NEMATODES FROM ITALIAN SAND DUNES. 6. TWO NEW AND THREE RARE SPECIES OF CEPHALOBIDAE (NEMATODA)

L. Orselli and M.T. Vinciguerra

Dipartimento di Biologia Animale, Università di Catania, 95124 Catania, Italy

Summary. During a nematode survey of the coastal sand dunes of Sicily (Italy) two new and three rare species of Cephalobidae were found, which are described and illustrated. *Chiloplacus insularis* sp. n. is characterized by labial probolae distally concave, lateral fields with five incisures, long post-vulval sac and rounded tail terminus. *Cervidellus psammophilus* sp. n. is mainly characterized by the shape of labial probolae, which bifurcate twice, and by the strongly crenate lateral fields. *Nothacrobeles sheri* Allen *et* Noffsinger, 1971 and *Paracrobeles psammophilus* Navarro *et* Lluch, 1999, found for the first time after their specific recognition, are redescribed. Males of *Stegelleta ophioglossa* Andrássy, 1967 are described for the first time.

During a nematode survey of the coastal sand dunes of Sicily (Italy) two new and three known but rare species of Cephalobidae were found, which are described and illustrated.

MATERIALS AND METHODS

Samples were collected with a plexiglass soil corer to a depth of 60 cm. Nematodes were extracted by centrifugation, killed and fixed in hot 4% formalin and processed to anhydrous glycerin. Measurements were made with the aid of a camera lucida. For SEM, some glycerin embedded specimens of each species were first washed with gradually added distilled water; subsequently they were dehydrated by a gradual series of ethanol concentrations increasing to 100%; then critical point dried with CO_2, mounted on stubs and coated with gold.

DESCRIPTIONS

CHILOPLACUS INSULARIS sp. n.

(Figs 1 and 2; Table I)

Female. Body more or less curved, often S-shaped in heat fixed specimens. Cuticle annulated; each ring 3.5-4.0 µm long at level of pharynx. The annules are furrowed by light longitudinal incisions. Lateral fields with five incisions which become three after the phasmids. Lip region characterized by three prominent labial probolae, symmetrical, appearing deeply incised distally by the light microscope, but with the external surface concave as viewed by SEM. The three cephalic probolae, flat and low, bear six labial and four cephalic papillae. Amphids small and round at the base of cephalic papillae. Pharynx cylindroid with short isthmus enlarging into a spherical basal bulb. Corpus 5-6.5 times as long as isthmus. Nerve ring at 81-86% of pharynx length. Excretory pore often obscure, just before nerve ring. Cardia short, hemispheroid, 5.5-7.5 µm long. Reproductive apparatus prodelphic. Vulva a transverse

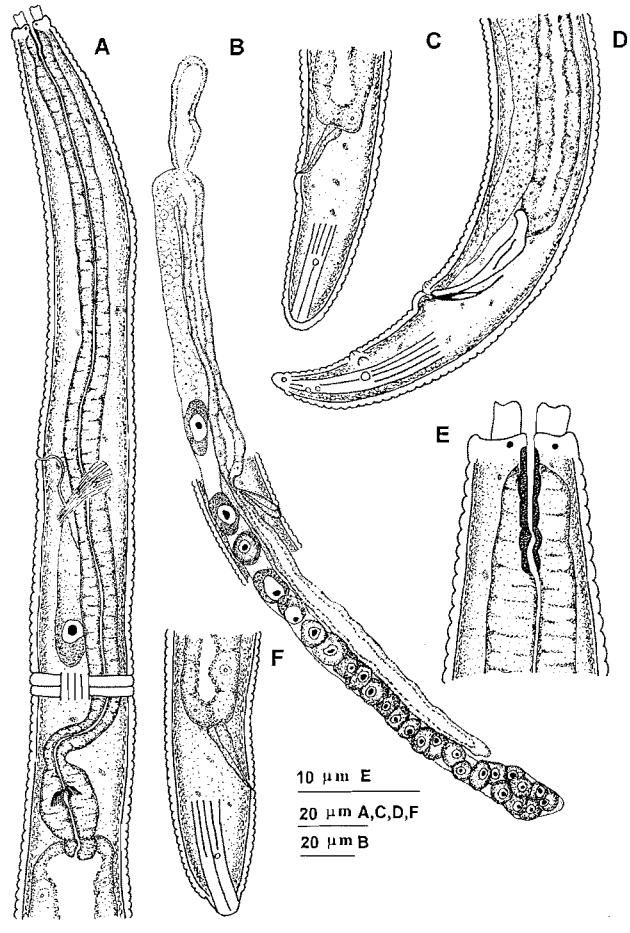

Fig 1. *Chiloplacus insularis* sp.n.: A, anterior region; B, female genital apparatus; C and F, female tails; D, male tail; E, anterior end.

Table I. Measurements of *Chiloplacus insularis* sp.n. (all measurements are in µm except L in mm).

	Siculiana			Selinunte		Irminio		Triscina	Vendicari		Eraclea	Manfria
	Holotype 1 ♀	Paratypes 2 ♀	Paratypes 3 ♂	1 ♀	4 ♂	3 ♀	6 ♂	1 ♀	1 ♀	♂	2 ♂	1 ♂
L	1.0	1.06-1.11	0.86-1.26	1.02	0.92-1.06	1.08-1.56	1.02-1.22	0.97	1.03	0.83	1.03-1.06	1.19
a	29	27-28	25-29	29	25-32	25-31	26-33	30	24	26	25-27	32
b	4	3.5-3.9	2.9-4.6	3.4	3.1-3.5	3.6-4.2	3.6-4.3	3.6	3.4	4.6	3.6	3.9
c	21.1	21.4-22.4	13-15.6	18.9	13.5-15.4	18-20.6	14.1-16.6	19.4	18.3	15.1	14.1-15.6	14.8
c'	1.6	1.5-2	1.8-1.9	1.8	2-2.2	2-2.2	1.9-2.1	2	1.7	2.1	1.8-2.1	2.2
V	68.1	67.9-68.4		68.6		68.5-69.4		67.5	66			
Body width	34.1	37.4-40.7	38.5-49.5	35.2	31.9-37.4	36.3-50.6	33-47.3	32.5	44	31.9	38.5-41.8	37.4
Labial probolae	4.4	4.4-5.5	4.4	5.5	4.4-5.5	4.9-6.6	4.4-5.5	4.4	4.9	4.4	4.4-4.9	4.9
Stoma	17.6	18.7-19.8	16.5-17.6	18.1	16.5-17.5	16.5-18.7	14.3-18.7	14.8	16.5	12.1	16.5-20.9	17.6
Corpus	179	210-229	184-204	237	213-241	218-279	195-210	198	234	137	216-220	229
Isthmus	35.2	35.2-38.5	33-41.8	25.3	27.5-39.6	41.8-51.7	29.7-42.9	35.1	26.4	16.5	28.6-39	38.5
Bulbus	30.8	28.6-31.9	28-33	29.1	24.7-30.8	22-28	27.5-31.9	27.5	29.7	22	28.6-30.2	27.5
Pharynx	250	282-302	262-270	253	292-295	30.2-37.4	260-287	265	295	180	282-290	300
Nerve ring	209	229-260	215-216	197	248-251	297-367	219-241	222	259	?	236-247	254
PUB	160	132-167		126		145		?	134			
Rectum	28.6	24.2-29.7		?		30.8-42.9		25	31.9			
Anal b.w.	28.6	24.2-31.9	35.2-40.7	29.7	33-34.1	27.5-35.2	31.9-40.7	25	31.9	25.3	34.6-36.3	36.3
Tail	47.5	49.5	66-80.3	53.9	67.1-78.1	55-74.8	64.9-78.1	50	56.1	55	66-74.8	80.3
Spicules			45.1-58.3		42.5-51.7		49.5-58.3			45.1	48.4-55	52.8
Gubernaculum			23.1-33		22.5-27.5		25.3-31.9			23.1	27.5-28.6	28.6

