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SOME SPECIES OF TYLENCHIDA FROM NATURAL HABITATS IN SOUTHEASTERN SPAIN

by
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Summary. Five species belonging to the order Tylenchida are reported for the first time from Spain. They are *Dolichorhynchus (Dolichorhynchus) lamelliferus*, *Paratylenchus (Gracilacus) straeleni*, *Pratylenchooides alkani*, *P. crenicauda* and *Scutylenchus quadrifer*. Descriptions and illustrations of them are provided.

During a study of nematodes from natural plant communities in a mountainous region of southeastern Spain, five species of *Tylenchida* were found which are new records from Spain. The species are redescribed and illustrated with observations on their morphological variability.

Specimens were fixed in 4% formaldehyde and preserved to anhydrous glycerine by Seinhorst (1962) method. For the identification and taxonomy of the species we have followed Siddiqi (1986).

Description

Dolichorhynchus (Dolichorhynchus) lamelliferus
(de Man, 1880) Mulk et Siddiqi, 1982
(Table I, Fig. 1)

Female: Body cuticle with transverse striae 1-1.5 μm wide and 12 longitudinal ridges, 4-4.5 μm wide at mid-body. Cephalic region conoid-rounded, continuous with body. Cephalic framework hardly sclerotized. Stylet 28-30 μm , conus longer than shaft (including knobs). Basal knobs 4-4.5 μm across, rounded, laterally inclined. Orifice of dorsal oesophageal gland 2.5-3.5 μm from spear base. Procorpus cylindrical, 37-53 μm long. Median oesophageal bulb oblong 16-20 μm long, with valvular apparatus well developed 4.5-5.5 μm long, lying at 51-59% of oesophagus length from anterior end. Isthmus slender, 23-36 μm long. Excretory pore usually situated at beginning to middle of basal oesophageal bulb. Hemizonid not detected. Basal bulb truncate at base, twice as long as wide. Dorsal gland nucleus larger than ventral nuclei. Cardia conoid-rounded, 5-6 μm long.

Vulva transverse, with lateral cuticular flaps 4.5-6.5 μm long. Vagina at right angles to body axis, extending two third body width at vulva. Spermathecae 16-20 μm in diameter, rounded, filled with rounded sperms 2-2.5 μm in diameter. Ovaries symmetrical, outstretched mostly with a single row of oocytes but two rows in the multiplication zone. Tail conoid, marked with 46-67 annules and tapering towards tip. Phasmids pore-like, 11-20 annules posterior to anus.

Male: Similar to female in general morphology. Spicules ventrally curved, stout. Gubernaculum 11-18 μm long, including the characteristic recurved posterior region. Bursa large, crenate, 81-98 μm long, usually with a characteristic notch at distal part of tail. Tail finely conoid.

Habitat and locality: From the rhizosphere of *Fraxinus angustifolia* L. at 8 km west of Tranco de Beas, Sierra de Cazorla, Jaén, Spain.

Discussion: Our population agrees with the description given by Loof (1961) and measurements are similar to those given by Hooper (1978) except for the stylet length (28-33 μm versus 24-28 μm) and c' index [3.4 (2.4-4.2) versus 1.9].

Paratylenchus (Gracilacus) straeleni
(de Coninck, 1931) Raski, 1976
(Table II, Fig. 2)

Female: Lip region rounded, truncate; with very slight sclerotization. Conus of stylet 2.4-3.5 times as long as shaft. Knobs small, 2.7-3.3 μm across, laterally directed.

TABLE I - *Morphometrics of Dolichorhynchus (Dolichorhynchus) lamelliferus (measurements in μm).*

	n=21 Females			n=12 Males		
	$\bar{X} \pm \text{SD}$	Extr. Val.	CV %	$\bar{X} \pm \text{SD}$	Extr. Val.	CV %
L	1021 \pm 85.7	828 - 1141	8.4	970 \pm 115	797 - 1176	11.9
a	35.5 \pm 3.0	30 - 40.3	8.4	34.5 \pm 2.7	31 - 39.2	7.9
b	6.4 \pm 0.5	5.2 - 7.5	8.2	6.1 \pm 0.7	5.2 - 7.0	11.7
b ₁	10.5 \pm 0.9	8.2 - 12.3	8.4	9.8 \pm 1.0	8 - 14	10.1
V or T	52 \pm 1.8	50 - 57	3.4	55 \pm 7.0	46 - 71	11.7
G ₁	30 \pm 4.1	25 - 39	13.5	—	—	—
G ₂	29 \pm 3.9	24 - 37	13.2	—	—	—
c	16.6 \pm 1.9	13 - 20.6	11.6	19.0 \pm 1.9	16.6 - 22	9.9
c'	3.4 \pm 0.5	2.4 - 4.2	14.5	2.5 \pm 0.3	2.1 - 2.9	9.6
stylet	30 \pm 1.3	28 - 33	4.5	30 \pm 1.5	28 - 33	4.9
m	55 \pm 2.8	50 - 59	5.1	56 \pm 1.4	54 - 58	2.6
S	1.6 \pm 0.8	1.5 - 1.7	5.1	1.6 \pm 0.1	1.5 - 1.7	5.1
DGO	3.1 \pm 0.3	2.7 - 3.3	9.4	2.8 \pm 0.6	1.7 - 3.3	20.8
O	10 \pm 1.0	8 - 11	9.9	9 \pm 1.9	6 - 11	20.8
Procorpus	46 \pm 5.9	37 - 53	13.0	44 \pm 3.3	40 - 48	7.5
Median oes. bulb	17 \pm 1.1	16 - 20	6.5	16 \pm 1.4	14 - 19	8.8
Isthmus	30 \pm 4.4	23 - 36	15.0	32 \pm 4.9	24 - 38	15.2
Basal oes. bulb	29 \pm 2.8	23 - 33	9.6	26 \pm 2.2	23 - 30	8.7
Oesophagus	160 \pm 14.0	131 - 183	8.7	159 \pm 9.2	143 - 173	5.8
Nerve ring	107 \pm 8.9	91 - 120	8.3	108 \pm 7.9	94 - 119	7.4
Excretory pore	132 \pm 8.9	105 - 145	6.8	133 \pm 12.4	115 - 152	9.3
Max. body width	29 \pm 2.4	25 - 33	8.3	28 \pm 9.5	23 - 34	12.4
Lateral field	8.1 \pm 0.5	7.3 - 8.7	6.6	7.2 \pm 0.7	6.3 - 8.7	9.7
Annule width	1.2 \pm 0.1	1.0 - 1.3	12.0	1.3 \pm 0.1	1.0 - 1.3	10.4
Anal body width	19 \pm 1.6	16 - 22	8.6	21 \pm 0.5	17 - 25	12.0
Tail length	62 \pm 8.7	42 - 79	14.0	51 \pm 5.7	45 - 67	11.1
Tail annules	54 \pm 6.4	46 - 67	11.9	—	—	—
Spicules	—	—	—	36.4 \pm 3.4	31 - 41	9.4
Gubernaculum	—	—	—	15.6 \pm 2.2	11 - 18	14.1

