0.2 (4.3-5.4)	5.3 \pm 0.1 (5.0-5.5)	5.4 \pm 0.1 (5.2-5.6)	4.4 \pm 0.1 (4.2-4.8)	4.6 \pm 0.1 (4.3-4.9)
Lip region height	3.0-4.5	3.5-4.0	4.0-4.5	3.5-4.0	3.5-4.0	3.5-4.0	3.5-4.0
Lip region diameter	10.0-11.0	10.0-10.5	10.5-11.5	9.0-9.5	9.5-11.0	10.5-11.0	10.5-11.0
Cephalic setae length	3.0-3.5	3.0-3.5	3.5-4.0	3.0-3.5	3.0-4.0	3.0-3.5	3.0-4.0
Stoma length	20-23	20-24	23-26	21-23	21-27	21-24	21-25
Corpus length	96-106	87-106	108-127	101-111	106-122	106-120	106-113
Isthmus length	66-72	58-68	70-83	64-73	67-76	69-78	62-73
Bulb (length x diam.)	26-32 x 19-20	24-28 x 18-23	31-33 x 21-24	26-29 x 20-21	28-30 x 19-21	31-34 x 21-24	27-30 x 18-20
Cardia	9.5-11.5	8.5-10.5	10.5-11.5	8.5-10.5	9.5-11.5	9.5-13.5	10.5
Corpus/isthmus	1.4-1.5	1.4-1.6	1.5-1.6	1.4-1.6	1.6	1.5-1.6	1.5-1.7
Amphid fr. ant. end	12.5-13.5	12.5-14.0	13.0-16.0	12.5-13.5	13.5-15.5	13.5-16.0	12.5-15.5
Amphid diameter	2.0-3.0	2.5-3.0	2.5-3.0	2.5	2.5-3.0	2.5-3.0	2.5-3.0
Amphid of BD (%)	15-21	17-20	17-19	18-19	17-20	16-19	17-20
Excr. pore fr. ant. end	108-125	98-116	121-142	112-119	114-135	123-138	109-126
Deirid fr. ant. end	115-133	101-122	126-148	119-122	118-145	129-147	116-133
Lateral field of BD (%)	15-18	14-18	14-16	15-16	14-16	13-14	15-16
Cuticle thickness	1.0-1.7	1.0-1.5	1.5-1.7	1.5	1.5	1.5-1.7	1.5
Annuli width	1.0-1.2	1.0-1.2	1.2-1.6	1.1-1.2	1.1-1.3	1.2-1.5	1.1-1.4
V %	49 \pm 0.4 (48-50)	50 \pm 0.2 (49-50)	47 \pm 0.8 (45-49)	49 \pm 0.4 (49-51)	48 \pm 0.4 (47-50)	49 \pm 0.5 (48-51)	49 \pm 0.5 (48-50)
G ₁ %	10.0-11.6	8.5-12.0	10.2-13.1	11.9-13.6	9.9-12.2	11.4-14.5	7.4-10.6
G ₂ %	8.9-10.9	7.5-12.3	9.7-12.0	9.7-12.2	8.7-10.7	10.8-12.5	9.8-12.7
Vagina	8.5-9.5	7.0-10.5	8.5-10.5	8.5-9.5	7.5-9.5	-	8.0-9.5
Rectum length	19-22	18-21	24-25	19-23	21-23	22-26	21-24
Rectum/ABD	1.1-1.2	1.1-1.3	1.1-1.2	1.2-1.4	1.1-1.3	1.0-1.1	1.1-1.2
Spur from tail terminus	12.5-14.5	12.0-17.0	14.5-18.0	12.5-14.5	12.5-16.5	11.5-16.5	11.5-16.0

Table 3. Measurements in μm of *Eudorylaimus* cf. *shirasei* Kito, Shishida & Ohyama 1996 from the area around the Russian station Novolazarevskaya, Schirmacher Oasis, Dronning Maud Land, East Antarctica (presented as mean \pm S.E. (range) or only range).