slit, with lips not always protruding. Vagina oblique, directed anteriad, without sclerotizations, 17.5-19 µm long. Ovary reflected twice; oviduct with a spermathaeca 42-45 µm long; post-vulval sac rather long, 4-5 times the corresponding body width. Tail conoid-cylindroid with 13-16 annuli on ventral surface and bluntly rounded terminus. Phasmids at 46-53% of tail length.

Male. Similar to female except for sexual characters. Spicules 1.2-1.5 times as long as anal body width. Gubernaculum just longer than half spicules length. Five pairs of post-anal papillae located as shown in Fig. 1D and a single pre-anal papilla. Tail conoid with rounded terminus.

Diagnosis and relationship

Chiloplacus insularis sp. n. is characterized by large size, labial probolae distally concave, lateral fields with five incisures, long post-vulval sac and rounded tail terminus. From the other species with five incisures in the lateral fields it can be distinguished for the following characters: from *C. sclerovaginatus* Sumenkova *et* Razzhivin, 1968, *C. saccatus* Loof, 1971, *C. tenuis* Rashid *et* Heyns, 1990 and *C. longiuterus* Rashid *et* Heyns, 1990 it differs in much larger size. Moreover it differs from *C. sclerovaginatus* by lacking the vaginal sclerotization and from *C. tenuis* since only three lateral incisures reach tail end. It differs from *C. magnus* Rashid *et* Heyns, 1990 by having longer postvulval sac (132-167 µm *vs* 68-135 µm) and only three lateral incisures reaching tail end. From *C. kralli* Bagaturija, 1973 it differs by having post-vulval sac and lower and less incise labial probolae. From *C. quinquesulcus* Ivanova, 1968, *C. quadricarinatus* (Thorne, 1925) Thorne, 1937 and *C. subtenuis* Rashid *et* Heyns, 1990 it differs in the different shape of labial probolae, length of post-vulval sac and absence of pre-anal ventro-lateral pairs of papillae in male. Moreover it differs from *C. subtenuis* because in the latter the number of lateral incisures does not change after the phasmids. The specimens from Sardinia described by Zullini (1978) as *C. quadricarinatus* agree rather well with the description of *C. insularis* and might belong to this species.

Type locality and habitat

Siculiana (Agrigento, Italy): sand dunes. Other localities: Selinunte (Trapani), Eraclea (Agrigento), Manfria (Caltanissetta), mouth of river Irminio (Ragusa).

Type specimens

Holotype and one male paratype deposited in the collection of the Dipartimento di Biologia Animale, University of Catania; one female and one male paratype in the Allatrendszertani Intézet, University of Budapest, Hungary; one female and one male paratype in the Instituut voor Dierkunde, University of Gent, Belgium.

Derivatio nominis

The specific epithet is the Latin word *insularis* = island inhabiting.

CERVIDELLUS PSAMMOPHILUS sp. n.

(Figs 2 and 3; Table II)

Female. Body ventrally curved or C-shaped. Cuticle strongly annulated, appearing very refractive in the optical section; each ring 2-3 µm long at level of pharynx. Lateral fields delimited by three longitudinal incisions, of which the median is hardly visible at the light microscope while the lateral ones are strongly refractive and crenate. Labial probolae deeply incised, Y-shaped, branching at 60-70% of their length; each branch bifurcates again before the apex. Six cephalic probolae, each constituted by five petaloid lobes whose length decreases symmetrically from the largest central one. The