Procorpus cylindrical, about 50 μm long. Excretory pore situated at distal end of basal oesophageal bulb. Hemizonid conspicuous, located two annules anterior to excretory pore. Valvular apparatus in metacarpus 4.7-6 μm long, at 59-65% of oesophagus length from anterior end. Basal oesophageal bulb pyriform. Lateral field with four smooth lines. Ovary outstretched, spermatheca rounded 10 (9-13) μm wide, filled with rounded sperm 1-1.2 μm in diameter. Lateral vulval membranes 5.3-6 μm long. Tail conoid-rounded, 0.5-0.8 times as long as vulva-anus distance.

Male: Body ventrally curved. Cephalic region conoid-rounded. Stylet lacking, oesophagus degenerate, 92 μm long. Excretory pore at 76 μm from anterior end.

Maximum body width 13 μm . Tail slender conoid, with acute terminus, 45 μm long.

Habitat and locality: From the rhizosphere of *Quercus faginea* Lam., in Arroyo Frío, Sierra de Cazorla, Jaén, Spain.

Discussion: Morphology and measurements of our specimens agree with those given by Tarjan (1960) and Rasky (1976). The species is widespread in Europe, including the mediterranean area, i.e. in Greece (Kyrou, 1976) and Italy (Mancini *et al.*, 1975) where in both cases it was associated with *Corylus avellana*. It has also been found in several parts of the USA associated with *Quercus* sp. and other plants.

