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**XIPHINEMA MACROACANTHUM (NEMATODA, DORYLAIMIDA)**  
**A NEW SPECIES FROM SOUTHERN ITALY CLOSELY RESEMBLING**  
**X. INGENS LUC *et* DALMASSO**

by

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**Summary.** *Xiphinema macroacanthum* sp. n. was found in the rhizosphere of olive trees (*Olea europaea* L.) in southern Italy. It closely resembles *X. ingens* Luc *et* Dalmasso, 1963, *X. melitense* Lamberti, Bleve-Zacheo *et* Arias, 1982 and *X. smoliki* Luc *et* Coomans, 1988. *X. macroacanthum* is characterized by the well developed Z-pseudo organ and the large uterine spines.

In 1964 Cohn and Martelli reported *Xiphinema ingens* Luc *et* Dalmasso, 1963 from Israel and Italy, accepting the few slight differences noticed from the type specimens as intraspecific geographic variations. Both descriptions (Luc and Dalmasso, 1963 and Cohn and Martelli, 1964) do not mention the presence of spines in the uteri nor the occurrence of a Z-pseudo organ in the female genital tract, although Cohn and Martelli indicate the presence of granules in their drawings.

Coomans (1964) reported a pseudo-Z differentiation as globular bodies occurring in the uterus of some Italian specimens. The female gonads structure of an apulian population of *X. ingens*, collected at Rutigliano (Bari), was studied later (Grimaldi *et al.*, 1979) and large spines and a well defined Z-pseudo organ were observed at this time.

More detailed observations on several Italian populations previously identified as *X. ingens* (Lamberti *et al.*, 1975; Roca and Lamberti, 1978; Roca and Lamberti, 1985; Lamberti *et al.*, 1985) consistently revealed the presence of these two characters.

The differences are sufficient, in our opinion, to separate, at specific level, the Italian populations from the type population of *X. ingens*. They are therefore described here as a new species named *Xiphinema macroacanthum*, due to the large spiniform structures occurring in the uteri.

Nematodes were extracted from soil samples by the Cobb wet sieve technique, killed and fixed in 5% hot formalin and mounted in glycerin by the slow method on nematology slides. Specimens were measured with the aid of a camera lucida.

**XIPHINEMA MACROACANTHUM sp. n.**  
**(Figs 1-3; Table I)**

**(syn. *X. ingens* apud Martelli and Lamberti, 1967; Lamberti *et al.*, 1975; Roca, 1980; Roca and Lamberti, 1978 and 1985; Lamberti *et al.*, 1985)**