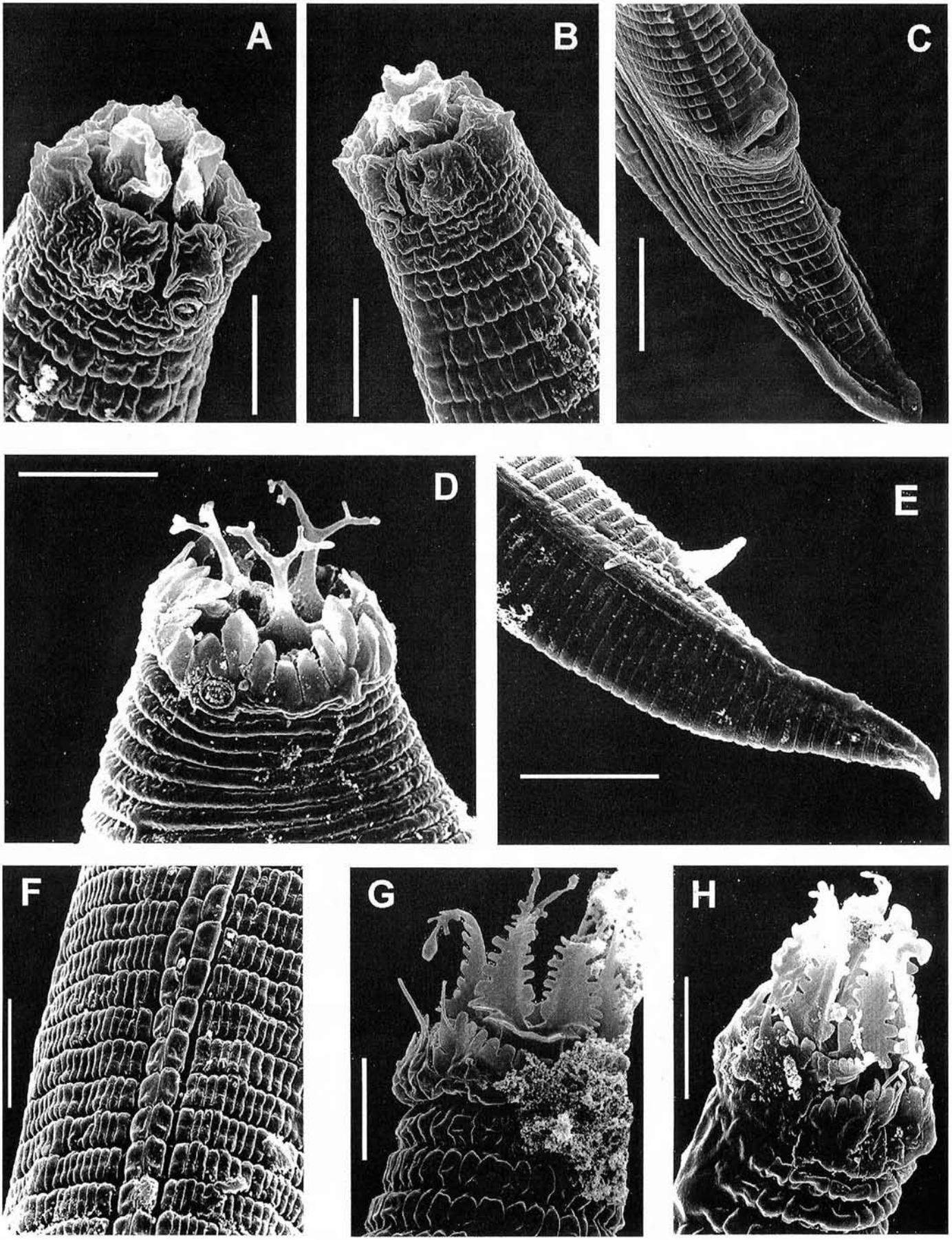

Fig. 2. - (A-C) *C. insularis* sp. n.: A and B, lip regions; C, male tail; (D-E) *Cervidellus psammophilus* sp. n.: D, lip region; E, male tail; (F-H) *Nothacrobeles sheri*: F, lateral field; G and H, lip region. (scale bar = A, 4 µm; B and G, 5 µm; C and E, 12 µm; D, 4.5 µm; F, 7 µm; H, 6 µm).

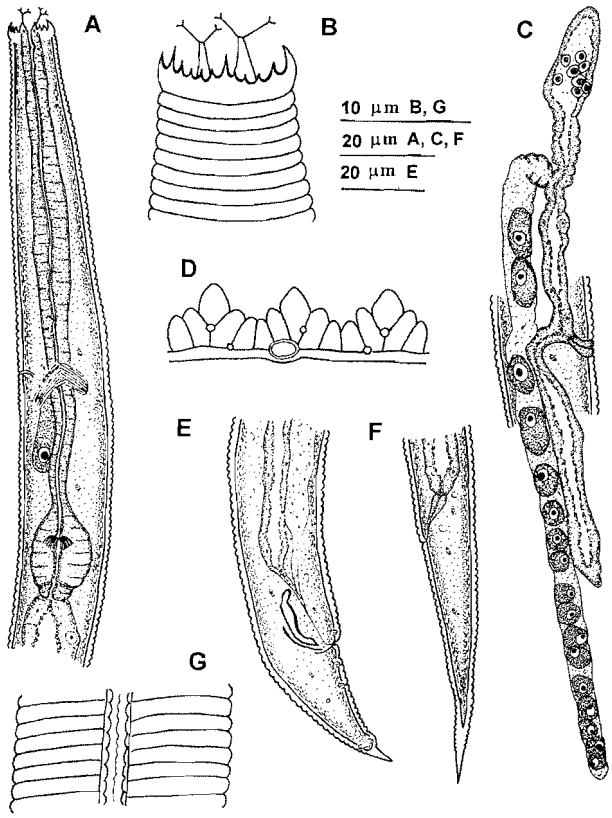

Fig. 3. - *C. psammophilus* sp. n.: A, anterior region; B, anterior end; C, female genital apparatus; D, schematized lip structure; E, male tail; F, female tail; G, lateral fields.

cephalic probolae bear the six labial and the four cephalic papillae and the small, round amphids. Pharynx cylindroid, ending with a basal bulb. Corpus 2.3 – 3.5 times as long as isthmus. Nerve ring at 60 – 73% of pharynx length. Excretory pore at the same level, 101-125 µm from anterior end. Cardia short, hemispheroid; terminal part of rectum appearing very refractive. Reproductive apparatus prodelphic. Vulva a transverse slit, with lips not protruding. Vagina without sclerotizations, 5-7.3 mm long. Ovary reflexed; oviduct with a spermathaeca 23-30 µm long containing sperms; post-vulval sac 1.6-2.7 corresponding body width long. Tail elongate conoid, straight, with pointed, smooth terminus. Phasmids at 20-30% of tail length.

Male. Similar to female except for sexual characters. Spicules ventrally curved, 0.9-1.2 times as long as anal body width. Gubernaculum as long as half spicules length. Five pairs of post-anal papillae located as shown in Fig. 3E. Tail conoid with acute, not annulated, terminus, 1.6-2.5 times as long as anal body width. Phasmids at 35-45% of tail length.

Diagnosis and relationship

Cervidellus psammophilus sp. n. is mainly characterized by the shape of labial probolae, which bifurcate twice, and by the strongly crenate lateral fields. It resembles *C. hamatus* Thorne, 1937 and *C. alutus* (Siddiqi, 1993) Shahina *et* De Ley, 1997, which have similar labial probolae, but differs from the former in the lateral fields structure (with three incisures vs. five) and in the relatively longer (c = 5.7-8.8 *vs* 14) female tail and from the latter by lacking a "double" cuticle and in the sharply pointed male tail end (in *C. alutus* it is rounded).

Type locality and habitat

Selinunte (Trapani, Italy): sand dunes. Other localities: Eraclea (Agrigento), Vendicari (Siracusa), Manfria (Caltanissetta), mouth of river Irminio (Ragusa).

Type specimens

Holotype and 10 female and 22 male paratypes deposited in the collection of the Dipartimento di Biologia Animale, University of Catania; one female and one male paratype in the Allatrendszertani Intézet, University of Budapest, Hungary; one female and one male paratype in the Instituut voor Dierkunde, University of Gent, Belgium; one female and one male paratype in the Museum of Natural History, Stockholm, Sweden; one female and one male paratype in the Nematology Laboratory, USDA, Belltsville, USA.

Derivatio nominis

The specific epithet is of Greek origin and means "which likes sand".

NOTHACROBELES SHERI Allen *et* Noffsinger, 1971

(Figs 2 and 4; Table III)

Female. Body cylindroid, tapering towards the posterior end. Cuticle transversely annulated; each annule, 4.5-7 µm long, shows punctuation in three rows, more or less evident in the various specimens and, due to the presence of several longitudinal furrows, appears to consist of a sequence of rectangular lobules. Lateral fields crenate, with four longitudinal incisions at mid-body; they start anteriorly as a single field delimited by two incisions; then, at level of pharynx base, a median line appears, which posteriorly bifurcates forming the two internal lines. The three labial probolae bifurcate at their base appearing as six long triangular projections; their margins fringed and their apices ending with a median lobule. The base of each probola projects outwards with a laminar process; the tangential ridges between the probolae appear fringed. Cephalic probolae with serrate distal margins; in each of the three cephalic primary axils two long and slender guard processes are present. Pharynx cylindroid, ending with a basal bulb. Corpus 3.3-4.6 times as long as isthmus. Nerve ring at the level of isthmus anterior end, at 65-76% of pharynx length; excretory pore in proximity of nerve ring, 140-190 µm from anterior end. Vulva transverse; vagina without sclerotizations, 9-12.5 µm long. Ovary prodelphic, reflexed; oviduct with a spermathaeca 37.5-55 µm long; a post-vulval sac, 1-2 body widths long, is present.