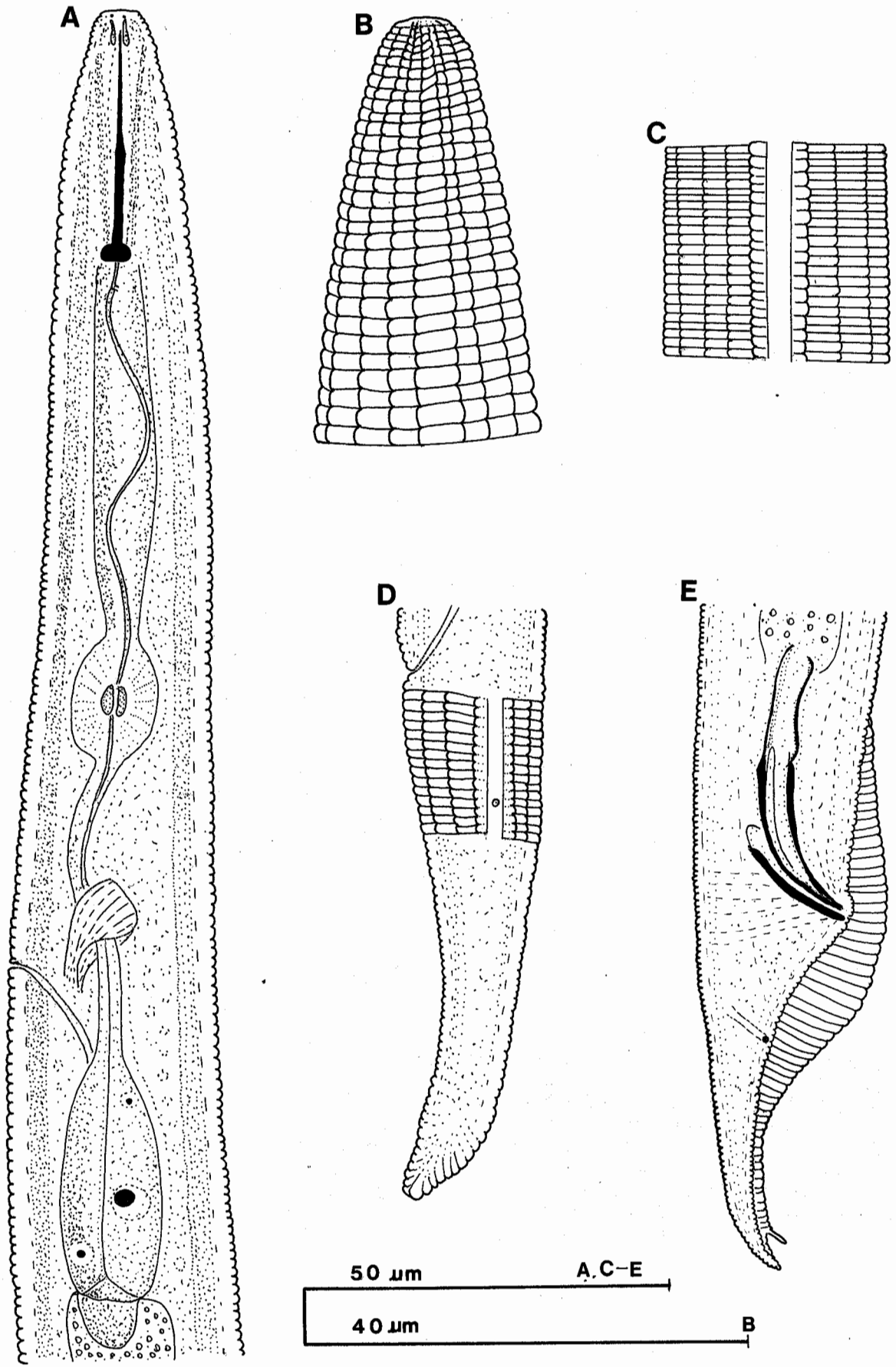


Fig. 1 - *Dolichorhynchus (Dolichorhynchus) lamelliferus*: A, female oesophageal region; B, female anterior region; C, mid-body region showing lateral field and longitudinal ridges; D, female tail, E, male tail.

TABLE II - Morphometrics of *Paratylenchus (Gracilacus) straeleni* (measurements in μm).

	n=19 Females			n=1 Male
	$\bar{x} \pm \text{SD}$	Extr. Val.	CV %	
L	363 \pm 37.8	308 - 447	10.4	356
a	23.4 \pm 3.0	17.3 - 29.8	12.8	28.0
b	3.4 \pm 0.3	3.0 - 4.2	8.7	3.9
b ₁	4.7 \pm 0.3	4.3 - 5.4	7.1	—
V or T	82 \pm 1.5	79 - 84	1.8	33
G ₁	38 \pm 10.7	23 - 58	28.1	—
c	13.4 \pm 2.1	9.9 - 18.6	15.7	8.0
c'	2.9 \pm 0.3	2.4 - 3.4	11.0	4.8
stylet	51 \pm 2.2	47 - 57	4.3	—
conus	39 \pm 2.4	35 - 46	6.2	—
m	76 \pm 2.2	73 - 81	2.9	—
S	4.3 \pm 0.3	3.6 - 4.7	7.7	—
DGO	5.9 \pm 0.6	5.3 - 6.6	11.1	—
O	11.3 \pm 1.5	10 - 12.9	13.0	—
Median oes. bulb	22.3 \pm 3.0	16 - 26	13.5	—
Isthmus	15.6 \pm 3.3	13 - 23	21.1	—
Basal oes. bulb	13.6 \pm 2.7	10 - 19	20.0	—
Oesophagus	107 \pm 9.4	92 - 129	8.7	92
Nerve ring	80 \pm 5.5	72 - 95	6.9	—
Excretory pore	85 \pm 9.1	71 - 107	10.7	76
Max. body width	16 \pm 2.1	13 - 20	13.2	13
Lateral field	3.3 \pm 0.7	2.3 - 4.9	20.7	—
Annule width	1.3 \pm 0.04	1.2 - 1.3	3.3	—
Anal body width	10 \pm 1.7	8 - 13	17.4	9.5
Tail length	27 \pm 3.3	22 - 34	12.0	45
Tail annules	21 \pm 2.0	17 - 24	9.3	27
Spicules	—	—	—	21
Gubernaculum	—	—	—	4

Pratylenchoides alkani Yüksel, 1977
(Table III, Fig. 3)

Female: Body almost straight upon fixation. Annules 1.7-1.9 μm wide at mid-body. Cephalic region rounded, 8.5 \times 4 μm , continuous with body contour, with four annules. Cephalic framework heavily sclerotized. Stylet with large, rounded knobs, 4-5 μm across, slightly directed posteriad. Conus as long as shaft. Dorsal gland opening 2.2-2.7 μm behind stylet knobs. Lateral fields with six lines, areolated in the external bands, 7.5-8 μm wide at mid-body. Procorpus 43-48 μm long. Median oesophageal bulb round to oval 18-23 \times 12-13 μm , with valvular apparatus well developed, 4.7 μm long. Isthmus slender, 31-33 μm long, enveloped by nerve ring in the middle. Excretory pore 2-3 annules anterior to oesophago-intestinal junction. Hemizonid well developed, 2 an-

nules anterior to excretory pore. Deirids at the level of excretory pore. Oesophageal glands overlapping intestine for 70-76 μm or 3 body widths. Reproductive system with two branches equally developed. Vagina straight, about 12 μm long. Spermathecae rounded, 12 μm in diameter. Ovaries with a single row of 12-13 oocytes. Tail cylindrical, 64-70 μm long with coarsely annulated terminus and hyaline region 9.5-12 μm long. Phasmids pore-like 15-20 annules posterior to anus level.

Male: Similar to female except for sexual dimorphism in the shape of the head (higher in male), oesophagus less developed and tail being conoid.

Habitat and locality: From rhizosphere of *Pinus halepensis* Mill., Monte Guadahornillos, Sierra de Cazorla, Jaén, Spain.