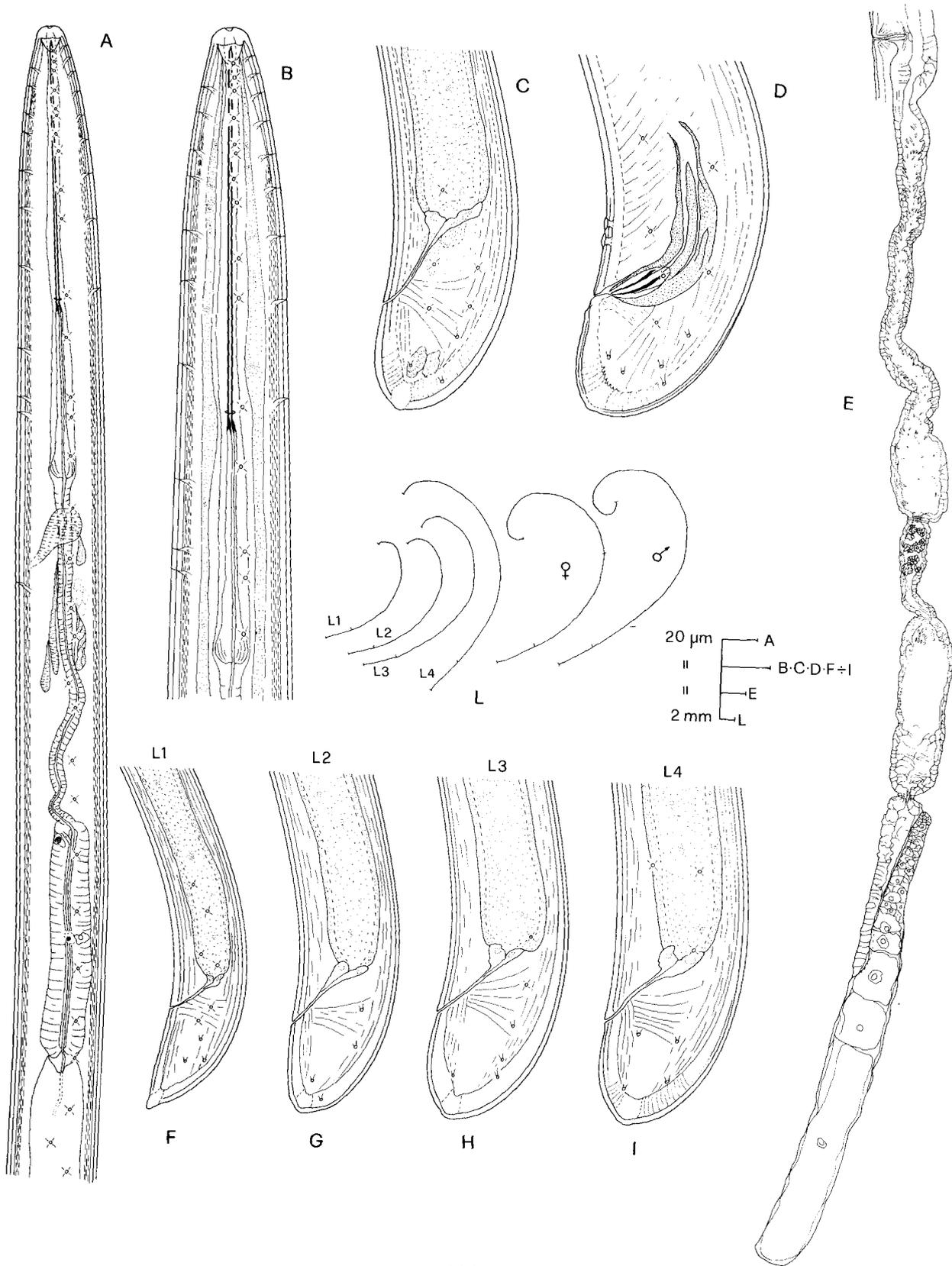
Holotype female: L = 4.6 mm; a = 75; b = 8; c = 117.5; c' = 0.85; V = 48.8; odontostyle = 156  $\mu$ m; odontophore = 93  $\mu$ m; oral aperture to guiding ring = 153  $\mu$ m; tail length = 39.5  $\mu$ m; J (hyalin portion of tail) = 12  $\mu$ m; body diameter at lip region = 15  $\mu$ m; body diameter at guiding ring = 46  $\mu$ m; body diameter at base of oesophagus = 52  $\mu$ m; body diameter at vulva = 62  $\mu$ m; body diameter at anus = 45.5  $\mu$ m; body diameter at beginning of J = 31  $\mu$ m.

Allotype male: L = 5.1 mm; a = 77; b = 9.8; c = 95; c' = 0.75; odontostyle = 147  $\mu$ m; odontophore = 91  $\mu$ m; oral aperture to guiding ring = 148.5  $\mu$ m; tail length = 41  $\mu$ m; J = 10  $\mu$ m; body diameter at lip region = 16  $\mu$ m; body diameter at guiding ring = 50  $\mu$ m; body diameter at base of oesophagus = 58  $\mu$ m; body diameter at mid body = 66.5  $\mu$ m; body diameter at anus = 54  $\mu$ m; body diameter at beginning of J = 33  $\mu$ m; spicules = 99  $\mu$ m; lateral guiding piece = 19  $\mu$ m.

**Description**

Female *habitus* as a C shape, more closed in the posterior half when heat-killed; body robust, cylindrical, tapering very gradually towards the anterior extremity; cuticle with very fine transverse striations, 3.5-4  $\mu$ m thick along the body, more thickened in neck region, where measures 5-5.5  $\mu$ m at the base of lip region, and in the caudal region where it is 6.5-7  $\mu$ m ventrally and 8-8.5  $\mu$ m dorsally in the

<sup>1)</sup> The valuable assistance of Mr. V. Radicci in preparing the illustrations is acknowledged.



