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One new and two known nematode species from the Subantarctic Islands South Georgia and East Falkland Island

Sven BOSTRÖM

Zoo-tax, Swedish Museum of Natural History, Box 50007, 104 05 Stockholm, Sweden.

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Summary – Populations of three species of nematodes, *Pelodera arnbomi* n. sp., *Plectus rhizophilus* and *Acrobeloides nanus,* are described from the Subantarctic island South Georgia for the first time. *Pelodera arnbomi* n. sp. differs from all species of *Pelodera* with a dome-shaped female tail by its conical female tail shape. It differs from *P. teres, P. conica* and *P. incilaria* by the number of preanal papillae in the male bursa (2 *vs* > 2). It is distinguished from *P. punctata* by a smaller body size (880 µm *vs* 1200-2500 µm) and smaller c'-value (2.8 *vs* 4) and from *P. comandorica* by a smaller body size (880 *vs* 1080-1500 µm) and larger c'-value (2.8 *vs* 1.5) in the females. The relation between some species of *Plectus,* especially the identity of *P. rhizophilus* and *P. varians,* is discussed. A population of *A. nanus* from East Falkland Island is compared with the South Georgia population and found to differ significantly in many quantitative characters. However, the ranges of measurements and ratios and also the qualitative characters are overlapping between the two populations.

***Résumé* – A propos d'une nouvelle espèce et deux espèces de nématodes déjà connues des îles subantarctiques de Géorgie du Sud et des Malouines de l'Est -** Des populations de trois espèces de nématodes, *Pelodera arnbomi* n. sp., *Plectus rhizophilus* et *Acrobeloides nanus,* sont décrites des îles subantarctiques de Géorgie du Sud pour la première fois. *Pelodera arnbomi* n. sp. se sépare de toutes les autres espèces du genre *Pelodera* à queue hémisphérique par la forme conique de la queue chez la femelle et diffère de *P. teres, P. conica* et *P. incilaria* par le nombre de papilles préanales sur la bursa des mâles (2 *vs* > 2); il diffère de *P. punctata* par la plus faible longueur du corps (880 *vs* 1200-2500 µm) et une valeur plus faible de c' (2,8 *vs* 4) et de *P. comandorica* par la plus faible longueur du corps (880 *vs* 1080-1500 µm) et une valeur de c' plus élevée (2,8 *vs* 1,5) chez les femelles. Les relations entre quelques espèces du genre *Plectus,* et plus spécialement l'identité de *P. rhizophilus* et *P. varians,* sont discutées. Une population d'*A. nanus* provenant de l'île des Malouines de l'Est est comparée avec celle de l'île de Géorgie du Sud dont elle diffère significativement par de nombreux caractères. Cependant les valeurs des mensurations et des coefficients, de même que les caractères qualitatifs, se recouvrent entre ces deux populations.

Key-words : *Acrobeloides nanus,* Cephalobidae, morphology, *Pelodera arnbomi* n. sp., Plectidae, *Plectus rhizophilus,* Rhabditidae, SEM, taxonomy.

Collections of marine, fresh-water and terrestrial nematodes from the Subantarctic islands and the Maritime and Continental parts of the Antarctica, have been made since the beginning of this century (e.g. de Man, 1904; Jägerskiöld, 1905; Steiner, 1916; Allgén, 1959) and many more species were recorded since then. Maslen (1979) reviewed the terrestrial nematodes from this area and noted that little was known of the Subantarctic island South Georgia. A general account of the island, including its natural history, was made by Headland (1984), but no details on the presence of nematodes were mentioned.

The aim of this paper is to describe populations of three nematode species, viz. *Pelodera arnbomi* n. sp., *Plectus rhizophilus* de Man, 1880 and *Acrobeloides nanus* (de Man, 1880) Anderson, 1968, from South Georgia (S.G.). A population of *A. nanus* collected on East Falkland Island (F.I.) is compared with the South Georgia population.

Materials and methods

Samples from South Georgia were taken by Tom Arnbom on February 16, 1989. A sample from an elephant seal *(Mirounga leonina)* moulting ground at Tønsberg Peninsula consisted of organic material and yielded the peloderan species. A sample from an old whaling station at Husvik consisted of sand and gravel and yielded specimens of plectids and cephalobids. Samples from East Falkland Island at Cerritos arroyo were taken by Anders Wasell on January 15, 1994 from a grassland grazed by sheep and geese. One sample yielded the cephalobids which were selected for comparison with those from South Georgia.