Site	Novo 7	Novo 15		Novo 16		Novo 17	
n and sex	2 ♂♂	4 ♀♀	3 ♂♂	1 ♀	1 ♂	3 ♀♀	1 ♂
Body length	1436-1526	2137 \pm 47 (2055-2256)	1824-2132	1481	2336	1168-1283	1223
Body diameter (BD)	38-41	68 \pm 4 (61-76)	47-60	52	52	49-59	45
Pharynx length	330-345	412 \pm 12 (394-435)	356-399	334	424	315-326	338
Tail length	38-46	48 \pm 0.5 (47-49)	40-47	32	46	31-34	35
Distance to vulva	—	1016 \pm 24 (971-1082)	—	722	—	589-668	—
Dist. vulva-anus/tail	—	22 \pm 1.1 (20-25)	—	23	—	16-20	—
Anal body diameter (ABD)	28-32	28.5 \pm 0.3 (28-29)	32-34	26	34	24-25	28
A	37-38	32 \pm 1.8 (29-36)	34-39	28	45	20-26	27
B	4.4	5.1 \pm 0.2 (4.7-5.3)	4.8-5.3	4.4	5.5	3.6-4.1	3.6
C	33-38	45 \pm 1.1 (42-47)	39-53	46	51	34-40	35
c'	1.3-1.4	1.7 \pm 0.03 (1.6-1.7)	1.2-1.4	1.2	1.3	1.3-1.4	1.3
Lip region diameter	15.5	17.5-19.0	18.5-19.0	15.5	16.5	15.0-16.0	14.5
Odontostyle	15.5-16.5	17.0-22.0	16.5-18.0	16.5	18.0	15.5-17.5	16.5
Odontophore	28-29	28-31	27-29	26	31	24-28	29
Cardia (length x diam.)	11.5-25.0 x 7.5-17.5	18.5-23.0 x 21.0-31.0	15.5-25.0 x 15.5-19.5	20.0 x 14.5	29.0 x 13.5	15.5-38.5 x 15.5	19.0 x 12.5
Amphid diameter	8.5	7.5	8.5-9.5	9.5	9.5	8.5-9.5	8.5
Amphid of BD (%)	47-50	38-40	43-50	53	50	50-53	50
Nerve ring fr. ant. end	130	145-172	145-149	121	149	111-116	112
Hemizonid fr. ant. end	119	147-164	149	106	154	106	102
Lateral field of BD (%)	31-33	30-36	28-36	?	31	35-40	33
Cuticle thickness	3.5	4.0	3.5-4.5	3.5	4.0	3.0	3.5
Annuli width	0.5	1.0	0.6	0.7	0.6	0.5	?
V %	—	47.5 \pm 1.0 (45-50)	—	49	—	50-52	—
Vagina or Spicules	60-63	30-33	58-60	23	63	24-27	56
Prerectum or Lat. piece	17.5-19.0	67-91	17.5-21.0	56	19.0	44-63	14.5
Prerectum/ABD	—	2.1-2.9	—	2.1	—	1.9-2.5	—
Rectum length	—	31-35	—	28	—	24-29	—
Rectum/ABD	—	0.9-1.1	—	1.1	—	1.0-1.1	—
No. of supplements	1 p.+ (6-7)	—	1 p.+ (6-7)	—	1 p.+ 6	—	1 p.+ 5