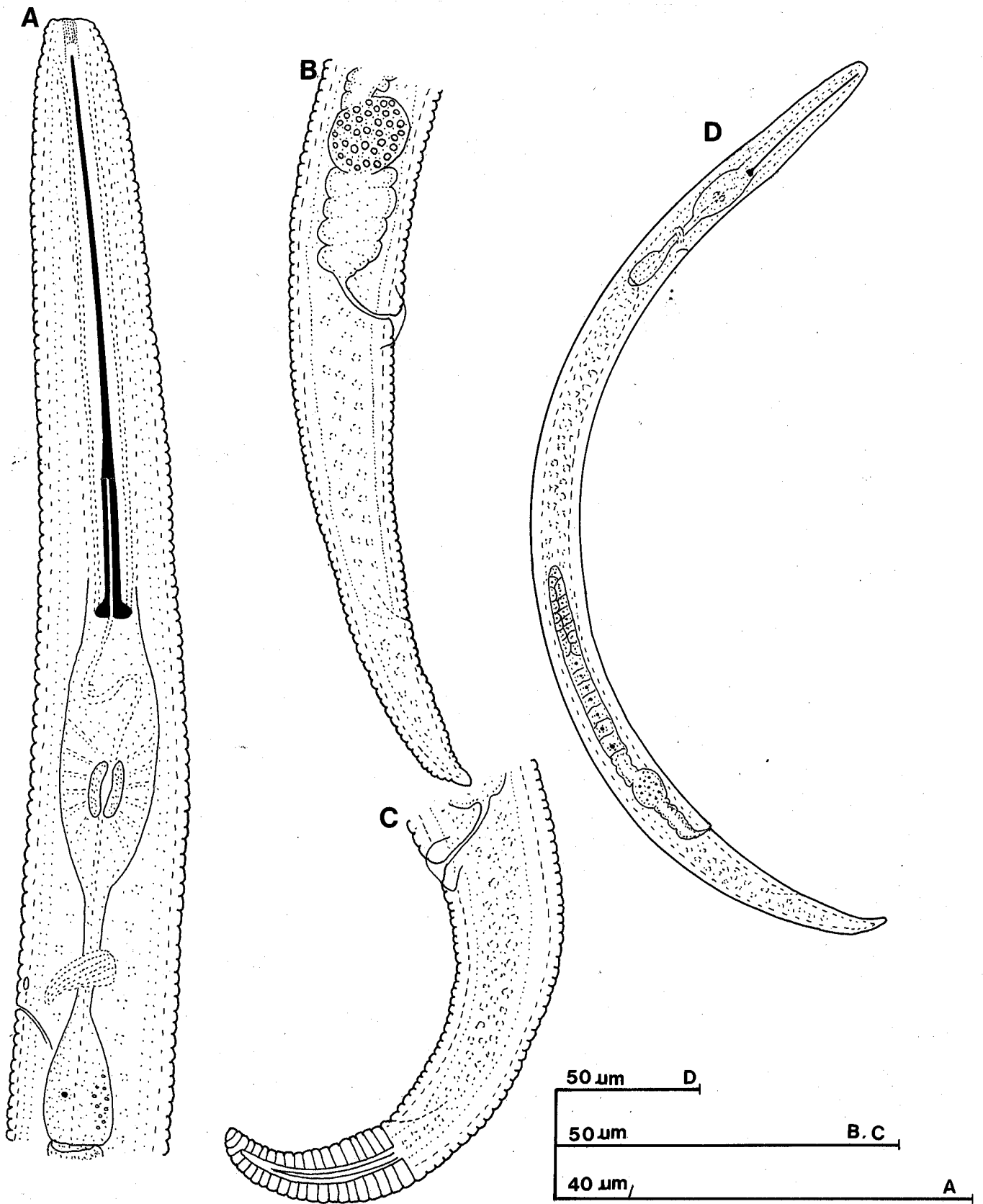


Fig. 2 - *Paratylenchus (Gracilacus) straeleni*: A, female oesophageal region; B and C, female postvulval regions; D, body habitus.

TABLE III - Morphometrics of *Pratylenchoides alkani* (measurements in μm).

	n=5 Females			n=1 Male
	$\bar{X} \pm \text{SD}$	Extr. Val.	CV %	
L	842 \pm 104	734 - 991	12.4	759
a	34.6 \pm 3.1	32.3 - 39.6	9.1	32.5
b	4.4 \pm 0.4	3.7 - 4.7	9.1	5.0
b'	6.6 \pm 0.2	6.4 - 6.8	3.0	6.9
b ₁	9.9 \pm 0.9	8.3 - 10.8	9.6	—
V or T	57 \pm 0.9	56 - 58	1.6	44
G ₁	21.3 \pm 3.9	17 - 24	17.7	—
G ₂	19 \pm 5.0	14 - 24	26.3	—
c	12.6 \pm 1.4	11.5 - 14.6	10.9	12.6
c'	3.5 \pm 0.4	3.1 - 4.2	13.0	3.6
stylet	20.7 \pm 1.0	20 - 22	4.6	21
m	52.2 \pm 0.5	52 - 53	1.0	55
S	1.2 \pm 0.8	1.1 - 1.3	6.8	1.5
DGO	2.1 \pm 0.5	1.4 - 2.7	25.3	—
O	10.2 \pm 2.5	7 - 13	24.4	11
Basal oes. bulb	19 \pm 3.2	17 - 23	16.6	—
Oesophagus	194 \pm 23.4	165 - 222	12.1	152
Nerve ring	102 \pm 13.0	92 - 117	12.8	—
Excretory pore	127 \pm 16.6	110 - 145	13.9	—
Max. body width	24.2 \pm 1.1	23 - 25	4.5	23
Lateral field	7.8 \pm 0.4	7.3 - 8.0	5.2	—
Annule width	1.8 \pm 0.1	1.7 - 1.9	6.3	—
Anal body width	19.4 \pm 2.1	17 - 22	10.7	16.5
Tail length	66.6 \pm 2.4	64 - 70	3.6	60
Tail annules	32 \pm 5.7	27 - 38	18.0	—
Spicules	—	—	—	28
Gubernaculum	—	—	—	4.5

Discussion: *P. alkani* was described by Yüksel (1977) from Turkey and since then it has not been recorded from any other place. In comparison with type material, our specimens are similar in the measurements and morphology except for the stylet length (20-22 vs 22-25 μm) and the oesophageal glands overlap (3 body widths vs 1-2 body widths long).