The nematodes were extracted by a wet funnel method (Sohlenius, 1979), killed by heat and fixed in cold TAF. For light microscopy (LM), nematodes were transferred to anhydrous glycerine by a slow evaporation method (Hooper, 1970) and mounted on slides as

described in Boström and Gydemo (1983). For scanning electron microscopy (SEM) they were processed according to Boström (1989). Identification to species level was made using LM. Measurements and ratios are generally given as : mean ± S.E. (range) or only range.

Pelodera arnbomi * sp. n.
(Fig. 1)

MEASUREMENTS

Female (holotype) : L = 881 µm; width = 48 µm; a = 18; pharynx = 210 µm; b = 4.2; tail = 60 µm; c = 15; c′ = 2.8; V = 57; vulva-anus/tail = 5.3.

Males (n = 7) : L = 680 ± 24 (563-754) µm; width = 34 ± 1 (30-37) µm; a = 20 ± 1 (17-23); pharynx = 173 ± 5 (157-190) µm; b = 3.9 ± 0.1 (3.6-4.2); tail = 32 ± 1 (26-38) µm; c = 21 ± 0.3 (20-23); c′ = 1.4 ± 0.1 (1.3-1.5); T = 67 ± 1 (62-70); spicules = 50 ± 2 (37-56) µm; gubernaculum (n=2) = 42-44 µm.

DESCRIPTION

Adults : Rather small peloderans with moderately offset lips. Cuticle finely annulated, annuli 1.4 µm wide in female; 0.8-1.1 µm in male. Cheilostom lightly sclerotized, three denticles on each metarhabdion. Stoma 25 µm long in female; 19-21 µm in male. Anterior part of pharynx enveloping base of mesostom. Corpus/isthmus ratio 1.4-2.1. Posterior bulb 40 × 30 µm in female; 29-37 µm long and 18-26 µm wide in male. Excretory pore at 66-72 % of pharynx length; at 165 µm from anterior end in female; at 140-154 µm in male.

Female : Reproductive system didelphic, amphidelphic; ovary branches reflexed, flexed portions ending past vulva. Branches occupy 39-41 % of body length, flexed portions occupy 103-134 % of the length of the branch prior to the flexure. Vulval lips protruding. A sphincter (" dosator " *sensu* Belogurov *et al.,* 1977) consisting of four cells present between oviduct and uterus. Rectum 27 µm long. Tail conoid, elongate with pointed terminus. Phasmids at 8 µm from anus, at 13 % of tail length.

Males : Reproductive system monorchic, testis reflexed anteriorly. Testis 456 ± 22 (368-518) µm long; reflexed part 106 ± 4 (96-128) µm long, occupying 20-29 % of testis length. Spicules fused along 22-37 µm (60-75 % of their length). Bursa peloderan, open, with fine transverse striae close to the body. Ten bursal papillae, generally arranged as 2/5 + 3 and sometimes 2/4 + 4. The preanal papillae numbers 1 and 2, 2-7 µm apart; this distance is, often different in the left and right sides in the same specimen (the following left/right combinations) were found; 2 µm/2 µm; 3 µm/2 µm;