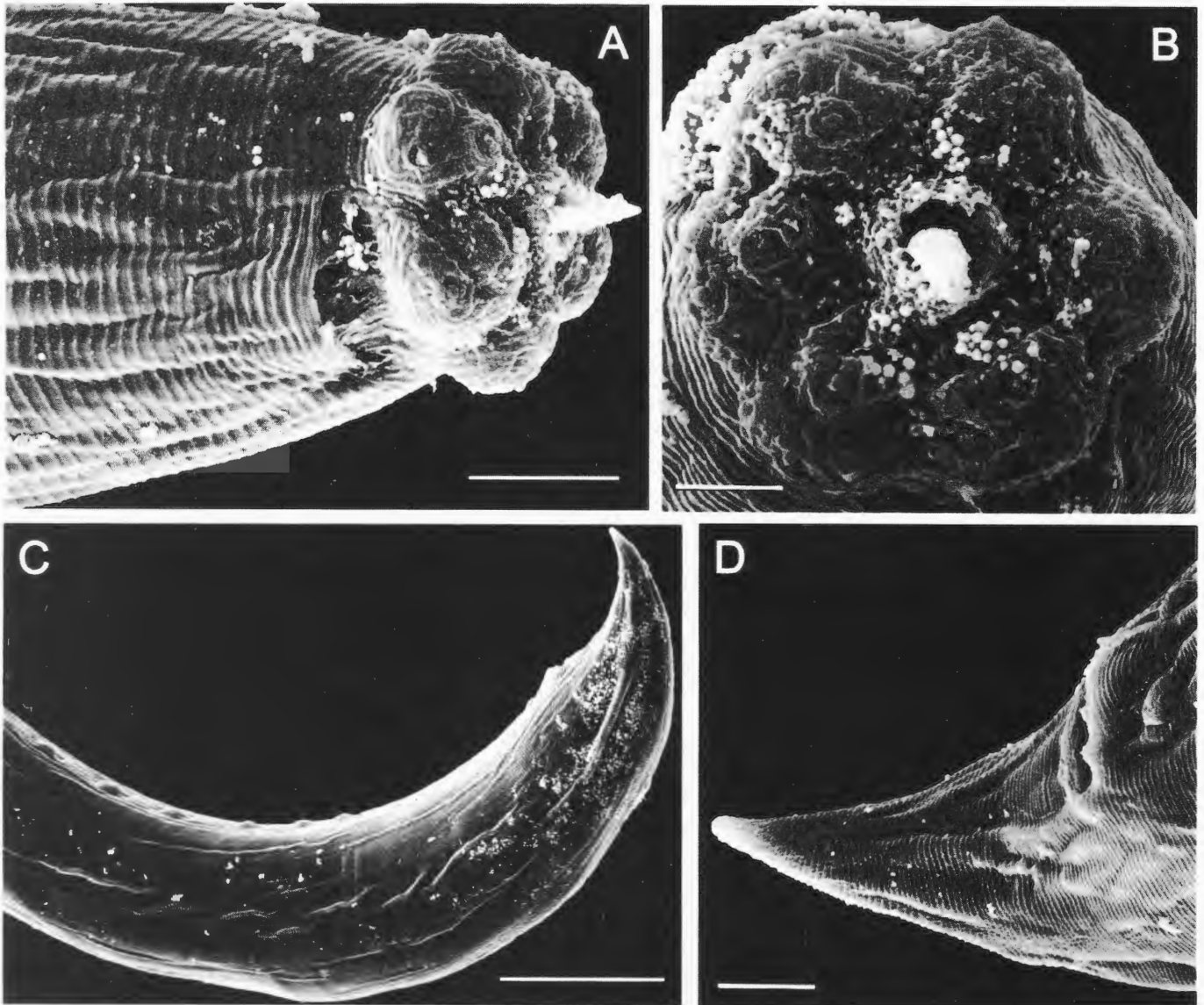


Fig. 2. *Eudorylaimus* cf. *shirasei* Kito, Shishida & Ohyama 1996 (SEM). Males from Schirmacher Oasis, Dronning Maud Land, East Antarctica (A-D). A: Labial region, dorso-lateral view; B: Labial region, *en face* view (ventral side up to the right); C: Posterior end, ventro-lateral view (showing six precloacal midventral supplements and small precloacal ventro-lateral papillae); D: Tail, ventro-lateral view (showing the pair of subventral supplements just anterior to cloaca). Scale bars: A, D - 5 μ m; B - 2.5 μ m; C - 30 μ m.

Kito, Shishida & Ohyama, 1996 and *E. glacialis* Andr ssy, 1998.

The specimens described here show a large variability in morphometric characters, e.g. a body length of 1168-2256 μ m in females and 1223-2336 μ m in males, which agrees with the recently described *E. nudicaudatus* from Robertsokollen, and *E. shirasei* from near the Russian station Molodezhnaya in Mt. Vechernaya area and from Cape Ryugu, Prince Olav Coast. All sites located in DML, East Antarctica, the former to the west

and the latter two to the east of Schirmacher Oasis. Regrettably, Kito *et al.* (1996) in their description of *E. shirasei* did not make any comparison with the recently described *E. nudicaudatus* as they were probably not aware of its existence.