Table II. Measurements of *Cervidellus psammophilus* sp.n. (all measurements are in µm except L in mm).

	Selinunte			Irminio		Triscina		Eraclea		Manfria		Vendicari	
	Holotype	Paratype	Paratype										
	1 ♀	14 ♀	26 ♂	5 ♀	9 ♂	1 ♀	4 ♂	1 ♀	1 ♂	2 ♀	1 ♂	1 ♀	1 ♂
L	0.72	0.59-0.71 (0.66±0.04)	0.53-0.7 (0.61±0.05)	0.62-0.68 (0.64±0.02)	0.48-0.63 (0.57±0.03)	0.56	0.52-0.65 (0.59±0.1)	0.68	0.54	0.48-0.58	0.46	0.68	0.59
a	22	16-22 (19.1±2.1)	16-24 (19±2.8)	20-25 (23±2.1)	17-21 (19.1±1.2)	21	20-25 (22±2.1)	19	20	14-17	13	19	20
b	3.5	3.3-4 (3.6±0.2)	2.7-3.5 (3.1±0.2)	3.2-3.6 (3.4±0.1)	2.8-3.2 (3±0.1)	3.6	3.2-3.3 (3.2±0.1)	3.7	2.9	2.9-3.1	3	3	3.1
c	7.9	6.7-8.8 (7.8±0.5)	10.2-13.6 (11.8±1.1)	7.5-8.4 (7.9±0.4)	11.1-13.9 (11.9±1)	6.7	10.7-13.1 (11.6±1)	8.5	11.9	5.7-7.1	9.7	8.3	12.1
c'	5.1	3.8±5.1 (4.5±0.5)	1.6-2.5 (2.1±0.2)	4.3-5.3 (4.8±0.3)	2-2.4 (2.2±0.1)	3.9	2.2-2.7 (2.4±0.2)	4.1	2.1	3.8-4.4	2	3.7	2.2
V	55.6	54.8-57.9 (56.2±1.1)		56.2-59.3 (57.1±1.2)		55.5		56.2		52.9-57.7		56.2	
Body width	33	28.6-44 (35.3±4.8)	23.1-39.6 (33.1±5.6)	25.3-31.9 (28.3±2.5)	25.3-34.1 (29.7±3.1)	26.4	26.4-29.7 (27.3±1.5)	35.2	27.5	34.1	36.3	35.7	29.7
Labial probolae	6.6	5.5-7.7 (6.6±0.7)	4.9-7.7 (6.4±1)	6.1-6.6 (6.4±0.2)	4.4-7.7 (6.2±1.2)	5.5	5.5-6.6 (6±0.6)	4.4	5.5	4.9-5.5		6.1	6.1
Stoma	12.1	9.9-12.1 (11.6±0.9)	8.8-13.2 (12±1.3)	9.9-12.1 (10.7±0.9)	11-14.3 (12±1.4)	12.1	11-13.2 (11.7±1.2)	12.1	13.2	13.2	?	12.1	13.2
Corpus	120	107-120 (111.5±4)	109-136 (120.6±7.8)	109-116 (113.6±3.1)	109-117 (113.6±2.7)	113	103-118 (112±7.9)	108	107	110-137	?	150	112
Isthmus	49.5	26.4-49.5 (37.2±10.6)	24.2-50.6 (40.8±7.7)	38.5-46.2 (41.8±3)	25.3-44 (40.1±3.8)	16.5	20.9-47.3 (37.4±14.3)	41.8	41.8	17.6-27.5	?	40.7	45.1
Bulbus	28.6	20.9-28.6 (26.5±2.3)	22-30.2 (27.1±2.6)	24.2-26.4 (25.7±0.9)	23.1-28.6 (25.9±2.1)	19.8	23.1-29.7 (26±3.3)	26.4	26.4	23.1-27.5	?	27.5	28.6
Pharynx	205	165-192 (182.2±11.6)	173-218 (195±13.7)	183-191 (187.4±2.8)	165-195 (186±6.8)	155	153-201 181.6±25.3)	181	181	156-198	151	224	192
Nerve ring	125	111-127 (120.3±5.6)	121-150 (131.7±9.1)	122-132 (126±4.3)	111-132 (110.7±4.3)	109	104-127 (116.3±11.5)	120	117	146	?	159	113
PUB	81	53-83 (72.1±9.3)		61-74 (66.6±5.3)		56		86		47-58		66	
Rectum	25.3	22-28.6 (26.1±2)		22-25.3 (23.6±1.6)		26.4		26.4		19.8-20.9		26.4	
Anal b.w.	17.6	16.5-22 (18.5±1.7)	19.2-26.4 (23.4±2.3)	15.4-17.6 (16.6±1.1)	18.7-24.2 (21.3±1.6)	20.9	16.5-23.1 (20.9±2.9)	19.2	20.9	18.7-20.9	23.1	22	22
Tail	90.2	77-91.3 (84.6±4.5)	41.8-55 (51.6±3.9)	75.9-88 (81±4.8)	40.7-56.1 (48.4±3.2)	83	45.1-55 (51.1±4.7)	79.2	45.1	81.4-83.6	47.5	81.4	48.4
Spicules			24.2-27.5 (26.1±1.3)		24.2-28.6 (26.2±1.8)		25.3-31.9 (27.2±3.1)		23.1		25.3		26.4
Gubernaculum			11-16.5 (14±1.6)		11-15.4 (14.4±0.4)		11-17.6 (14.4±2.7)		14.3		13.2		15.4

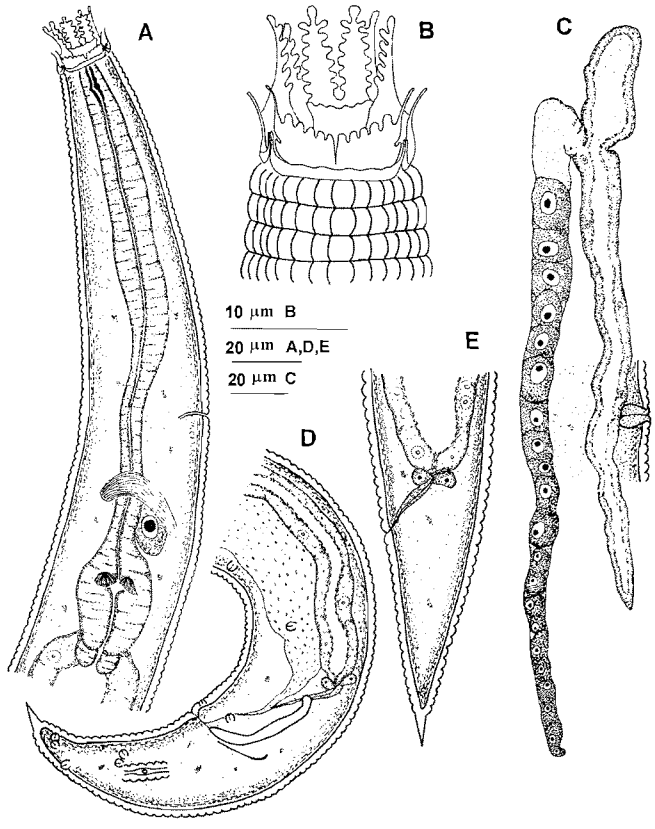

Fig. 4. - *Nothacrobeles sheri*: A, anterior region; B, anterior end; C, female genital apparatus; D, male tail; E, female tail.

