

Xiphinema lupini sp. n. (Nematoda : Longidoridae) from Portugal

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Summary – The authors give a description of *Xiphinema lupini* sp. n. It was found in the rhizosphere of yellow lupin (*Lupinus luteus* L.) at Herdade dos Barrões, Couço, Coruche, province of Ribatejo, Portugal. The new species is characterized by two female genital branches equally developed, vulva almost at mid-body, a rudimentary pseudo-Z-organ, spiniform structures in the uterus, tail regularly short conical and male abundant. *X. lupini* sp. n. is similar to *X. conurum* Siddiqi, 1964 and *X. italiae* Meyl, 1953 from which it differs mainly in having uterine differentiations.

Résumé – *Xiphinema lupini* sp. n. (Nematoda : Longidoridae) provenant du Portugal – Les auteurs donnent la description de *Xiphinema lupini* sp. n. Cette nouvelle espèce a été trouvée dans la rhizosphère de lupin (*Lupinus luteus* L.) à Herdade dos Barrões, Couço, Coruche, province de Ribatejo, Portugal. *X. lupini* sp. n. est caractérisé par une vulve médiane, des branches génitales femelles également développées, un utérus pourvu d'un pseudo-organe Z rudimentaire et de structures spiniformes, une queue régulièrement conique; les mâles sont abondants. Cette nouvelle espèce est proche de *X. conurum* Siddiqi, 1964 et *X. italiae* Meyl, 1953 dont elle se sépare par la présence de différenciations utérines.

Key-words : Nematodes, *Xiphinema*, yellow lupin, Portugal.

Soil samples were collected by Mrs Fatima Matias and Mr Mario Rodrigues from the rhizosphere of lupin (*Lupinus luteus* L.) at Herdade dos Barrões, Couço, Coruche, province of Ribatejo, Portugal. Specimens of *Xiphinema* were sent to the Istituto di Nematologia Agraria as a suspected new species. Examination of this material by the senior author confirmed the previous opinion and the species is described here as *Xiphinema lupini* sp. n.

Xiphinema lupini sp. n. (Fig. 1)

MEASUREMENTS

Holotype, allotype, females, males and juveniles : see Table 1.

DESCRIPTION

Female : In specimens killed by gentle heat, habitus usually slightly curved ventrad as J shaped, with increasing curvature behind the vulva in the posterior part; body cylindrical, tapering towards the anterior extremity, more abruptly at the posterior end. Cuticle 1.8-2 μm thick along the body, more thickened in the neck region, where it measures 3-3.5 μm at the base of the lip region, and on the tail where it is 3.5-4 μm ventrally and 5.5-6 μm dorsally. Lateral hypodermal cords 8-12 μm wide at mid-body or 24-36 % of the corre-

sponding body diameter. Lateral body pores, three in the range of the odontostyle, not visible in the rest of the body; four dorsal and two ventral body pores in the range of the odontostyle. Labial region rounded laterally and less so frontally, offset from the rest of the body by a conspicuous constriction; amphids stirrup-shaped, with aperture a straight, transverse slit, occupying about the 60 % of the lip region width, situated on the lip region at just above the corresponding constriction. Odontostyle 1.5-2 μm in diameter; odontophore well developed with large basal flanges; guiding tube well evident with guiding ring 2.5 μm wide. Oesophagus dorylaimoid with the anterior part tubular; the posterior part containing three nuclei : the dorsal located at the beginning of the oesophageal bulb, the two subventral almost at the middle of the glandular oesophagus; oesophageal-intestinal valve inconspicuous, pear-shaped, surrounded by intestinal tissue. Reproductive system amphidelphic, with both genital branches equally developed and reflexed; ovary occupying less than one-sixth of the entire genital branch; oviduct with a slender part consisting of discoid cells, and a *pars dilatata oviductus* separated from the uterus by a very robust sphincter muscle; uterus consisting of a wide and long *pars dilatata uteri*, a tube and an ovejector. In the uterine portion close to *pars dilatata uteri* in which is generally located the "Z" differentiation, a rudimentary pseudo-Z-organ consisting of a variable number of small granular bodies, generally round-

Table 1. Morphometrics of *Xiphinema lupini* sp. n. (paratypes) (all measurements in μm , except L).