A comparison of some characters among these two species and the population from Schirmacher Oasis described here is made in Table 4. It is shown that the present specimens differ from both *E. nudicaudatus* and *E. shirasei* by smaller c'-

values in both females and males. The recent population agrees with *E. shirasei* in cuticle thickness, presence of transverse body striae, and length of odontostyle, rectum and spicules. It also agrees well with *E. shirasei* in vagina morphology, which regrettably was not described in such detail for *E. nudicaudatus*. The positional patterns of female and male gonads in relation to the intestine are more variable in the recent specimens (either on each side or both on the same side of intestine – right or left – in females, and on each side in males), than in *E. shirasei* (both on the same side – right or left – of the intestine in females and males). These patterns were not recorded for *E. nudicaudatus*.

The diagnostic features of *E. nudicaudatus*, i.e. possession of a minute stylet aperture and the outer layer of cuticle not continuing around tail tip, have not been possible to document for the specimens from Schirmacher Oasis. The similarities in character sets between this population and *E. shirasei* thus point at these two as being conspecific.

Chiloplacoides antarcticus Heyns, 1994

Measurements: Female (n = 3): L = 786-837 µm; Body diameter (BD) = 46-49 µm; Pharynx = 148-163 µm; Tail = 48-50 µm; Anal body diameter (ABD) = 19-22 µm; Vulva-anus/tail = 5.0-5.5; a = 17; b = 5.0-5.3; c = 16-17; c' = 2.2-2.6; V = 63%.

Male (n = 1): L = 799 µm; BD = 41 µm; Pharynx = 167 µm; Tail = 53 µm; ABD = 27 µm; a = 19.5; b = 4.8; c = 15.1; c' = 2.0; T = 59%.

Adult. Body almost straight or slightly arcuate ventral when killed by heat. Cuticle annulated, annuli 2.0-2.4 µm wide at midbody. Lateral field with three incisures at midbody, 8.5-9.5 µm wide occupying 18-19% of BD. Lip region 12.5-14.5 µm in diameter, 3.5-4.0 µm high (excluding labial probolae). Six (three pairs) globular lips carrying 6+4 papillae and two oval amphids. Primary axils (separating the pairs of lips) deep, carrying two elongate-slender guarding processes; secondary axils shallow without guarding processes. Three flattened elongate labial probolae, joined at bases by tangential ridges, 9.5-11.5 µm long, apically bifurcated with prongs about 2 µm long. Stoma 15.0-16.5 µm long, divided into six regions: cheilorhabdia oval, about 2 µm long; gymnorhabdia thin and short; pro-, meso-, meta-, and telostegorhabdia bacilliform and of almost equal length; metastegorhabdia without denticles (terminology according to De Ley *et al.*, 1995). Pharyngeal corpus cylindrical, 77-85 µm long;

isthmus narrow, 34-46 µm long; bulb rounded or oval, 29-32 µm long and 24-27 µm wide; corpus/isthmus ratio 1.7-2.3. Nerve ring surrounding isthmus, at 113-141 µm from anterior end, 38-52 annuli from base of lips. Excretory pore obscure. Deirid at level of bulb, 159-169 µm from anterior end, 55-65 annuli from base of lips.

Female. Reproductive system monodelphic, prodelphic, reflexed posteriorly at oviduct, ovary short and straight posterior to vulva. Vulval lips slightly protruding. Spermatheca 39-58 µm long, containing spermatozoa. Postvulval uterine sac (PUS) short, 28-34 µm long, 0.6-0.8 times corresponding BD. Tail elongate-conoid with 26-28 ventral annuli, slightly dorso-ventrally flattened, with a narrow rounded terminus somewhat indented by the extended middle incisure. Phasmid at 56-59% of tail length. Rectum 27-29 µm long, 1.3-1.5 times ABD.

Male. Similar to female in general appearance. Testis single, reflexed ventrally anteriorly. Spicules 35 µm long, gubernaculum 21 µm long. Two shallow subventral grooves extend from cloacal opening about 60-70 µm anteriorly. Two pairs of precloacal papillae, one pair about 10 µm and one pair about 55 µm anterior to cloaca. A single midventral papilla on anterior cloacal lip. Phasmid at 50% of tail length. Caudal papillae: one subventral pair close to phasmids; pairs of subventral, ventrolateral and subdorsal papillae subterminally.