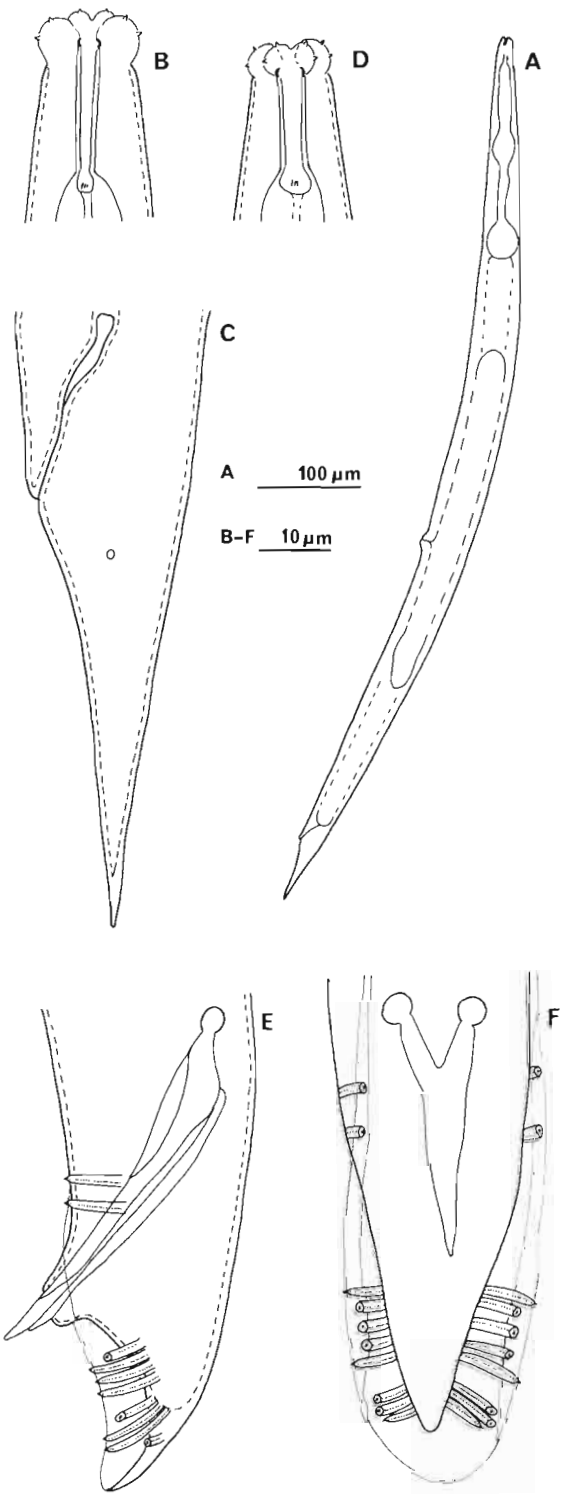

Fig. 1. Pelodera ambomi *sp. n. A-B. Holotype female. A : Whole body; B : Anterior end; C : Tail; D-F : Paratype males; D : Anterior end; E : Tail, lateral view; F : Tail, ventral view.*

* After Dr. Tom Arnbom who collected the samples for this study and who has made significant contributions to the knowledge of the biology of the Southern elephant seal.

6 µm/2 µm; 4 µm/7 µm). First papilla sometimes missing or displaced anteriorly (about 20 µm). Papillae numbers 3, 7 and 10 open at the outer edge of the bursa. Papillae numbers 8-10 (sometimes 7-10) always standing together. Gaps between the papillae 3 to 7 variable in position; arrangement 2/4 + 4 : gap between papillae number 5-6; arrangement 2/5 + 3 : gap between papillae number 4-5 and 5-6, or 3-4 and 6-7, or 6-7 only.

TYPE SPECIMENS

Holotype female and four paratype males (access no. 4665) deposited at Swedish Museum of Natural History, Department of Invertebrate Zoology, Box 50007, 104 05 Stockholm, Sweden. Three paratype males deposited at Muséum National d'Histoire Naturelle, Laboratoire de Biologie Parasitaire, Protistologie, Helminthologie, 61, rue Buffon, 75005 Paris, France.

TYPE HABITAT AND LOCALITY

Organic material collected from an elephant seal *(Mirounga leonina)* moulting ground on the southern part of Tønsberg Peninsula (54° 10'S, 36° 43'W) on the Subantarctic island South Georgia.

DIAGNOSIS AND RELATIONSHIPS

Pelodera arnbomi n. sp. is distinguished by the conical female tail from the species *P. strongyloides* (Schneider, 1860) Schneider, 1866, *P. nidicolis* Sudhaus & Schulte, 1986, *P. orbitalis* Sudhaus & Schulte, 1986 and *P. cutanea* Sudhaus, Schulte & Hominick, 1987, which all have female tail dome-shaped with a little spine. The new species is distinguished from the species *P. teres* Schneider, 1866 (female tail variable), *P. conica* (Reiter, 1928) Dougherty, 1955 and *P. incilaria* (Yokoo & Shinohara, 1958) Andrássy, 1983 (all having a conical female tail) by the number of preanal papillae in the male bursa (2 *vs* > 2). It is distinguished from *P. punctata* (Cobb, 1914) Dougherty, 1955 (L = 1200-2500 µm) and *P. comandorica* Belogurov, Muchina & Churikova, 1977 (L = 1080-1500 µm) by a much smaller female body size (L = 880 µm) and a smaller c'-value in the female (2.8 *vs* about 4) compared to *P. punctata,* and by a larger c'-value in the female (2.8 *vs* about 1.5) compared to *P. comandorica.*

COMMENTS

The genus *Pelodera* was recently reviewed by Sudhaus *et al.* (1987). They provided a key to the six species in the *strongyloides*-group, characterized by 10 pairs of bursal papillae arranged as 2/4 + 4 or 2/5 + 3. Andrássy (1984) also included in his revision the three species with more than two pairs of preanal papillae in the male bursa. The new species reported here has been contrasted above with all previously described species in the genus.