Pratylenchoides crenicauda Winslow, 1958
(Table IV, Fig. 4)

Females: Body slightly curved ventrally when relaxed. Cuticle about 1 μm thick. Lateral fields with four lines that increase to six beyond posterior end of oesophageal glands, with external bands partially areolated. Cephalic region rounded, anteriorly flattened, 3.7-4.3 μm high, 8.7-9.3 μm wide. Stylet with conus as long as

shaft; knobs 4.7-5.3 μm across, posteriorly directed. Procorpus cylindrical, with a slight depression near the median oesophageal bulb, 36-39 μm long. Median oesophageal bulb rounded, 15-16 μm wide, with valvular apparatus 4 μm long, located at 45-48% of total oesophagus length. Excretory pore situated near the anterior end of basal oesophageal bulb. Hemizonid at level of excretory pore or 1-2 annules anterior. Deirids 2-3 annules anterior to excretory pore. Vagina straight. Ovaries similar, with a single row of oocytes. Tail cylindroid, tip with 4-5 coarse annules. Terminal hyaline region 10-10.7 μm long. Phasmids pore-like 27-32 annules posterior to anus level.

Male: Body straight. Cephalic region narrower and stylet shorter than those of the female. Stylet knobs 3-3.5 μm across. Oesophagus less developed than that of female. Median oesophageal bulb oval, 10-11 μm long

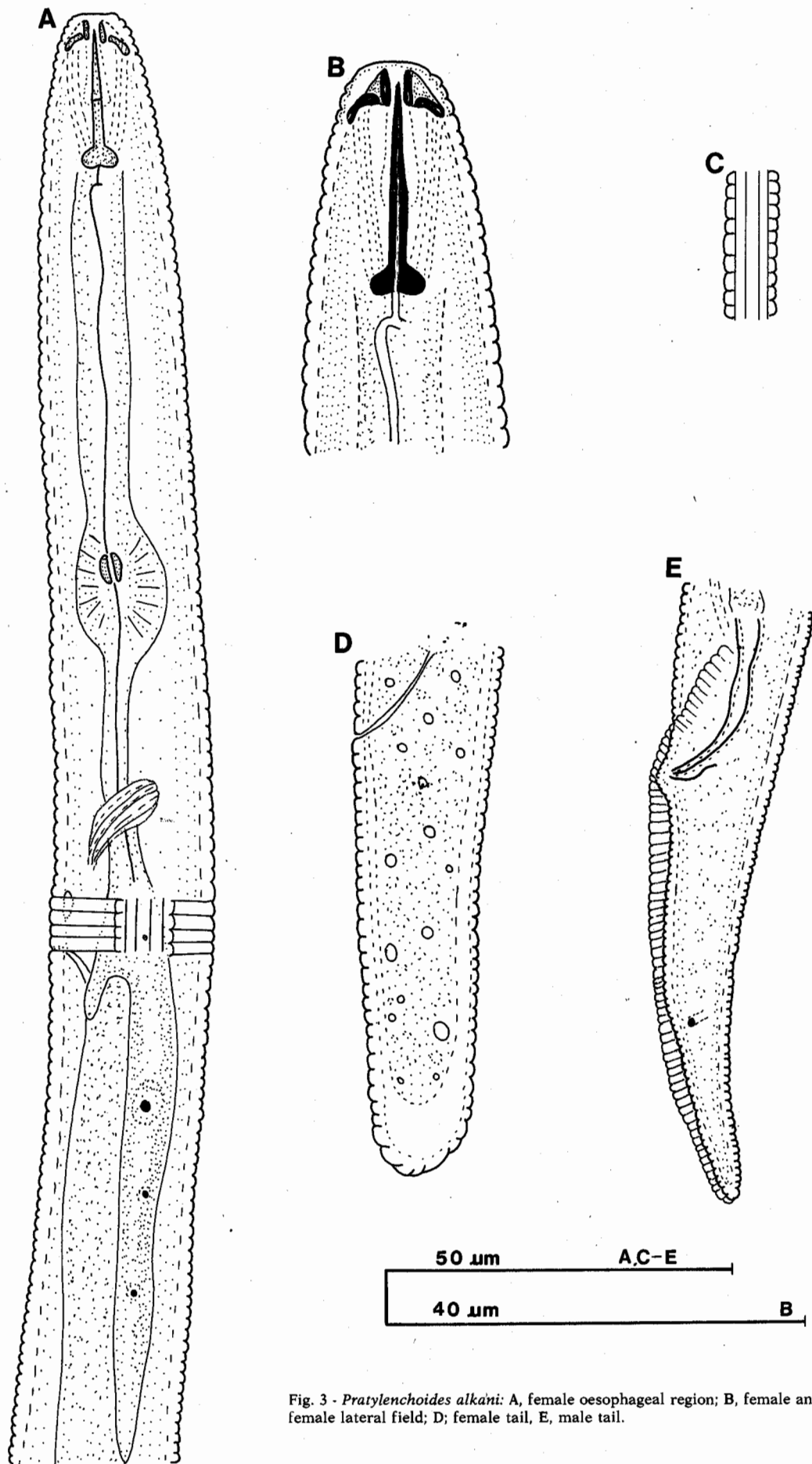


Fig. 3 - *Pratylenchoides alkani*: A, female oesophageal region; B, female anterior region; C, female lateral field; D, female tail, E, male tail.