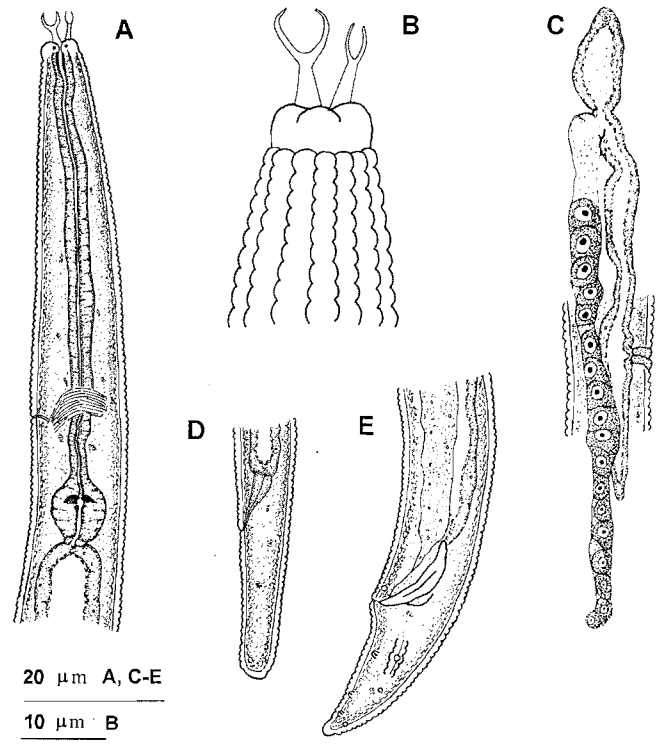

Fig. 5. - *Stegelleta ophioglossa*: A, anterior region; B, anterior end; C, female genital apparatus; D, female tail; E, male tail.

Rectum 0.7-1.2 times anal body width long, provided with two rectal glands. Tail conoid, with pointed, non-annulated terminus. Phasmids at 15-25% of tail length.

Male. Similar to female except for sexual characters. Spicules 1 - 1.2 times as long as cloacal body width. Gubernaculum just longer than half spicule length. Three pairs of pre-anal papillae-like organs are present. Five pairs of post-anal papillae. Tail conoid with acute terminus. Phasmids at 25-35% of tail length.

Localities and habitat

Israel: soil; Italy (southeastern coast of Sicily): dune sand.

Remarks

This species was originally described from Israel (Allen and Noffsinger, 1971) and never reported again. The characteristics of the population from Sicily fit well with the original description.

STEGELLETA OPHIOGLOSSA Andrássy, 1967
(Figs 5 and 6; Table IV)

Female. Body ventrally bent or S-shaped. Cuticle annulated, each annule 2-2.5 µm long at mid-body, and crossed by 14 longitudinal prominent ridges. Lateral fields two, with crenate margins, very close to each other. Labial probolae long, Y-shaped, each with a wide, tongue-like basal part bifurcating at about 40% of its length; branches slender, rope-like. Lips globular, without cephalic probolae, bearing the anterior sensilla. Stoma weakly sclerotized. Pharynx cylindroid, ending with a basal bulb. Nerve ring at 72-78% of pharynx length, where the isthmus starts. Excretory pore opening nearby, at 122-147 µm from anterior end. Vagina slightly protruding, without sclerotizations, 7-8 µm long; spermatheca well developed, 24-26.5 µm long; post vulval sac short, 0.7-1.3 body diameter long. Tail cylindroid, straight, with blunt terminus, 2.3-2.9 anal body width long. Phasmids at 15-30% of its length.

Male. Similar to female in most respects. Spicules cephaloboid, 1.2-1.7 cloacal body width long. Gubernaculum very slender, epsilon-shaped, slightly longer than half spicule. Tail conoid, slightly ventrally curved, with rounded terminus. Phasmids at 25-35% of tail length.

Localities and habitat

Mongolia, Hungary, Venezuela, Uzbekistan, Senegal, Italy (southeastern coast of Sicily): dune sand, steppe, wet sand, marginal soil.

Remarks

Stegelleta ophioglossa is a rather uncommon, even though widespread, species of which males have never

Table III. – Measurements of *Nothacrobeles sheri* (all measurements are in µm except L in mm).