The males in the *strongyloides*-group are distinguished by the distance between papillae no. 1 and 2 (*P. punctata* - 1-3 µm, *P. comandorica* - 4 µm, *P. orbitalis* - 4-6 µm, *P. nidicolis* - < 5 µm, *P. strongyloides* - > 5 µm and *P. cutanea* - 6-18 µm; Sudhaus *et al.,* 1987; Sudhaus & Schulte, 1988). In the new species described here, the variability of the distances between these papillae (2-7 µm) traverses the distances recorded in many other species. This put in question the diagnostic value of this character.

Plectus rhizophilus de Man, 1880

(Figs 2 A-D, 3)

MEASUREMENTS

Females (n = 9) : L = 757 ± 12 (696 – 817) µm; width = 38 ± 0.5 (35-39) µm; a = 20 ± 0.3 (19-22); pharynx = 171 ± 2 (160-176) µm; b = 4.4 ± 0.05 (4.1-4.6); tail = 95 ± 2 (82-102) µm; c = 8.0 ± 0.2 (7.4-8.9); c' = 5.4 ± 0.2 (4.6-6.2); V = 49 ± 0.3 (47-50) %; vulva-anus/tail = 3.1 ± 0.1 (2.8-3.5).

DESCRIPTION

Females : Body arcuate ventrad when relaxed by heat. Cuticle 1.5-2 µm thick, annulated; annuli about 1 µm wide. Lateral field consisting of two bands extending to about 70-80 % of tail length, about 5 µm wide at mid-body, occupying about 1/7-1/8 of body width (BW). Pharyngeal region with 6-8 somatic setae in three pairs : one median lateral, one ventrolateral, and one dorsolateral at corpus level; plus sometimes one dorsal and one ventral setae at level of posterior part of isthmus. Body between cardia and anus with 8-12 scattered somatic setae. Lip region rounded, not or very slightly offset. Height of labial region 3.5-4 µm, diameter 9-10 µm. Six lips, well separated from each other, small inner labial papillae situated apically on the lips. Four cephalic setae, about 3-3.5 µm long, directed forward and outward, placed at anterior part of stoma, on second annulus from anterior end. Amphids circular, about 4 µm in diameter, occupying about 30 % of neck width, located at 10.5-12.5 µm from anterior end, i.e. somewhat posterior to middle part of stoma. Length of stoma 18-21 µm, width 2.5-4 µm anteriorly. Basal bulb 23-26 µm long, 19-23 µm wide; cardia 11-15 µm long, enveloped by intestine. Excretory pore at 95-105 µm from anterior end. Deirids setiform, in middle of lateral field at 101-117 µm from anterior end, at 4-8 annuli from excretory pore. Genital organs didelphic, amphidelphic; ovary branches reflexed, the two ovaries extending 2-3.5 times BW anteriorly and 2-3 times BW posteriorly. Two females with one egg each, measuring 58 × 34 µm and 43 × 29 µm. Vulva at middle of body, vulval lips not protruding. Vagina straight, occupying about one-fifth to one-fourth of vulval body width. Distal vaginal walls refractive with cuticular folds (epiptygmata), seen with SEM. [This type of vagina structure in *Plectus* was recently described by De Ley and Coomans (1994) in a new species, *P. lamproptychus,* from the Galápagos Archipelago.] Rectum about 1.0-1.2 anal body widths