TABLE IV - Morphometrics of *Pratylenchoides crenicauda* (measurements in μm).

	n=9 Females			n=4 Males		
	$\bar{X} \pm \text{SD}$	Extr. Val.	CV %	$\bar{X} \pm \text{SD}$	Extr. Val.	CV %
L	668 \pm 77.6	578 - 797	11.6	516 \pm 68.2	431 - 594	13.2
a	28.5 \pm 1.5	26.4 - 31.3	5.5	30.3 \pm 3.2	26.9 - 34.3	10.5
b	4.2 \pm 0.6	3.6 - 5.6	13.8	4.4 \pm 0.6	3.7 - 5.0	13.4
b'	4.3 \pm 0.06	4.2 - 4.3	1.3	4.4	—	—
b ₁	8.1 \pm 0.2	7.9 - 8.3	2.2	7.8	—	—
V or T	57 \pm 1.6	54 - 59	2.7	35 \pm 4.2	31 - 40	11.8
G ₁	21 \pm 1.5	20 - 23	7.2	—	—	—
G ₂	19 \pm 1.6	18 - 20	6.0	—	—	—
c	14.3 \pm 1.1	12.9 - 16.5	7.5	11.5 \pm 1.2	10 - 12.8	10.3
c'	2.8 \pm 0.3	2.6 - 2.4	9.1	3.4 \pm 0.3	3.1 - 3.8	8.7
stylet	20 \pm 0.5	19 - 21	2.5	17 \pm 0.7	16.6 - 18	3.8
m	52 \pm 0.8	51 - 53	1.4	56 \pm 0.7	56 - 57	1.3
S	1.3 \pm 0.9	1.2 - 1.4	7.7	—	—	—
DGO	2.1 \pm 0.3	2 - 2.7	13.5	1.7	—	—
O	10 \pm 1.2	10 - 13	11.7	10	—	—
Median oes. bulb	15 \pm 0.6	15 - 16	3.7	—	—	—
Basal oes. bulb	36 \pm 9.2	30 - 43	25.2	—	—	—
Oesophagus	157 \pm 9.4	142 - 170	6.0	117 \pm 3.7	114 - 122	3.1
Nerve ring	88 \pm 14.0	76 - 103	15.8	74 \pm 4.2	68 - 78	5.7
Excretory pore	103 \pm 19.8	83 - 125	19.2	95 \pm 3.2	91 - 98	3.3
Max. body width	23.5 \pm 3.1	19 - 29	13.3	17 \pm 0.7	16 - 17	3.8
Lateral field	8.2 \pm 0.2	8 - 8.3	1.8	5 \pm 0.9	4.3 - 6.0	17.8
Annule width	1.4 \pm 0.1	1.3 - 1.5	8.4	—	—	—
Anal body width	17 \pm 2.1	13 - 19	12.7	13 \pm 0.6	13 - 14	4.3
Tail length	47 \pm 6.7	36 - 57	14.0	45 \pm 5.0	39 - 50	11.0
Tail annules	29 \pm 2.2	27 - 32	7.5	—	—	—
Spicules	—	—	—	22 \pm 1.4	20 - 23	6.2
Gubernaculum	—	—	—	5.7 \pm 0.4	5.5 - 6.2	7.0
Bursa	—	—	—	66 \pm 9.4	57 - 79	14.2

with valvular apparatus 2.5-3 μm long. Tail finely conoid, completely enveloped by a crenate bursa (57-79 μm long).

Habitat and locality: From the rhizosphere of several grasses in a gall oak grove, Arroyo Frío, Sierra de Ca-zorla, Jaén, Spain.

Discussion: Morphology and morphometry of our specimens are broadly similar to those given by Siddiqi (1974), but the above details give further information about the species.

Scutylenchus quadrifer (Andrássy, 1954) Siddiqi, 1979 (Table V, Fig. 5)

Females: Body straight when relaxed with gentle heat. Cephalic region rounded, set off, 8 μm wide, bearing 6-7 annules that are smaller than those of body which average 2 (1.8-2.5) μm at mid-body. Cephalic framework slightly developed. Cuticle 1.3-1.7 μm thick, with 30-34 longitudinal striae at mid-body. Stylet knobs 4.7-5.3 μm across, sloping backward. Orifice of dorsal oesophageal gland located 2-2.7 μm behind stylet base. Procorpus cylindrical, 50 (47-55) μm long. Median bulb oval, 17