	Triscina		Selinunte		Eraclea		Siculiana	Manfria		Vendicari		Irminio	
	11 ♀	6 ♂	2 ♀	2 ♂	1 ♀	2 ♂	1 ♀	12 ♀	16 ♂	9 ♀	11 ♂	31 ♀	47 ♂
L	0.85-1.06 (0.97±0.1)	0.68-0.96 (0.87±0.1)	0.86-0.96	0.94-1.08	0.8	0.92-1.08	0.86	0.9-1.04 (0.97±0.04)	0.93-1.11 (1±0.05)	0.81-0.92 (0.86±0.03)	0.69-1.02 (0.87±0.1)	0.93-1.02 (0.97±0.03)	0.79-1 (0.92±0.1)
a	15-19 (17.1±1.3)	13-21 (18.5±3.3)	15-16	17	17	17-19	23	15-19 (16.9±1.1)	16-25 (18.5±2.9)	13-20 (15.7±2.5)	12-19 (15.4±1.8)	15-21 (18.6±2)	13-21 (17.8±2.3)
b	3.7-4.8 (4.2±0.3)	4.1-4.6 (4.3±0.2)	3.8	4.1-4.3	3.9	4.3-4.8	4.3	4-4.6 (4.2±0.2)	4.1-4.9 (4.4±0.2)	3.8-4.2 (3.9±0.1)	3.8-4.9 (4.2±0.3)	3.7-4.7 (4.2±0.3)	3.4-4.7 (4.2±0.3)
c	10.7-12.4 (11.4±0.5)	10.1-11.5 (10.8±0.5)	10.6-11.9	11.3-12.2	?	11.1-11.6	12.7	10.6-12.5 (11.4±0.6)	10.5-12.9 (11.5±0.7)	10.1-12.3 (11.1±0.8)	10.2-13.8 (11.4±1.1)	11.1-12.8 (11.8±0.6)	10.5-13 (11.5±0.7)
c'	1.8-2.5 (2.2±0.2)	1.7-2.3 (2.1±0.2)	2.1-2.3	2.1	?	2-2.1	2.4	2-2.6 (2.2±0.2)	1.9-2.4 (2.1±0.1)	1.8-3.1 (2.3±0.4)	1.7-2.3 (2±0.1)	1.9-2.8 (2.3±0.3)	1.8-2.5 (2.1±0.2)
V	60.4-65.4 (63.2±1.7)		62.3-63		64.3		65.5	61.5-65.6 (63.8±1.3)		61.7-63.9 (63.2±0.7)		62.5-64.7 (63.6±0.7)	
Body width	48.4-66 (56.5±5)	39.6-49.5 (48.1±6.8)	57.2-59.4	56.2-62.7	47.5	49.5-61.6	37.5	50.6-67.1 (57.9±5.6)	40.7-63.8 (55.3±7)	40.7-69.3 (55.8±9.1)	50.6-61 (56±3.2)	44-68.2 (52.4±6.9)	42.9-70.4 (52.5±7.9)
Labial probolae	12.1-16.5 (15±1.3)	12.1-15.4 (13.8±1.5)	13.2	14.3	15.4	13.2-16.5	14.3	12.1-15.4 (14.4±1)	12.1-15.4 (13.9±0.9)	9.9-14.3 (12.8±1.4)	9.9-13.2 (12.3±1.2)	12.1-14.3 (13.3±0.9)	11-14.8 (13±1.2)
Cephalic probolae	6.6-11 (8.9±1.3)	6.1-11 (8.9±2.4)	7.7-8.8	6.6-8.8	9.9	7.7-9.9	6.6	6.6-11 (9.2±1.3)	7.7-9.9 (8.5±0.9)	6.6-11 (8.7±1.3)	6.6-9.9 (8.1±1.2)	7.7-11 (9.2±1.1)	6.6-9.9 7.6±1.1)
Stoma	15.4-18.7 (16.8±1.1)	14.3-18.1 (16.1±1.6)	15.4-17.5	18.7	15.4	16.5-18.7	16.5	14.8-17.6 (16.3±1)	13.2-16.5 (15.4±1)	16.5-19.8 (17.7±0.8)	15.4-17.6 (16.5±0.9)	15.4-22 (18.1±1.9)	14.3-18.7 (16.6±1.5)
Corpus	127-151 (144.2±7.1)	120-140 (129.7±8.1)	144-161	138-155	122	129-133	120	138-152 (142.8±4.8)	127-145 (137.8±5.4)	131-145 (135.4±4.9)	113-134 (125.6±6.9)	130-164 (143.5±9.1)	111-135 (125±8.7)
Isthmus	25-45 (36.4±5.7)	32.5-37.5 (35.2±1.8)	35-37.5	35-42.5	37.5	35-40	30	35-45 (39.3±3.1)	33.7-40 (37.6±2.1)	32.5-50 (38.6±5.6)	32.5-47.5 (38.6±4.1)	31.2-47.5 (39.4±5.3)	22.5-52.5 (37.1±7.8)
Bulbus	30-37.5 (33.2±2.3	30-35 (31.7±2.4)	32.5-39.6	35-37.5	30	32.5-35	21.2	30-35 (32.6±1.3)	31.2-35 (33.7±1.3)	27.5-32.5 (30.5±2.1)	30-35 (31.7±1.7)	32.5-38.7 (34.6±2.5)	27.5-37.5 (33.6±3)
Pharynx	205-247 (229±11.3)	205-225 (210.8±8.4)	225-251	225-247	205	210-225	200	222-242 (229.4±7.5)	210-235 (223.1±7.8)	207-225 (215.6±7.3)	200-217 (208.3±4.5)	208-255 (230.9±12.9)	192-262 (213.8±20.1)
Nerve ring	150-180 (168.7±8.9)	138-162 (149.4±9.6)	156-172	150-157	?	142-152	134	155-170 (165.8±7.5)	145-165 (158.6±6.5)	140-167 (154.6±10.4)	137-155 (147.3±5.2)	150-177 (161.5±9.7)	135-167 (153±10.3)
PUB	74-124 (95±18.2)		79-103		63		?	75-108 (93.3±10.1)		76-101 (89.2±13.2)		90-103 (93.6±4.5)	
Rectum	28.6-39.6 (33.5±3.2)		33		?		?	30.8-37.4 (34.8±2.3)		24.2-36.3 (32.3±3.4)		29.7-36.3 (32.6±2.3)	
Anal. b.w.	33-45.1 (37.1±3.6)	34.1-41.8 (37.3±3)	34.1-38.5	40-40.7	?	39.6-46.2	27.5	33-41.8 (37.2±3.2)	35.2-44 (39.6±3.2)	26.4-40.7 (33.1±4.5)	34.1-40.1 (37.3±1.9)	29.7-39.6 (34.4±3.1)	29.7-44 (38.5±4.6)
Tail	78.1-90.2 (84.5±5.2)	67.1-90.2 (80.6±8.4)	80.3-80.8	82.5-88	?	82.5-92.4	67.5	77-92.4 (85±3.8)	84.7-91.3 (86.9±2.2)	71.5-84 (78.1±4.5)	60.5-90.2 (76.1±8.9)	77-90.2 (82.7±4.8)	69.3-89.1 (79.9±6.4)
Spicules		38.5-51.7 (43.6±5)		42.9-45.1		45.1-47.3			41.8-48.4 (45.5±2.2)		37.4-44 (41.3±2.4)		40.7-46.2 (43.1±1.7)
Gubernaculum		23.1-27.5 (25.7±1.9)		25.3-27.5		25.3-27.5			22-26.4 (24.4±1.6)		20.9-25.3 (22.6±1.6)		19.8-26.4 (22.9±2.1)