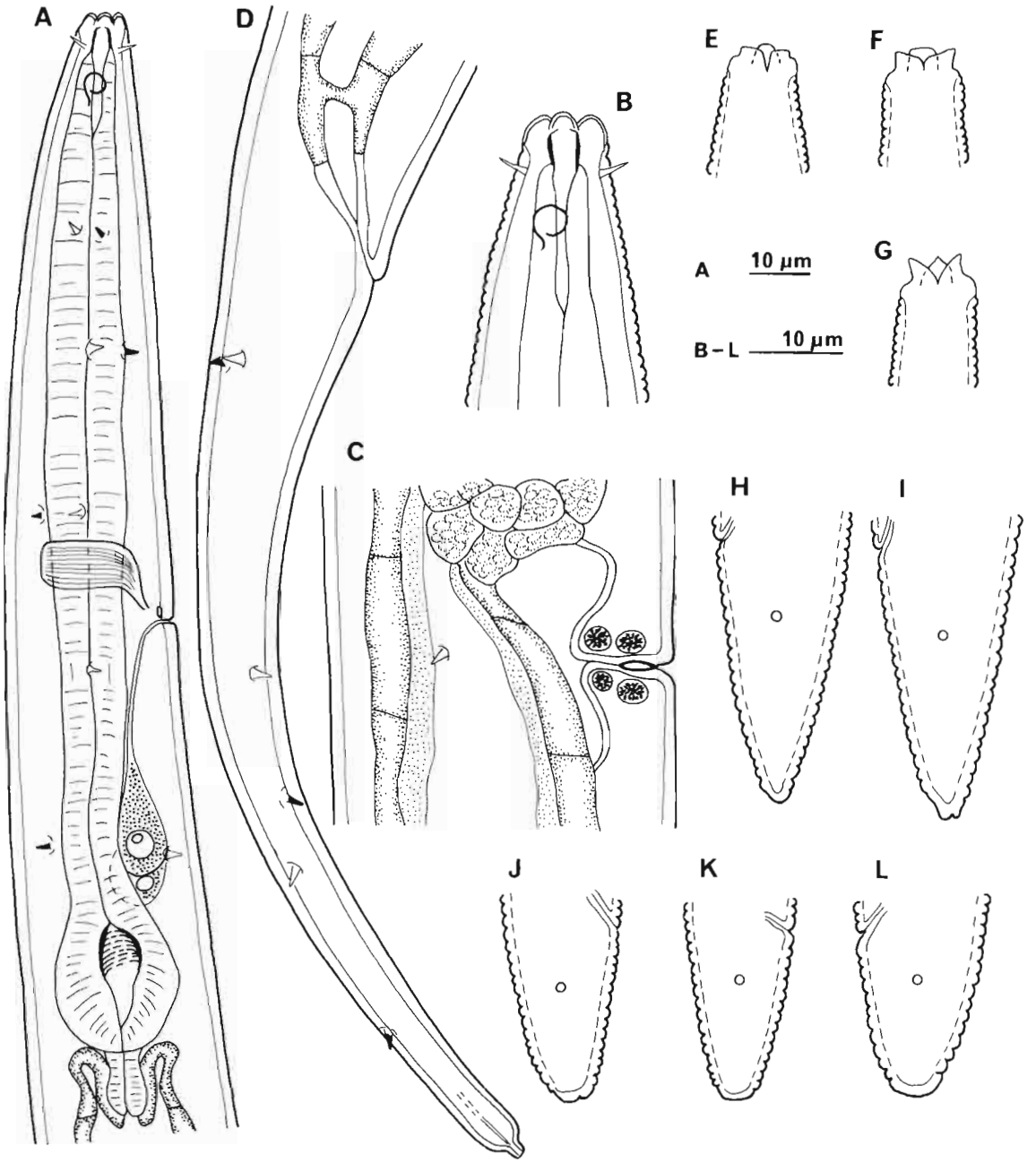

Fig. 2. Plectus rhizophilus *de Man, 1880. A : Pharyngeal region; B : Anterior end; C : Vulval region; D : Tail.* (The black and the white setae are located on different sides of the body.) – Acrobeloides nanus *(de Man, 1880) Anderson, 1968. E-G. Variability in labial probolae shape. E : Squared; F : Knobbed; G : Conoid. H-L. Variability in tail shape. H : Conoid, rounded terminus; I-J : Conoid, irregular terminus; K : Conoid, broadly rounded terminus; L : Conoid-cylindrical, broadly rounded terminus.*