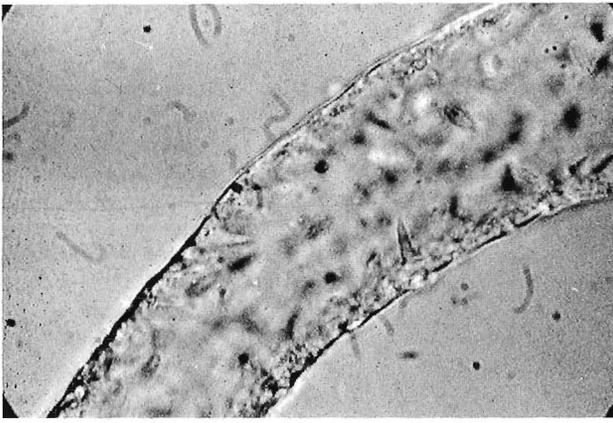


Fig. 2 - *Xiphinema macroacanthum* sp. n.: spiniform structures in the uterus.



Fig. 3 - *Xiphinema macroacanthum* sp. n.: the pseudo «Z» organ.

TABLE I - *Morphometrics of Xiphinema macroacanthum* sp. n. (paratypes).

STAGES	Range (Means ± Standard Deviation)					
	L1	L2	L3	L4	♀♀	♂♂
n	8	8	10	5	23	20
L mm	1.7–2 (1.9 ± 0.09)	2.2–2.8 (2.5 ± 0.22)	3.1–3.7 (3.5 ± 0.21)	4–4.3 (4.1 ± 0.12)	4.3–5.7 (5.1 ± 0.33)	4.2–5.7 (4.9 ± 0.43)
a	48–57.2 (52.7 ± 3.52)	51.7–61.7 (56.2 ± 4.14)	62.1–70.5 (65.4 ± 2.28)	60.7–69.7 (64.7 ± 3.58)	63.2–81.4 (72.2 ± 3.95)	63.7–90 (76.8 ± 7.40)
b	5.3–6.2 (5.7 ± 0.26)	5.2–6.6 (5.9 ± 0.48)	5.6–8.4 (6.9 ± 0.80)	7.1–8.6 (7.9 ± 0.54)	7.6–12.6 (9.4 ± 0.90)	8.1–12.9 (9.5 ± 1.21)
c	37.3–50.2 (42.9 ± 4.46)	54.3–71.4 (66.1 ± 5.90)	81.3–98.4 (90.2 ± 6.81)	90.1–112.2 (100.2 ± 8.13)	113.9–182.6 (140.1 ± 15.5)	98–136.1 (118 ± 9.00)
c'	1.3–1.9 (1.5 ± 0.19)	0.9–1.3 (1.05 ± 0.09)	0.8–1 (0.9 ± 0.06)	0.8–0.9 (0.8 ± 0.05)	0.6–0.8 (0.7 ± 0.07)	0.7–0.9 (0.8 ± 0.04)
V	—	—	—	—	45.3–49.5 (48.2 ± 1.18)	—
Odontostyle μm	75.3–84.1 (79.6 ± 2.70)	101.8–111.8 (107.6 ± 3.59)	127.7–134.7 (131.5 ± 2.21)	128.2–138.2 (132.4 ± 3.70)	145.8–169.4 (157.8 ± 5.45)	137.7–167.7 (155.8 ± 6.38)
Odontophore μm	52.9–61.2 (56.1 ± 3.01)	63.5–72.4 (68.8 ± 3.43)	76.5–85.3 (80.3 ± 3.25)	81.2–82.4 (81.7 ± 0.64)	72.9–98.2 (89.5 ± 7.78)	71.2–98.2 (87 ± 9.19)
Replacement odontostyle μm	98.8–107.1 (103.2 ± 2.91)	126.5–147.1 (134.7 ± 6.69)	145.9–173.5 (159.4 ± 8.80)	145.3–160 (156.6 ± 6.33)	—	—
Oral aperture to guiding ring μm	57.67–2.3 (65.4 ± 5.34)	71.2–106.5 (88.6 ± 12.34)	85.8–131.2 (104.2 ± 14.09)	117.7–181.8 (134.1 ± 26.8)	131.2–162.9 (146.5 ± 9.99)	120–161.2 (143.8 ± 11.16)