Remarks. The specimens described here agree well with the description of *Chiloplacoides antarcticus* by Heyns (1994). The species was originally described from the nunatak area Robertskollen, to the west of Schirmacher Oasis, and there is no doubt that the present specimens are conspecific with *C. antarcticus*, which appears endemic to Antarctica.

DISCUSSION

An ecological study of the nematode fauna of Schirmacher Oasis was made by Hazra (1994), who recorded specimens of five genera, *viz.* *Tylenchorhynchus*, *Dorylaimellus*, *Aporcelaimellus*, *Dorylaimoides* and *Paramylonchulus*. None of these genera was listed by Maslen (1979) or Andrassy (1998) for continental Antarctica. Andrassy (1998) listed only nematodes identified to species level and such identifications were not made by Hazra (1994). The three genera (*Plectus*, *Eudorylaimus* and *Chiloplacoides*) reported here thus add to the nematode diversity of Schirmacher Oasis. The genera and species of nematodes recorded from Schirmacher Oasis in this study

Table 4. Comparison of some morphological characters in the population of *Eudorylaimus* described from Schirmacher Oasis (S.O.), Dronning Maud Land, East Antarctica with *Eudorylaimus nudicaudatus* Heyns, 1993 and *Eudorylaimus shirasei* Kito *et al.*, 1996. Figures in **bold** indicate similarities between populations.

Character	<i>Eudorylaimus</i> S.O.	<i>E. nudicaudatus</i>	<i>E. shirasei</i>
Body length (µm) ♀♀	1168-2256	1400-2080	1537-2667
Body length (µm) ♂♂	1223-2336	1770-2200	1347-2484
Cuticle thickness (µm)	3.0-4.5	1.8-2.0	3.0-5.0
Transv. striae width (µm)	0.5-1.0	Not seen	0.8
Odontostyle (rm) ♀♀	16-22	13-14	16-19
Odontostyle (rm) ♂♂	15-18	13-15	17-19
Odontostyle length/LRD	~1	<1	~1
c'-value ♀♀	1.2-1.7	1.8-2.2	1.8-2.3
c'-value ♂♂	1.2-1.4	1.4-1.7	1.3-1.8
Rectum length (µm) ♀♀	24-35	34-49	23-36
Spicule length (µm)	56-63	48-56	54-65
No. of ♂♂ supplements	1 pair + (5-7)	1 pair + (6-8)	1 pair + (7-8)

agree rather well with the species found in DML by Heyns (1994, 1995) and Kito *et al.* (1996).

Plant feeding tylenchids are rarely found in continental Antarctica and, besides the finding of *Tylenchorhynchus* in Schirmacher Oasis by Hazra (1994), the only records are made by Yeates (1979), who found *Helicotylenchus* sp. in Bunger Hills, and by Van den Berg & Harris (1996), who found *Rotylenchus capensis* Van den Berg & Heyns, 1974 on nunataks in Ahlmannryggen, DML. Several genera of tylenchids, viz. *Aglenchus*, *Apratylenchoides*, *Filenchus*, *Paratylenchus*, *Pratylenchus* and *Tylenchorhynchus* were recorded from the nunatak Basen, Vestfjella, DML, during SWEDARP 2001/02 and these results are presented elsewhere (Ryss *et al.*, in press).

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REFERENCES

Andrássy, I. 1984. Klasse Nematoda (Ordnungen Monhysterida, Desmoscolecida, Araeolaimida,

Chromadorida, *Rhabditida*). Deutschland, Stuttgart, Gustav Fischer Verlag. 509 pp.

Andrássy, I. 1985. The genus *Plectus* Bastian, 1865 and its nearest relatives (Nematoda: Plectidae). *Acta Zoologica Hungarica* 31: 1-52.

Andrássy, I. 1998. Nematodes in the sixth continent. *Journal of Nematode Morphology and Systematics* 1: 107-186.

Bastian, H.C. 1865. Monograph on the Anguillulidae, or free nematoids, marine, land and freshwater; with descriptions of 100 new species. *Transactions of the Linnean Society of London* 25: 73-184.

Block, W. 1994. Terrestrial ecosystems: Antarctica. *Polar Biology* 14: 293-300.