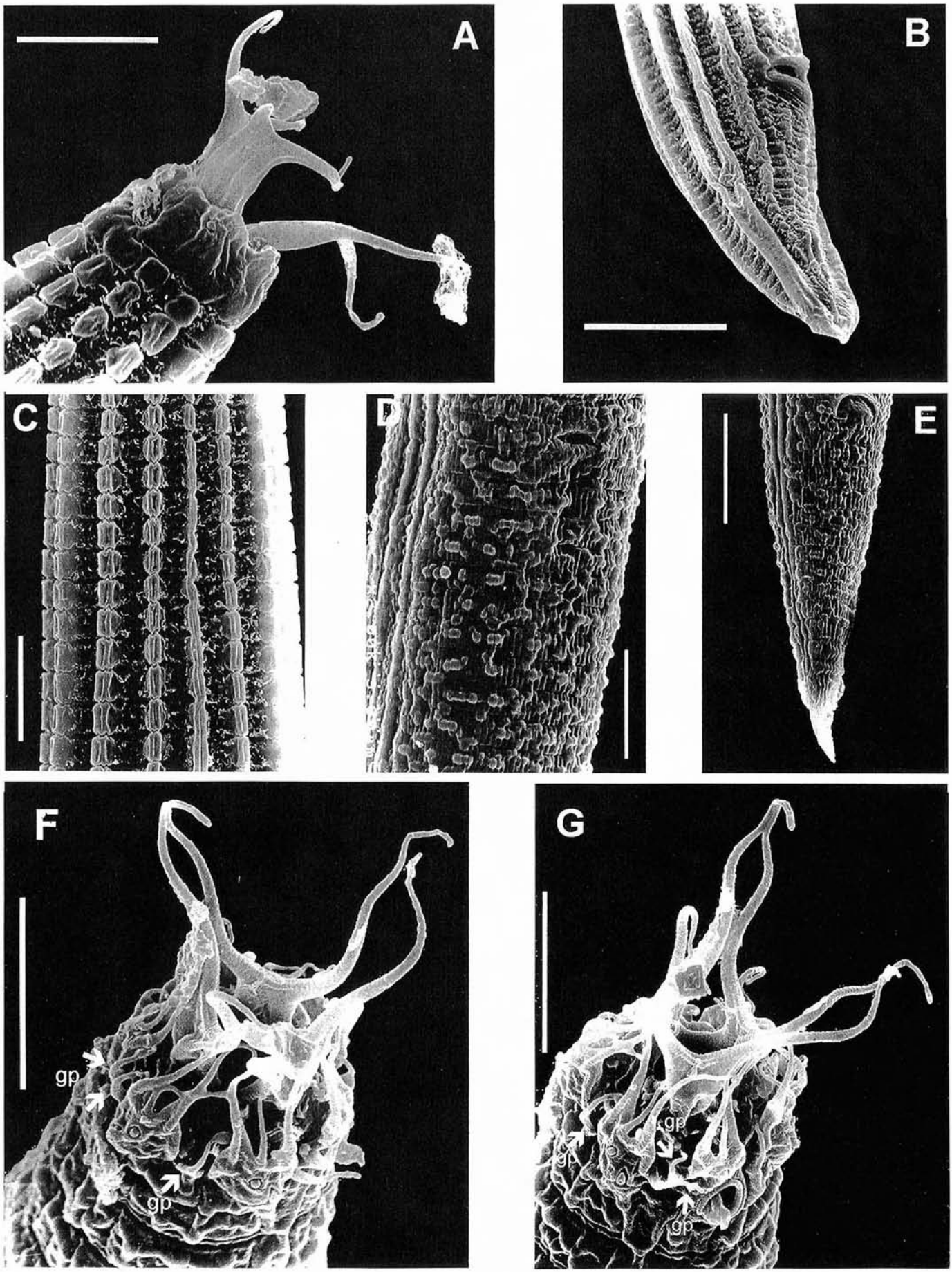

Fig. 6. - (A-C) *S. ophioglossa*: A, lip region; B, male tail; C, detail of cuticle; (D-G) *Paracrobeles psammophilus*: D, lateral field; E, female tail; F and G, lip regions. (scale bar = A, 4.5 µm; B, 12 µm; C and F, 6 µm; D, 9 µm; E, 10 µm; G, 5 µm).

been found so far. The characteristics of our specimens agree well with those of the original description, except for the rather larger size.

PARACROBELES PSAMMOPHILUS Navarro *et* Lluch, 1999

(Figs 6 and 7; Table V)

Female. Body straight or slightly curved ventrad, tapering towards both extremities. Cuticle annulated; each annule 4.0-5.0 µm long at mid-body, sub-divided into numerous rectangular lobules by fine and shallow longitudinal furrows and covered with small protuberances which at light microscope appear as a scattered punctuation. Lateral fields two, originating at level of metacorpus. Lip region very elaborate. Each of the three labial probolae consists of a short laminar base (about 15% of its total length) which bifurcates giving rise to two long pointed tentacles. The six lips give rise to as many cephalic probolae, each of which projects anteriad with three tapering prongs, the median of which is clearly shorter than the lateral ones. In each primary axil there is a guard process much shorter than the cephalic probolae; in the secondary axils there are two short processes. The contiguous prongs of a cephalic probola or of adjacent probolae are sometimes linked by fine anastomoses (visible only by SEM) which give the whole cephalic structure a complicated and somewhat irregular pattern. Pharynx cylindroid; metacorpus very wide, its lumen expanded and lined by sclerotized walls; corpus ending with a valvular apparatus, 2.8-3.7 times as long as isthmus. Nerve ring at level of isthmus, at 70.7-82.4% of pharynx length. Excretory pore not always visible, located at 114-139 µm from the anterior end, just anterior to

Table IV. Measurements of *Stegelleta ophioglossa* (all measurements are in µm except L in mm).

	Irminio		Triscina	Eraclea	Manfria
	5 ♀	5 ♂	1 ♂	1 ♂	1 ♂
L	0.51-0.58 (0.55±0.03)	0.51-0.6 (0.55±0.03)	0.54	0.55	0.54
a	17-21 (19±2)	19-25 (22±2.2)	20	17	15
b	2.8-3.2 (3±0.1)	2.6-3.3 (2.9±0.2)	3	3.2	2.8
c	10.4-11.5 (11±0.5)	10.9-12.1 (11.3±0.6)	12.2	11.6	11.1
c'	2.3-2.9 (2.6±0.2)	2-2.3 (2.1±0.1)	2.3	1.9	2
V	61.4-63 (62.5±0.6)				
Body width	27.5-30.8 (29±1.4)	20.9-27.5 (25.3±2.6)	26.4	31.9	35.2
Labial probolae	7.7-11 (9.6±1.4)	8.8-11 (9.5±1.1)	9.9	9.9	9.3
Stoma	11-15.4 (13.2±2)	13.2-14.3 (13.5±0.4)	13.2	13.2	12.1
Corpus	117-129 (123±5.4)	102-159 (123.6±21.5)	111	109	130
Isthmus	17.6-36.3 (30.3±7.5)	25.3-37.4 (32.7±4.6)	35.2	29.7	34.1
Bulbus	17.6-23.1 (20.2±2.1)	18.1-19.8 (18.8±0.6)	19.8	18.7	17.6
Pharynx	177-192 (181.4±6.1)	161-225 (184.8±24.2)	176	167	191
Nerve ring	129-144 (137.5±6.3)	118-179 (141.8±23.1)	130	123	146
PUB	22.5-36.3 (30.6±5.9)				
Rectum	16.5-24.7 (21.6±3.2)				
Anal b.w.	17.6-18.7 (18.4±0.4)	20.9-23.1 (22±1.1)	18.7	24.2	24.2
Tail	44-53.9 (50.1±3.6)	45.1-53.9 (48.6±3.6)	44	47.3	48.4
Spicules		31.9-36.3 (34.5±1.6)	29.7	35.2	29.7
Gubernaculum		19.8-23.1 (20.4±1.4)	16.5	17.6	18.7

Table V. Measurements of *Paracrobeles psammophilus* (all measurements are in µm except L in mm).