Tail length μm	40–50 (44.8 ± 3.56)	33.5–44.7 (38.5 ± 3.68)	34.7–42.4 (38.4 ± 2.92)	37.7–47.7 (41.5 ± 3.83)	29.4–43.5 (37.4 ± 3.76)	35.9–47.7 (41.8 ± 3.06)
J (hyalin portion of tail) μm	7.7–11.8 (8.9 ± 1.46)	5.9–9.4 (8.2 ± 1.35)	7.7–10.6 (9.2 ± 0.93)	8.2–10.6 (9.4 ± 0.93)	8.8–13.5 (11 ± 1.48)	8.8–12.9 (10.6 ± 1.16)
Body diameter at lip region μm	8.8–10.6 (9.6 ± 0.61)	10.6–11.8 (11.1 ± 0.38)	12.4–14.1 (13.2 ± 0.57)	12.9–14.1 (13.2 ± 0.53)	13.5–16.5 (14.9 ± 0.73)	12.9–16.5 (15 ± 0.94)
Body diam. at guiding ring μm	24.1–28.2 (26 ± 1.76)	29.4–37.1 (33.2 ± 2.25)	36.5–42.4 (39.8 ± 1.92)	36.5–44.1 (43.3 ± 0.53)	45.3–55.3 (48.6 ± 2.07)	40–51.8 (47.1 ± 2.94)
Body diam. at base of oesophagus μm	30–37.1 (33.8 ± 2.50)	37.1–50 (42 ± 4.69)	45.3–51.8 (48.7 ± 2.30)	52.9–58.8 (56.8 ± 2.34)	50.6–70.6 (61 ± 4.09)	47.1–67.7 (57.9 ± 4.55)
Body diam. at mid body or vulva μm	33.5–41.8 (36.4 ± 3.04)	40–53.5 (45.4 ± 5.28)	46.5–56.5 (52.8 ± 3.06)	58.2–66.5 (64.1 ± 3.35)	61.2–80 (71.6 ± 4.77)	54.1–75.3 (64.4 ± 4.90)
Body diam. at anus μm	26.5–31.8 (29.3 ± 2.17)	32.4–41.8 (36.9 ± 3.74)	40.6–48.8 (44.8 ± 2.83)	47.7–52.4 (49.8 ± 2.29)	45.8–55.8 (51.6 ± 2.52)	47.1–56.5 (51.5 ± 2.59)
Body diam. at beginning of J μm	10.6–14.7 (12.9 ± 1.54)	18.2–25.8 (22.8 ± 3.04)	23.5–32.4 (27.9 ± 2.82)	28.8–31.8 (30.1 ± 1.13)	26.5–40.6 (33.7 ± 3.39)	28.2–36.5 (32 ± 2.45)
Spicules μm	—	—	—	—	—	76.5–114.7 (102.6 ± 8.54)
Lateral guiding piece μm	—	—	—	—	—	16.5–22.4 (19.9 ± 1.29)

Fig. 1 - (Front page) *Xiphinema macroacanthum* sp. n.: A and B, female anterior region; C, female posterior region; D, male posterior region; E, posterior branch of the genital tract; F-I, posterior region of juveniles; L, posture of juvenile and adult stages.