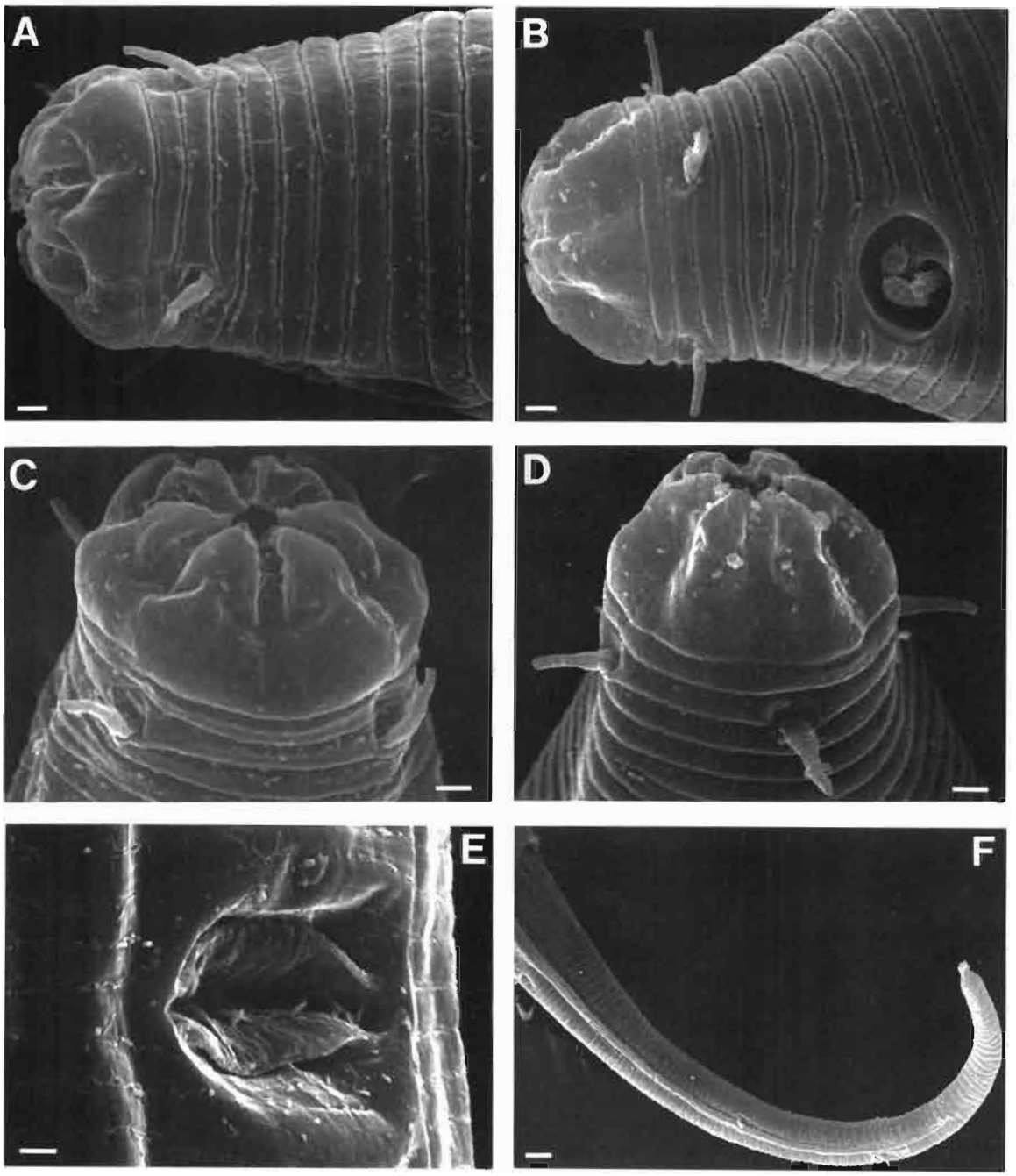

Fig. 3. Plectus rhizophilus *de Man, 1880. A : Anterior end, ventral view; B : Anterior end, lateral view; C : Anterior end, slightly tilted ventral view; D : Anterior end, slightly tilted lateral view; E : Vulva; F : Tail.* (Lips retracted in A and C. Scale bars : A-E = 1 μm, F = 4 μm.)

(ABW) long. Tail conoid, elongate, arcuate ventrad with 5-7 setae, of which the most posterior one is situated at 18-22 µm from tail terminus.

Male : Not found.

DISCUSSION

The taxonomy of the genus *Plectus* Bastian, 1865 is complex. Several species are morphologically very similar and many species have been described over the years. The most recent revision of the genus was made by Zell (1993) and covered about 50 valid species (almost 30 species were considered *sp. inq.* by Zell).

Several cosmopolitan and possibly some endemic species of *Plectus* have been reported from the Antarctic continent and the Subantarctic region, viz. *P. acuminatus* Bastian, 1865, *P. cirratus* Bastian, 1865, *P. parietinus* Bastian, 1865, *P. parvus* Bastian, 1865, *P. antarcticus* de Man, 1904, *P. belgicae* de Man, 1904, *P. frigophilus* Kirjanova, 1958 and *P. murrayi* Yeates, 1970 [see Kito *et al.* (1991) and Maslen (1979) for reviews]. Zell (1993) also added *P. indicus* Khera, 1972 and *P. infundibulifer* Andrássy, 1985 to that list.