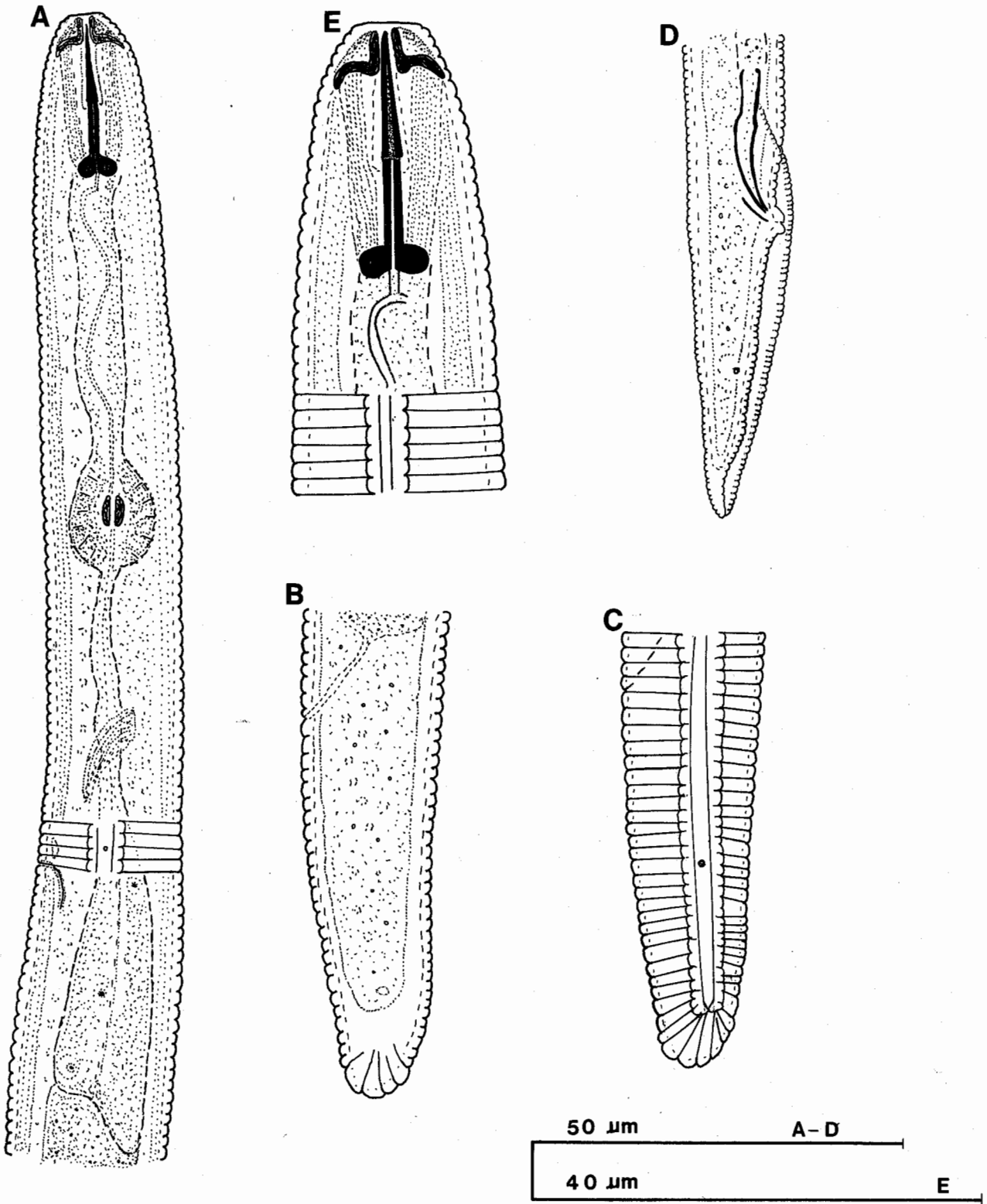


Fig. 4 - *Pratylenchoides crenicauda*: A, female oesophageal region; B and C, female tails; D, male tail; E, female anterior region.

TABLE V - Morphometrics of *Scutylemchus quadrifer* (measurements in μm).

	n=8 Females		
	$\bar{X} \pm \text{SD}$	Extr. Val.	CV %
L	800 \pm 61.1	687 - 890	7.6
a	28.9 \pm 3.1	23.4 - 33.3	10.9
b	5.6 \pm 0.5	4.8 - 6.5	9.3
b ₁	10.2 \pm 0.7	9.1 - 11.2	7.4
V	55.4 \pm 1.8	53 - 58	3.3
G ₁	20.8 \pm 4.4	16 - 27	21.1
G ₂	18.5 \pm 5.0	10 - 23	26.9
c	16 \pm 2.2	13.4 - 20.2	13.6
c'	2.8 \pm 0.2	2.5 - 3.0	6.4
stylet	23 \pm 1.8	20 - 25	7.8
m	52 \pm 3.1	47 - 55	6.0
S	1.4 \pm 0.1	1.2 - 1.5	7.8
DGO	2.2 \pm 0.4	2 - 2.7	16.2
O	9.5 \pm 2.0	8 - 12	20.8
MB	50 \pm 2.9	47 - 55	5.9
Procorpus	36 \pm 1.4	35 - 37	3.9
Median oes. bulb	17 \pm 1.8	15 - 20	10.3
Isthmus	36 \pm 1.2	35 - 37	3.2
Basal oes. bulb	25 \pm 5.9	18 - 31	22.3
Oesophagus	144 \pm 20.9	105 - 174	14.5
Nerve ring	93 \pm 8.6	84 - 104	9.2
Excretory pore	122 \pm 11.7	110 - 136	9.6
Max. body width	28 \pm 3.9	23 - 36	14.0
Lateral field	7.1 \pm 0.7	6 - 8	10.3
Annule width	2.3 \pm 0.5	1.8 - 2.7	20.4
Anal body width	17.4 \pm 2.4	13 - 21	14.0
Tail length	51 \pm 8.9	34 - 60	17.4
Tail annules	28 \pm 2.8	25 - 32	10.1

(15-20) μm long with refractive valvular apparatus 4-4.7 μm long. Basal oesophageal bulb elongate, 27-31 μm long. Cardia rounded, 1.3-1.5 μm . Excretory pore near the distal end of basal bulb. Hemizonid well developed, 2 annules anterior to excretory pore. Ovaries symmetrical, with a single row of oocytes. Vulva sunk in a long cavity, vagina wall thickened, 12-14 μm long. Spermathecae slightly developed without sperm. Tail cylindrical, with smooth terminus. Phasmids pore-like at 27-42 μm from tail tip, 6-10 annules posterior to anus level.

Male: Not found.

Habitat and locality: From rhizosphere of *Pinus halepensis* Mill., Monte Guadahornillos, Sierra de Cazorla, Jaén, Spain.

Discussion: This population of *Scutylemchus quadrifer* corresponds well with the description given by Andrásy (1985).