	Holotype	Allotype	Female	Male	J1	J2	J3	J4
n	1	1	17	20	4	8	11	13
L (mm)	4.2	4.5	4.2 \pm 0.28 (3.7-4.8)	4.3 \pm 0.28 (3.8-4.8)	1.9 \pm 0.23 (1.6-2.0)	2.2 \pm 0.07 (2.0-2.3)	2.7 \pm 0.11 (2.5-2.8)	3.1 \pm 0.15 (2.9-3.4)
a	125.5	137.0	128.5 \pm 8.01 (116.0-142.5)	139.0 \pm 8.91 (123.0-157.0)	84.0 \pm 10.74 (72.1-97.2)	87.1 \pm 3.82 (80.9-91.4)	104.8 \pm 4.94 (95.0-113.5)	113.2 \pm 5.82 (99.2-126.0)
b	9.5	9.8	9.5 \pm 0.86 (7.5-11.0)	9.5 \pm 0.70 (8.1-10.9)	5.7 \pm 0.46 (5.2-6.3)	6.0 \pm 0.14 (5.9-6.3)	6.5 \pm 0.48 (5.6-7.0)	7.3 \pm 0.51 (6.5-8.0)
c	71.5	98.0	77.0 \pm 6.6 (65.0-87.0)	96.6 \pm 11.23 (76.0-119.7)	31.6 \pm 3.36 (26.8-34.7)	32.8 \pm 1.34 (31.2-35.5)	44.0 \pm 4.94 (38.2-52.0)	50.5 \pm 4.22 (43.5-58.5)
c'	2.9	1.7	2.4 \pm 0.19 (2.1-2.8)	1.8 \pm 0.16 (1.6-2.2)	3.9 \pm 0.43 (3.4-4.4)	3.8 \pm 0.3 (3.4-4.2)	3.2 \pm 0.33 (2.6-3.5)	3.1 \pm 0.3 (2.8-4.0)
V	53.0	-	51.3 \pm 1.86 (48.3-54.4)	-	-	-	-	-
Lip reg. width	11.0	11.0	11.5 \pm 0.55 (10.5-12.5)	11.0 \pm 0.38 (10.5-12.0)	9.5 \pm 0.29 (9.0-10.0)	9.5 \pm 0.54 (9.0-10.5)	10.0 \pm 0.4 (9.5-10.5)	10.0 \pm 0.45 (9.5-10.5)
Lip reg. height	4.5	4.0	4.5 \pm 0.55 (3.5-6.0)	4.0 \pm 0.67 (3.0-6.0)	3.5 \pm 0.34 (3.0-4.0)	3.5 \pm 0.27 (3.0-4.0)	3.0 \pm 0.41 (2.5-3.5)	3.5 \pm 0.38 (3.0-4.0)
Odontostyle	113.5	110.0	112.5 \pm 3.03 (107.0-117.5)	112.0 \pm 3.59 (106.0-120.0)	73.0 \pm 5.83 (64.5-77.0)	79.0 \pm 2.13 (77.0-83.0)	93.0 \pm 1.65 (89.5-94.0)	97.0 \pm 2.83 (94.0-102.5)
Odontophore	60.0	59.0	60.0 \pm 1.83 (56.0-63.0)	60.0 \pm 1.64 (57.5-63.5)	45.5 \pm 2.11 (43.0-47.5)	48.0 \pm 1.53 (46.0-50.0)	53.5 \pm 1.57 (50.5-55.5)	55.0 \pm 2.16 (52.0-59.0)
Tot. stylet	173.5	169.0	172.5 \pm 3.29 (166.5-177.5)	172.0 \pm 4.27 (165.5-180.5)	119.0 \pm 7.85 (107.5-124.5)	127.0 \pm 3.58 (123.0-133.0)	146.5 \pm 2.37 (143.0-149.5)	151.5 \pm 3.66 (146.0-159.0)
Repl. odontostyle	-	-	-	-	88.0 \pm 4.8 (81.0-91.5)	96.5 \pm 1.47 (94.5-99.0)	109.5 \pm 1.86 (106.0-110.5)	113.5 \pm 2.13 (110.5-116.5)
Flanges width	9.0	9.0	8.5 \pm 0.49 (7.5-9.5)	8.5 \pm 0.7 (7.5-11.0)	7.0 \pm 0.74 (6.0-7.5)	7.5 \pm 0.52 (6.5-8.5)	8.0 \pm 0.83 (7.0-10.0)	8.0 \pm 0.56 (7.0-9.0)