Boström, S. 1995. Populations of *Plectus acuminatus* Bastian, 1865 and *Panagrolaimus magnivulvatus* n. sp. (Nematoda) from nunataks in Dronning Maud Land, East Antarctica. *Fundamental and Applied Nematology* 18: 25-34.

Boström, S. 1997. *Chiloplectus masleni* sp. nov. and variability in populations of *Plectus acuminatus* Bastian, 1865 (Nematoda: Plectidae) from the nunatak Basen, Vestfjella, Dronning Maud Land, East Antarctica. *Polar Biology* 17: 74-80.

Boström, S. & Gydemo, R. 1983. Intraspecific variability in *Acrobeloides nanus* (de Man) Anderson (Nematoda: Cephalobidae) and a note on external morphology. *Zoologica Scripta* 12: 245-255.

Brzeski, M. 1963. Contribution to the knowledge of the Polish species of the genera *Plectus* Bastian and *Anaplectus* De Coninck et Sch. Stekh. (Nematoda, Plectidae). *Fragmenta Faunistica* 11: 21-30.

De Ley, P., Loof, P.A.A. & Coomans, A. 1993. Terrestrial nematodes from the Galápagos Archipelago II: Redescription of *Aporcelaimellus obtusicaudatus* (Bastian, 1865) Altherr, 1968, with review of similar species and a nomenclature for the