post anal portion; lateral hypodermal cords readily visible throughout the length of the body, 14.5-15  $\mu\text{m}$  wide at mid body or 23-25% of the corresponding body diameter; lateral body pores, 11-12 in the range of the odontostyle, arranged in a single row in the neck region and in a double row in the rest of the body from the beginning of the intestine; nine dorsal and seven ventral body pores in the range of the odontostyle well evident in the neck region and less in the rest of the body; labial region 5.5-6  $\mu\text{m}$  high, almost hemispherical, slightly flattened frontally and rounded laterally, offset from the rest of the body by a slight depression; amphids large, stirrup shaped, with aperture as a wide, straight, transverse slit; odontostyle robust 2.5-3  $\mu\text{m}$  in diameter; basal flanges 13-13.5  $\mu\text{m}$  wide and guiding «tube» well evident, variable in length from 11 to 26  $\mu\text{m}$ , with robust guiding ring 4-4.5  $\mu\text{m}$  wide; oesophagus dorylaimoid with the anterior part tubular; basal enlarged portion occupying 1/4 of the total oesophagus length, 120-124  $\mu\text{m}$  long and 22-24  $\mu\text{m}$  wide, containing

three nuclei; oesophageal-intestinal valve heart-shaped; reproductive system amphidelphic, with equally developed branches; vulva slit-like, situated slightly anterior to mid body; vagina extending to more or less 2/3 of the corresponding body diameter with a conspicuous «pars uterina»; uteri very long (550-600  $\mu\text{m}$ ) consisting of a proximal tubular portion and a distal «pars dilatata» in which a well developed Z-pseudo differentiation occurs; along the whole length of the uteri very large lanceolate spines, 1.2-1.5  $\mu\text{m}$  long, arise from the wall (Fig. 2); Z-pseudo organ formed by six, seven units consisting of a globular central body (2.5-3  $\mu\text{m}$  diam) surrounded by six to eight vesicular granules (Fig. 3), uterus followed distally by a large spermatheca delimited proximally and distally by well developed sphincters; oviduct consisting of a large pouch and a tubular portion; ovaries reflexed; prerectum around 100  $\mu\text{m}$  long; rectum extending more or less the body width at anus; tail rounded, with mammillate projection at the terminus; three or four caudal pores are evident on each side of the tail.

TABLE II - *Morphometrics of three populations of Xiphinema macroacanthum sp. n. (from Sicily).*

Habitat	Rhizosphere of:	Means (Minimum-Maximum)					
		Loquat		Olive		Pine	
Locality		Colli (Palermo)		Melilli (Siracusa)		Monte Pellegrino (Palermo)	
n		7 ♀ ♀	4 ♂ ♂	5 ♀ ♀	4 ♂ ♂	9 ♀ ♀	5 ♂ ♂
Lmm		4.6 (4.1-5.8)	5.3 (4.9-6.2)	5.2 (4.7-5.4)	5.3 (4.6-5.6)	5.7 (5.1-6.0)	5.4 (4.8-5.8)
a		60 (55-70)	81 (73-92.5)	70 (64-73)	76 (68-81)	74.5 (63-83)	78 (63-84)
b		8.3 (7-10)	9.4 (8.5-11)	9.2 (8.5-9.5)	9.1 (7.5-10.5)	10 (9.5-11.5)	9.7 (8.5-10.5)
c		141 (122.5-161.5)	139.5 (128-165)	147.5 (139-155.5)	127.5 (115-136)	154 (133.5-167)	129.5 (112.5-142.5)
c'		0.6 (0.6-0.7)	0.7 (0.7-0.7)	0.7 (0.6-0.7)	0.7 (0.7-0.8)	0.7 (0.6-0.7)	0.7 (0.7-0.8)
V		46 (44-49)	-	46 (44-47)	-	46 (45-47)	-
Odontostyle $\mu\text{m}$		165 (156.5-170.5)	163.5 (160-167)	172 (163.5-177)	169 (166.5-171)	174 (165-180)	178.5 (174-182.5)
Odontophore $\mu\text{m}$		86 (83.5-89.5)	83.5 (79.5-86.5)	91.5 (87-94)	95 (93.5-96.5)	93.5 (88.5-98.5)	88 (79.5-95.5)
Oral aperture to guiding ring $\mu\text{m}$		147 (134.5-152)	146.5 (139.5-151)	154 (143.5-165.5)	158 (149.5-156.5)	149.5 (112.5-164.5)	147 (137.5-164.5)
Tail length $\mu\text{m}$		32.5 (30.5-36)	38 (36.5-40.5)	35.5 (30.5-38)	41 (40-42.5)	37 (34-40)	42 (37.5-44.5)
J $\mu\text{m}$		10 (8.5-11)	10.5 (9.5-12.5)	11 (9.5-12.5)	9 (8.5-10)	10.5 (10-11.5)	10 (9.5-10)
Body diameter at lip region $\mu\text{m}$		15.5 (14.5-16.5)	16 (16-16.5)	16.5 (16.5-16.5)	16 (16-16.5)	16.5 (16-17)	16 (16-16.5)
Body diam. at guiding ring $\mu\text{m}$		52.5 (46-61.5)	46.5 (46-47)	49.5 (44.5-54)	50.5 (49-52)	50 (45.5-57.5)	51 (48-59)
Body diam. at base of oesophagus $\mu\text{m}$		69.5 (53-84.5)	58 (56.5-59)	65 (56.5-74.5)	63 (62.5-64)	64.5 (55.5-78)	62.5 (56.5-73.5)
Body diam. at mid body or vulva $\mu\text{m}$		75.5 (59-94)	65.5 (62.5-67)	75 (65.5-84.5)	69.5 (67.5-72)	77.5 (65.5-85.5)	70 (63-76.5)
Body diam. at anus $\mu\text{m}$		56 (47-63)	53.5 (51-56)	53.5 (46.5-59)	55.5 (54.5-56)	53.5 (47-62)	56.5 (53-62.5)
Body diam. at beginning of J $\mu\text{m}$		36 (31-41)	35 (31-38)	36 (33-42.5)	35 (33-36)	35.5 (31-40)	36.5 (35.5-39)
Spicules $\mu\text{m}$		-	93 (88.5-100)	-	99.5 (97.5-103)	-	99.5 (94-103.5)