Using the key of Andrássy (1985), the specimens of the population from South Georgia may be identified as *Plectus rhizophilus* de Man, 1880 (with *P. varians* Maggenti, 1961 as one of its synonyms). The recent key of the genus *Plectus* by Zell (1993) gives a dichotomy between *P. rhizophilus* and *P. varians* built on head diameter (7-8 µm *vs* at least 8.5 µm). The latter species can easily be confused with *P. murrayi* according to Zell (1993). Maggenti (1961) separated *P. rhizophilus* from *P. varians* by the lip height/lip region width-ratio (1/2 *vs* 1/4) and amphid diameter (about 3.5 µm *vs* 3 µm).

The main differences between the present specimens and those from Dronning Maud Land described as *P. acuminatus* by Boström (1995) are : a smaller body size (696-817 *vs* 831-968 µm), more anteriorly placed amphids (7-9 *vs* 12-14 annules from base of lips) and larger diameter of amphid apertures (4 *vs* 2.5-3 µm or 30 *vs* 15-20 % of neck width).

Neither *P. rhizophilus* nor *P. varians* have previously been recorded from the Antarctic continent or the Subantarctic islands, while *P. murrayi* was described from the McMurdo Sound region by Yeates (1970). *P. murrayi* has subsquently been synonymized with *P. antarcticus* by Timm (1971) and this synonymy was accepted by Yeates (1979) and Kito *et al.* (1991). Zell (1993) considered it a valid species and stated that the synonymization by Timm (1971) was due to a misidentification because Timm's slides contained a mixture of two different species, viz. *P. indicus* and *P. murrayi*. Andrássy (1985) synonymised *P. murrayi* with *P. acuminatus*.

The specimens recorded by Zell (1993) under the name *P. murrayi* differ in several respects from the original description of the species by Yeates (1970) : number of lips (6 *vs* 12, which Zell (1993) explained as an artefact, but may be a division of lips by striae), annulus width (0.8-1.35 *vs* 2.5 µm), stoma length (14.5-22.5 *vs* 9 µm) and position of amphid (just posterior to middle of stoma *vs* at base of stoma). The specimens of the present population resemble *P. murrayi sensu* Zell (1993) in many morphometric characters. There are, however, the same differences as mentioned above between these specimens and the original description of *P. murrayi*. Thus the identity of *P. murrayi* is not ascertained and, although there are resemblances, the present specimens can not be identified as *P. murrayi*. Their identity must be searched among the species *P. rhizophilus* and *P. varians* which, as mentioned above, are separated mainly by the width of the lip region (7-8 µm *vs* 8.5-10 µm). The lip region in the specimens from South Georgia is 9-10 µm, which places them closer to *P. varians*. The small differences between *P. rhizophilus* and *P. varians,* however, make it likely that they are conspecific as proposed by Andrássy (1984, 1985) and the South Georgia population is thus identified as *P. rhizophilus,* which is a new record for the area.

Acrobeloides nanus (de Man, 1880) Anderson, 1968

(Fig. 2 E-L)

MEASUREMENTS

Measurements and ratios presented in Table 1.

DESCRIPTION

Females : Body slightly arcuate ventrad when killed by heat. Cuticle annulated, annules 1.6-1.9 µm wide in specimens from South Georgia (S.G.), 1.4-2.4 µm in specimens from Falkland Islands (F.I.). Lateral field with five incisures at midbody. The number of incisures diminishes posteriorly and one incisure extends to tail terminus. Three pairs of lips, bearing 6 + 4 papillae and two amphids. Simple cephalic axils. Three labial probolae, knobbed to conoid shaped in specimens from S.G., generally squared to knobbed shaped (single specimens with low-rounded or conoid) in specimens from F.I. Cheilorhabdions ovoid in specimens from S.G., ovoid-rounded in specimens from F.I. Cheilostom wide, rest of stoma narrow. Pharynx cephalobid, metacorpus fusiform, basal bulb with valves. Cardia not prominent, enveloped by intestinal cells. Nerve ring from corpus-isthmus junction to the anterior part of isthmus in specimens from S.G., from the anterior to the middle part of isthmus in specimens from F.I. Excretory pore from the level of corpus-isthmus junction to the middle part of isthmus in specimens from S.G., from the middle part of isthmus to the anterior part of bulb in specimens from F.I. Deirids from the middle to the posterior part of isthmus in specimens from S.G., from the anterior to the posterior part of bulb in specimens from F.I. Reproductive system cephalobid, monodelphic, prodelphic; genital branch reflexed at oviduct; ovary varying from straight to twice reflexed posterior to vulva. Spermathe-

ca small, empty. Post-uterine branch (PUB) generally lacking, 7-8 μm long in two females from S.G. and 5-6 μm long in three females from F.I. Vulval lips protruding. Anus a transverse slit with posterior lip protruding. Tail conoid, usually with rounded (sometimes irregular) terminus in specimens from S.G., conoid-cylindrical, usually with broadly rounded terminus in specimens from F.I.