- vagina in Dorylaimida (Nematoda). *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Biologie* 63, 13-34.
- De Ley, P., Van de Velde, M.C., Mounport, D., Baujard, P. & Coomans, A. 1995.** Ultrastructure of the stoma in Cephalobidae, Panagrolaimidae and Rhabditidae, with a proposal for a revised stoma terminology in Rhabditida (Nematoda). *Nematologica* 41: 153-182.
- Hazra, A.K. 1994.** Study of the population ecology of soil nematode fauna in relation to some edaphic factors in Schirmacher Oasis, Antarctica. *Scientific Report of Ninth Indian Expedition to Antarctica, Technical Publication* 6: 65-90. (Only seen abstract.)
- Heyns, J. 1993.** *Eudorylaimus nudicaudatus* sp. n. from Antarctica (Nematoda: Dorylaimoidea). *South African Journal of Antarctic Research* 23: 33-36.
- Heyns, J. 1994.** *Chiloplacoides antarcticus* n. gen., n. sp. from western Dronning Maud Land, Antarctica (Nematoda: Cephalobidae). *Fundamental and applied Nematology* 17: 333-338.
- Heyns, J. 1995.** *Plectus antarcticus* de Man, 1904 from western Dronning Maud Land, Antarctica. *Nematologica* 41: 1-6.
- Holovachov, O., Boström, S. & Susulovsky, A. 2001.** Study of Plectidae (Nematoda) from Ukraine. Description of *Plectus paracuminatus* Zell, 1993 with observations of male sexual characters. *Journal of Nematode Morphology and Systematics* 4: 11-20.
- Kennedy, A.D. 1993.** Water as a limiting factor in the Antarctic terrestrial environment: a biogeographical synthesis. *Arctic and Alpine Research* 25: 308-315.
- Kirjanova, E.S. 1958.** Antarctic specimens of fresh-water nematodes of the genus *Plectus* Bastian (Nematoda, Plectidae). *Information Bulletin of the Soviet Antarctic Expedition* 3: 101-103. [English translation: Vol. 1: 163-165, 1964].
- Kito, K., Shishida, Y. & Ohyama, Y. 1991.** *Plectus antarcticus* de Man, 1904 and *P. frigophilus* Kirjanova, 1958 (Nematoda: Plectidae), with emphasis on the male, from the Soya Coast, East Antarctica. *Nematologica* 37: 252-262.
- Kito, K., Shishida, Y. & Ohyama, Y. 1996.** A new species of the genus *Eudorylaimus* Andrassy, 1959 (Nematoda: Qudsiannematidae) from East Antarctica. *Polar Biology* 16: 163-169.
- Loof, P.A.A. 1975.** Dorylaimoidea from some Subantarctic islands. *Nematologica* 21: 219-255.
- Maggenti, A.R. 1961.** Revision of the genus *Plectus* (Nematoda: Plectidae). *Proceedings of the Helminthological Society of Washington* 28: 139-166.
- de Man, J.G. 1904.** Nématodes libres. *Expédition Antarctique Belge. Résultats du Voyage du S.Y. Belgica en 1897-1898-1899, Zoologie*: p. 3-55.
- Maslen, N.R. 1979.** Additions to the nematode fauna of the Antarctic region with keys to taxa. *British Antarctic Survey Bulletin* 49: 207-229.
- Sohlenius, B. 1979.** A carbon budget for nematodes, rotifers and tardigrades in a Swedish coniferous forest soil. *Holarctic Ecology* 2: 30-40.
- Sohlenius, B., Boström, S. & Hirschfelder, A. 1995.** Nematodes, rotifers and tardigrades from nunataks in Dronning Maud Land, East Antarctica. *Polar Biology* 15: 51-56.
- Sohlenius, B., Boström, S. & Hirschfelder, A. 1996.** Distribution patterns of microfauna (nematodes, rotifers and tardigrades) on nunataks in Dronning Maud Land, East Antarctica. *Polar Biology* 16: 191-200.
- Sohlenius, B., Boström, S. & Jönsson, K.I. 2003.** Simple animal communities on Antarctic nunataks. *Polarforskningssekretariatets ersbok 2002*: 58-61.
- Sohlenius, B., Boström, S. & Jönsson, K.I. 2004.** Occurrence of nematodes, tardigrades and rotifers on ice-free areas in East Antarctica. *Pedobiologia* 48: 395-408.
- Steiner, G. 1916.** Beiträge zur geographischen Verbreitung freilebender Nematoden. *Zoologischer Anzeiger* 46: 311-335.
- Timm, R.W. 1971.** Antarctic soil and freshwater nematodes from the McMurdo Sound Region. *Proceedings of the Helminthological Society of Washington* 38: 42-52.
- Van den Berg, E. & Harris, J.M. 1996.** *Rotylenchus capensis* Van den Berg & Heyns (Tylenchida: Hoplolaimidae) in soils of isolated inland nunataks in western Dronning Maud Land, Antarctica. *African Plant Protection* 2: 19-24.
- Van den Berg, E. & Heyns, J. 1974.** South African Hoplolaiminae 3. The genus *Rotylenchus* Filipjev, 1936. *Phytophylactica* 6: 165-184.
- Vinciguerra, M. T. 1984.** Description of two new species and remarks on some known species of nematodes from Sardinia. *Animalia* 11: 127-134.
- Vinciguerra, M. T. 1994.** *Plectus antarcticus* de Man, 1904 (Nematoda, Plectidae): remarks on the male characters and new diagnosis of the species. *Animalia* 21: 113-115.
- Wall Freckman, D.W. & Virginia, R.A. 1998.** Soil biodiversity and community structure in the McMurdo Dry Valleys, Antarctica. In: *Ecosystem dynamics in a polar desert: The McMurdo Dry Valleys, Antarctica*. (J. Prisco, Ed.). pp. 323-335. American Geophysical Union.
- Yeates, G.W. 1970.** Two terrestrial nematodes from the McMurdo Sound Region, Antarctica, with a note on *Anaplectus arenicola* Killick, 1964. *Journal of Helminthology* 44: 27-34.
- Yeates, G.W. 1979.** Terrestrial nematodes from the Bunger Hills and Gaussberg, Antarctica. *New Zealand Journal of Zoology* 6: 641-643.
- Zell, H. 1993.** Die Gattung *Plectus* Bastian, 1865 sensu lato (Nematoda, Plectidae). Ein Beitrag zur Ökologie, Biogeographie, Phylogenie und Taxonomie der Plectidae. *Andrias* 11: 1-171.

Boström S. Нематоды из оазиса Ширмахера, Земля Королевы Мод, Восточная Антарктика.

Резюме. Дано описание трех видов нематод: *Plectus* cf. *acuminatus* Bastian, 1865, *Eudorylaimus* cf. *shirasei* Kito, Shishida & Ohyama, 1996 и *Chiloplacoides antarcticus* Heyns, 1994 из проб почвы и мха, собранных близ российской станции Новолазаревская в т.н. оазисе Ширмахера, на Земле Королевы Мод в Восточной Антарктике. Аргументируется видовое определение и проводится сравнение полученных данных с предыдущими находками нематод на Антарктическом континенте.