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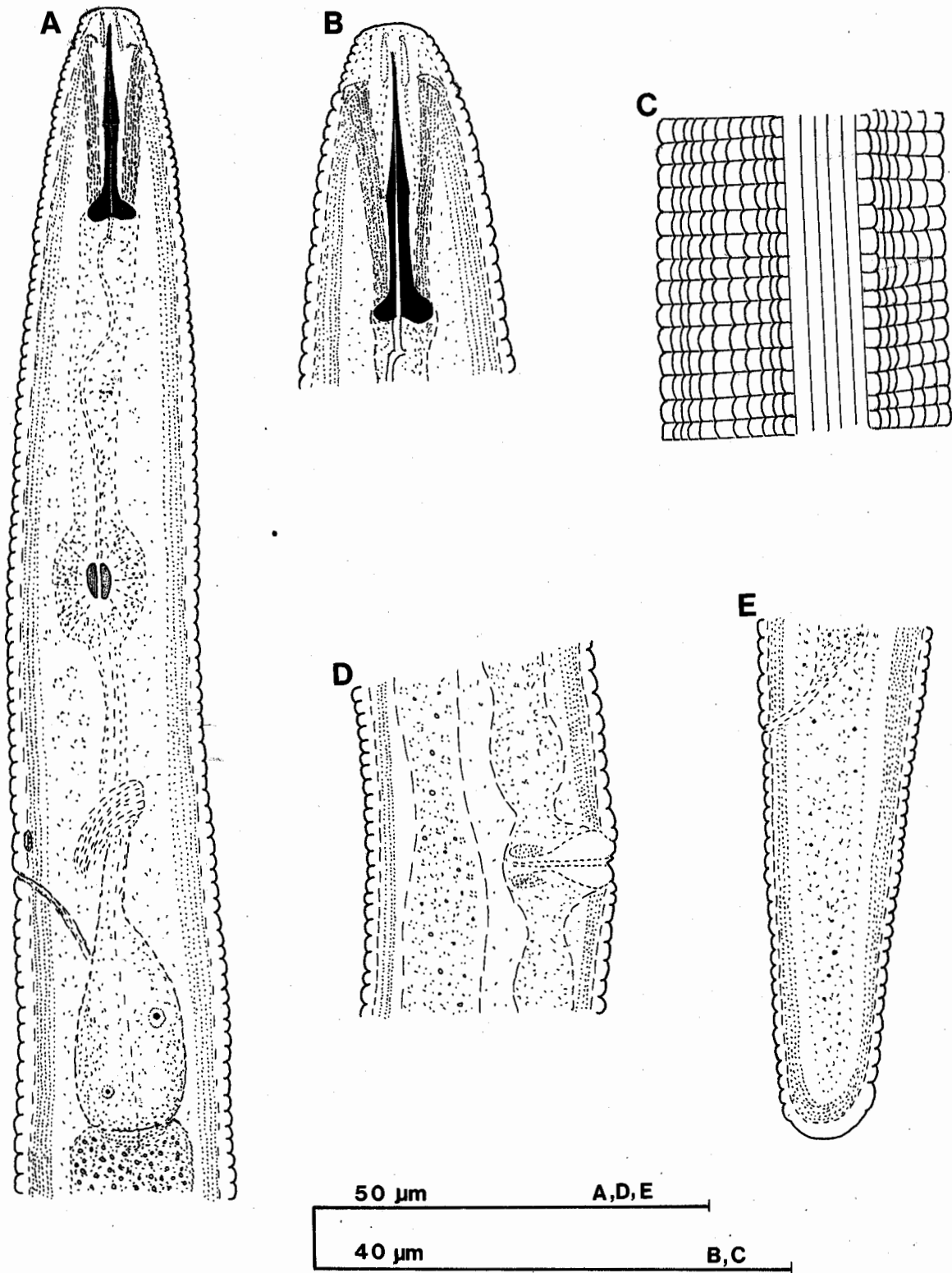


Fig. 5 - *Scutylemchus quadrifer*: A, female oesophageal region; B female anterior region; C, mid-body region showing lateral field and longitudinal striae; D, vulval region; E, female tail.

Literature cited

- ANDRÁSSY I., 1985 - *Scutylechus quadrifer*, C.I.H. Descriptions of Plant-parasitic Nematodes. Set 8, No. 108. Farnham Royal, UK: C.A.B. 2 pp.
- HOOPER D.J., 1978 - The identification and biology of stunt nematodes (Tylenchorhynchidae) especially those in western Europe. Proceedings of Nematol. Workshop, Assoc. Appl. Biol., Rothamsted Exp. Sta. 72 pp.
- KYROU N.C., 1976 - New records of nematodes in Greece. *Plant Dis. Rep.*, 60: 630.
- LOOF P.A.A., 1961 - The nematode collection of Dr. J.G. de Man. I. *Meded. Van de Landbouw. Wageningen*, 190: 169-254.
- MANCINI G., MORETTI F. and PALENZONA M., 1975 - *Gracilacus audriellus* Brown: possibile agente del «seccume» del nocciolo «gentile delle Langhe». *Redia*, 56: 447-454.
- MULK M.M. and SIDDIQI M.R., 1982 - Three new species of hoplolaimid nematodes from South America. *Indian J. Nematol.*, 12: 124-131.
- RASKI D.J., 1976 - Revision of the genus *Paratylenchus* Micoletzky, 1922 and descriptions of new species. Part III of three parts - *Gracilacus*. *J. Nematol.*, 8: 97-115.
- SEINHORST J.W., 1962 - On the killing, fixation and transferring to glycerine of nematodes. *Nematologica*, 8: 29-32.
- SIDDIQI M.R., 1974 - *Pratylenchoides crenicauda*. C.I.H. Descriptions of Plant-parasitic Nematodes. Set 2, No. 38. Farnham Royal, UK: C.A.B., 2 pp.
- SIDDIQI M.R., 1979 - Taxonomy of the plant nematode subfamily Merliniinae Siddiqi, 1970, with descriptions of *Merlinius processus* n. sp., *M. loofi* n. sp. and *Amplimerlinius globigerus* n. sp. from Europe. *Syst. Parasitol.*, 1: 43-59.
- SIDDIQI M.R., 1986 - *Tylenchida. Parasites of Plants and Insects*. C.A.B., London, 645 pp.
- TARJAN A.C., 1960 - A review of the genus *Paratylenchus* Micoletzky, 1922. (Paratylenchinae: Nematoda) with a description of two new species. *Ann. of the New York Acad. of Sciences*, 84: 329-390.
- WINSLOW R.D., 1958 - The taxonomic position of *Anguillulina obtusa* Goodey, 1932 and 1940. *Nematologica*, 3: 136-139.
- YÜKSEL H.S., 1977 - *Pratylenchoides alkani* sp. n. *P. erzurumensis* sp. n. (Nematoda: Tylenchoidea) from soil in Turkey. *Proc. helminth. Soc. Wash.*, 44: 185-188.