Guide ring	107.5	103.0	103.0 \pm 1.96 (99.0-105.5)	100.5 \pm 5.99 (80.0-109.0)	66.5 \pm 5.2 (59.5-71.5)	71.5 \pm 2.15 (67.5-75.5)	82.0 \pm 3.97 (76.5-87.0)	87.0 \pm 3.1 (82.5-93.0)
Guide sheath	11.5	8.0	10.0 \pm 3.22 (5.5-20.0)	9.5 \pm 2.7 (6.5-17.0)	5.5 \pm 1.4 (3.5-6.5)	6.6 \pm 1.63 (3.5-9.0)	8.5 \pm 2.8 (4.5-13.0)	7.0 \pm 2.07 (2.5-10.0)
Phar. bulb length	132.0	130.0	130.0 \pm 7.1 (116.5-146.0)	129.5 \pm 5.48 (120.0-140.0)	95.5 \pm 5.47 (90.0-103.0)	100.0 \pm 4.4 (91.0-104.5)	116.0 \pm 9.08 (106.0-136.0)	116.0 \pm 5.76 (104.0-124.0)
Phar. bulb width	14.5	17.5	16.0 \pm 1.5 (13.5-19.5)	16.0 \pm 1.57 (13.5-19.5)	12.0 \pm 1.02 (11.0-13.5)	13.0 \pm 0.93 (12.0-14.0)	13.5 \pm 0.96 (12.0-14.5)	14.0 \pm 1.46 (12.5-17.5)
Ant. gen. branch	453.0	-	404.5 \pm 35.57 (335.5-459.0)	-	-	-	-	-
Post. gen. branch	394.0	-	357.0 \pm 51.45 (282.5-441.0)	-	-	-	-	-
Ant. gen. branch %	10.7	-	9.5 \pm 0.84 (8.4-11.5)	-	-	-	-	-
Post. gen. branch %	9.4	-	8.4 \pm 1.06 (6.6-10.3)	-	-	-	-	-
Body diam. mid-body	33.5	32.5	33.0 \pm 1.72 (29.5-35.5)	31.0 \pm 1.63 (28.0-33.5)	23.5 \pm 2.74 (20.5-27.0)	25.0 \pm 0.89 (23.5-26.0)	26.0 \pm 0.9 (24.5-27.0)	27.0 \pm 1.86 (24.5-30.5)
Body diam. anus level	20.5	26.0	23.0 \pm 0.90 (21.5-24.5)	25.5 \pm 0.98 (24.0-27.5)	15.5 \pm 1.82 (14.0-18.5)	17.0 \pm 0.66 (16.5-18.0)	19.5 \pm 0.79 (17.5-20.5)	20.5 \pm 1.01 (18.0-22.0)
Rectum	34.0	31.0	31.0 \pm 2.31 (27.0-34.0)	30.0 \pm 1.81 (26.0-32.5)	18.5 \pm 0.76 (16.5-20.5)	18.5 \pm 2.22 (16.0-21.0)	24.0 \pm 1.55 (22.0-26.5)	24.5 \pm 1.74 (21.0-27.0)
Tail	59.0	45.5	55.5 \pm 4.99 (46.5-63.5)	45.0 \pm 4.86 (38.5-57.5)	61.5 \pm 1.0 (60.0-62.5)	66.0 \pm 3.3 (61.0-70.5)	62.0 \pm 5.3 (52.5-69.0)	62.5 \pm 4.35 (56.5-72.0)
Hyaline tail lip	17.5	16.0	16.5 \pm 1.98 (12.5-19.5)	16.0 \pm 4.02 (8.5-26.5)	11.0 \pm 1.13 (9.5-11.5)	11.0 \pm 1.22 (9.0-13.0)	15.0 \pm 2.78 (11.0-19.0)	15.0 \pm 1.7 (11.5-17.0)
Prerectum	753.0	776.5	641.5 \pm 70.02 (470.5-753.0)	710.5 \pm 88.57 (576.5-894.0)	306.0 \pm 110.78 (165.0-400.0)	353.5 \pm 30.72 (306.0-400.0)	457.5 \pm 74.82 (341.0-582.5)	468.0 \pm 97.54 (323.5-641.0)
Spicules	-	51.0	-	50.0 \pm 1.72 (47.0-53.0)	-	-	-	-
Lateral guiding piece	-	13.0	11.0 \pm 1.1	-	-	-	-	-