Male : Not found.

Discussion

When tested for significance between mean values, the two populations from South Georgia and East Falkland Island were found to differ in many characters (Table 1). The ranges of measurements and ratios were, however, overlapping and it was not possible to find any qualitative differences separating the two populations, which were both identified as *Acrebeloides nanus*.

Detailed descriptions of the morphological variability in specimens of several populations of *A. nanus* have been made from many geographic areas, e.g. Canada (Anderson, 1968), Sweden (Boström & Gydemo, 1983), Brazil (Rashid *et al.,* 1985), Krakatau (Rashid *et al.,* 1989) and Malaysia (Boström, 1993). The specimens of the two populations described here are well within the morphological ranges reported for the species. Anderson (1968) was the first to show a wide variability in labial probolae shape (from low-rounded over knobbed and conoid to apiculate) and tail shape (from rounded to conoid-apiculate) induced by various environmental conditions. Variability in these characters, albeit less than that shown by Anderson (1968), has also been found in the specimens from South Georgia and East Falkland Island.

The identity of *A. nanus* and *A. buetschlii* (de Man, 1884) Steiner & Buhrer, 1933 has been questioned. In spite of the main difference between the two species : the number of incisures in the lateral field, five *vs* three, Anderson (1968) considered *A. buetschlii* to be a synonym of *A. nanus*. Rashid *et al.* (1985) also regarded their populations from Brazil as *A. nanus,* although some specimens had only three incisures. Another character, presence *vs* absence of a PUB, was introduced by Zell (1987), who concluded that there are two valid species : *A. buetschlii* with three incisures and a short (4-7 μm long) PUB and *A. nanus* with five incisures and no PUB. This statement is contradicted by the findings in Rashid *et al.* (1985), Bird *et al.* (1993), Boström (1993) and the present study, which show the possibility of having five incisures and a short or absent PUB, indicating that there is only one valid species : *A. nanus*.

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Table 1. *Measurements in μm and ratios of females of* Acrobeloides nanus *(de Man, 1880) Anderson, 1968 from South Georgia and East Falkland Island* (All measurements in μm. Significance levels : n.s. = not significant, * = $P < 0.05$, ** = $P < 0.01$, *** = $P < 0.001$.)

	South Georgia	East Falkland Island	Significance
n	13	17	
L	410 ± 8 (345-459)	371 ± 10 (258-458)	**
Body diameter	22 ± 0.6 (18-25)	23 ± 1 (19-34)	n.s.
Pharynx	122 ± 2 (106-129)	101 ± 1.4 (90-108)	***
Tail	27 ± 1 (18-30)	19 ± 1 (14-26)	***
a	19 ± 0.4 (17-22)	16 ± 0.4 (13-19)	***
b	3.4 ± 0.03 (3.2-3.6)	3.7 ± 0.1 (3.2-4.3)	**
c	15 ± 0.4 (14-19)	20 ± 0.8 (17-26)	**
c'	2.0 ± 0.07 (1.5-2.2)	1.5 ± 0.07 (1.2-1.8)	***
V	64 ± 0.3 (61-66)	66 ± 0.3 (65-68)	***
Vulva-anus/tail	4.7 ± 0.1 (4.1-5.3)	5.6 ± 0.3 (4.2-7.7)	*
Stoma	13 ± 0.2 (11.5-14.0)	11 ± 0.2 (10-12)	***
Corpus	62 - 75	50 - 63	-
Isthmus	19 - 26	17 - 20	-
Corpus/isthmus ratio	3.1 ± 0.06 (2.8-3.4)	2.9 ± 0.04 (2.7-3.1)	*
Bulb length	18 - 20	15 - 19	-
Bulb diameter	13 - 16	11 - 14	-
Nerve ring - ant. end	88 ± 2 (76-93)	75 ± 2 (69-83)	**
Excret. pore - ant. end	91 ± 1.5 (79-94)	83 ± 2 (73-93)	**
Deirids - ant. end	79 - 107	88 - 104	-
Spermatheca	8 ± 1.3 (2-14)	9 ± 0.6 (6-11)	n.s.
Rectum/anal diam.	1 ± 0.03 (0.9-1.1)	0.9 ± 0.04 (0.8-1.2)	*
Phasmid %	32 ± 1 (28-38)	30 ± 1.3 (23-35)	n.s.

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