Male general appearance similar to female with posterior part of the body more curved; morphology and anatomy similar to female except in the genital apparatus and the somatic structures associated with it; testis well developed, full of sperms; spicules robust, curved, not cephalated with enlarged central portion; lateral guiding piece rounded proximally and bifid at distal end; precloacal pairs of papillae preceded by 4 or 5 ventromedian single supplements; tail similar to that of female, bearing 3 or 4 caudal pores on each side.

Sicilian populations of *X. macroacanthum* are morphologically identical to the apulian ones, although some have larger size, longer odontostyle and slightly posterior vulva (Table II); male supplements are 6 or 7 in addition to the adanal pair.

*Juveniles*: morphologically similar to adult females but smaller; tail of first stage conoid elongated.

*Type habitat and locality*: rhizosphere of *Olea europaea* L. at Palo del Colle, Bari, Italy.

*Type material*: holotype, allotype, nineteen paratype females, sixteen paratype males and juveniles in the collection of the Istituto di Nematologia Agraria del Consiglio Nazionale delle Ricerche, Bari, Italy; two paratype females and two paratype males in the Nematology Department, Rothamsted Experimental Station, Harpenden, Herts, England; two paratype females and two paratype males in the Plant Nematology Laboratory Collection, United States Department of Agriculture, Beltsville, Maryland, U.S.A.

*Differential diagnosis*: *Xiphinema macroacanthum* sp. n. is characterized by the two equally developed female genital branches, the large uterine spines, the well developed Z-pseudo organ, the almost equatorial vulva and the hemispherical tail with a very slight bulge.

It closely resembles *X. ingens* Luc et Dalmasso, 1963, *X. melitense* Lamberti, Bleve-Zacheo et Arias, 1982 and *X. smoliki* Luc et Coomans, 1988. However, it differs from *X.*

*ingens* in the large uterine spines (absent in *X. ingens*) and the well developed Z-pseudo organ (only rudimentary in *X. ingens*), from *X. melitense* in the larger uterine spines (much smaller in *X. melitense*), the better developed Z-pseudo organ, the larger body length ( $L = 4.3$  mm in *X. melitense*), the anterior vulva ( $V = 51.5$  in *X. melitense*) and the presence of frequent males (male unknown in *X. melitense*) and from *X. smoliki* in the larger size ( $L = 4.3$  mm in *X. smoliki*), the longer odontostyle ( $111 \mu\text{m}$  in *X. smoliki*), the posterior vulva ( $V = 44$  in *X. smoliki*) and the presence of frequent males (male unknown in *X. smoliki*).

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