	Irminio	
	34 ♀	42 ♂
L	0.49-0.58 (0.54±0.02)	0.52-0.61 (0.55±0.03)
a	13-16 (13.7±1)	12-20 (15.1±2.6)
b	2.3-2.9 (2.6±0.1)	2.4-3.2 (2.7±0.2)
c	8.1-9.5 (8.6±0.4)	8.1-9.3 (8.7±0.4)
c'	2.2-2.8 (2.4±0.2)	1.7-2.8 (2.1±0.3)
V	59.2-62.1 (60.8±1)	
Body width	35-46.2 (40.3±2.8)	30-45.1 (37±4.7)
Labial probolae	11-17.6 (14.4±2.3)	13.2-16.5 (15.1±1.2)
Cephalic probolae	7.7-12.1 (9.9±1.5)	8.8-12.1 (10.6±0.9)
Stoma	9.9-17.6 (14.2±2.2)	12.1-18.7 (14.9±2)
Metacorpus width	15.4-24.2 (17.5±2.5)	12.1-17.6 (15.6±1.5)
Metacorpus heigth	46.2-56.1 (50.8±3.1)	47.3-56.1 (51.4±2.7)
Corpus	112-138 (121.3±8.2)	106.7-138.6 (119.1±8.4)
Isthmus	25.3-42.8 (36.3±5.1)	27.8-49.4 (38.5±7.9)
Bulbus	27.5-33 (29.9±1.5)	27.5-33 (28.8±1.5)
Pharynx	192-212 (203.7±6.1)	184-232 (202±15.9)
Nerve ring	140-169 (158.7±8.8)	140-171 (158.3±14)
PUB	64.9-105.6 (81.4±13.4)	
Rectum	17.6-25.3 (21.6±2)	
Anal b. w.	22.5-27.5 (24.9±1.9)	25-31.9 (29.7±2.7)
Tail	57.5-68.2 (62.8±3.2)	56.1-70 (63.8±4.3)
Spicules		68.2-81.4 (72.3±3.5)
Gubernaculum		27.5-30.8 (28.9±1.2)

Excretory pore not always visible, located at 114-139 µm from the anterior end, just anterior to

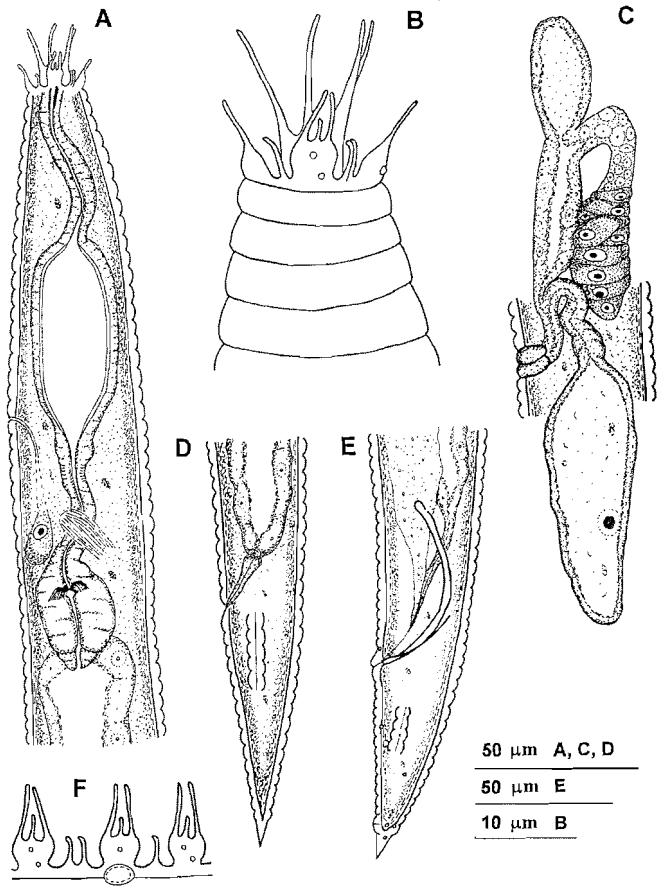

Fig. 7. - *Paracrobeles psammophilus*: A, anterior region; B, anterior end; C, female genital apparatus; D, female tail; E, male tail; F, schematized lip structure.

nerve ring. Cardia small, emispheroid. Reproductive apparatus prodelphic with reflected ovary, spermatheca 30-37 µm long and a large post-vulval sac with a large nucleus in the wall. Vulva lips not prominent; vagina without sclerotizations, 14-18.5 µm long. Tail conoid, straight, with pointed terminus, 2.2 – 2.8 anal body width long. Phasmids at 20-26 % of tail length.

Male. Similar to female in most respects. The spicules, 2-3 cloacal body width long, are very slender and recurved ventrad. Gubernaculum thin, its length about two-fifth that of the spicules. Tail conoid, pointed, only slightly bent ventrad. Papillae: one pair precloacal and five pairs in the tail, located as in figure 5 E, often obscure. Phasmids at 33-46% of tail length.

Localities and habitat

Dehesa de El Saler (Spain): sandy soil of a clearing in a *Pinus halepensis* Mill. forest; mouth of the river Irminio (Ragusa, Italy): dune sand.

Remarks

Paracrobeles psammophilus belongs to a genus of Cephalobidae which differs from all the others in the peculiar structure of the metacorpus; moreover the spicules in both species described are relatively longer and more slender than usually. In this species the spicule length is much longer than in *P. laterellus* Heyns, 1968 and its shape is unique among Cephalobidae. The characteristics of the population from Sicily agree well with the original description of the species, even though here the spicules are longer than in the population from Spain (68-81 µm vs. 42-57 µm).

LITERATURE CITED

Allen M.W. and Noffsinger E.M., 1971. *Nothacrobeles* n.gen., with description of four new species (Nematoda: Cephalobidae). *Journal of Nematology, 3:* 145-153.

Andrássy I., 1967. Ergebnisse der zoologischen Forschungen von Dr. Z. Kaszab in der Mongolei. 92. Weitere Bodennematoden aus den Jahren 1964 und 1965. *Opuscula Zoologica Budapest, VI,2:* 203-233.

Heyns J., 1968. *Paracrobeles laterellus* n. gen. n. sp. from South Africa (Nematoda: Cephalobidae). *Nematologica, 14:* 511-514.

Ivanova T.S., 1968. Nov'i vid ij roda *Chiloplacus* Thorne, 1937 (Nematode: Acrobelinae). *Doklady Akademi Nauk Tadzhikskoi SSR, T. XI, n° 12:*54-56.

Navarro P. and Lluch J., 1999. *Paracrobeles psammophilus* sp. nov. (Nematoda: Cephalobidae) from El Saler, Valencia (Spain). *Journal of Zoology, London, 249*: 481-485.

Rashid F. and Heyns J., 1990. *Chiloplacus* and *Macrolaimellus* species from South West Africa/Namibia (Nematoda: Cephalobidae). *Phytophylactica, 22*: 189-199.

Thorne G., 1925. The genus *Acrobeles* Von Linstow, 1877. *Transaction of American Microscopical Society, 44*: 171-210.

Thorne G., 1937. A revision of the Nematode family Cephalobidae Chitwood and Chitwood, 1934. *Proceedings of the Helminthological Society of Washington, 4*: 1-16.

Zullini A., 1978. Nematodi liberi dell'isola di Tavolara (Sardegna). *Accademia Nazionale XL. Rendiconti serie V:* 67-76.

Accepted for publication on 22 May 2002.