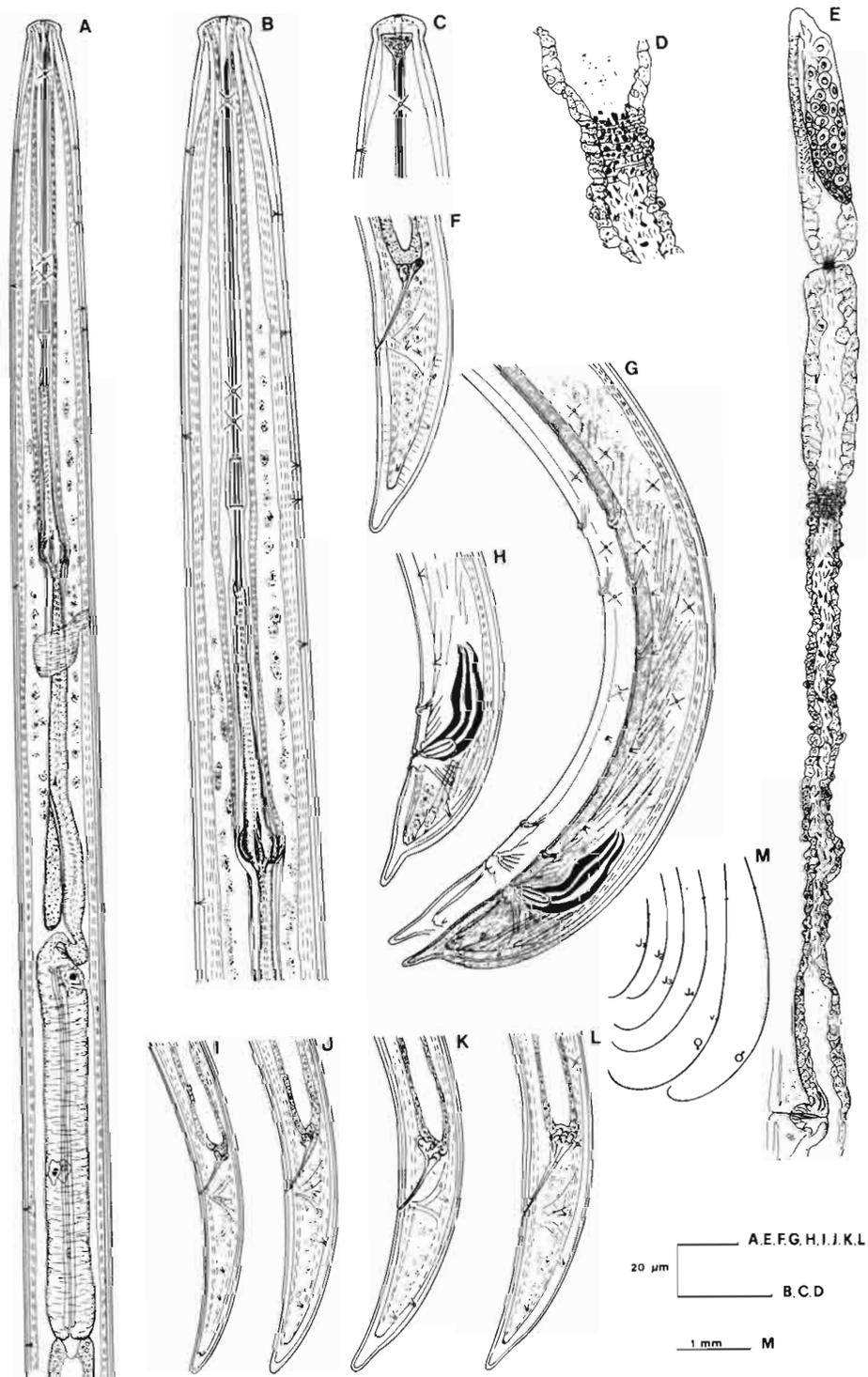


Fig. 1. *Xiphinema lupini* sp. n. A, B : Female, anterior region; C : Head (surface view); D : Pseudo-Z-organ; E : Anterior branch of the genital tract; F : Female, posterior region; G, H : Male, posterior region; I-L : Posterior region of juveniles, J1-J4 respectively; M : Posture of juveniles and adult stages.

ed, 1.5-2 μm in diameter, is visible. In the lumen of the tubular portion of the uterus there are spiniform structures, apparently attached to the internal uterine wall, with large base and slender tip oriented preferably towards the pseudo-Z-organ. The spiniform structures are variable in length from 1.5 to 3 μm and are regularly distributed over the entire tubular portion of the uterus. Sperm were observed occasionally in the uterus of some females, showing the functionality of the male. Protrusions of the muscle cells (Coomans *et al.*, 1992) were observed on the external uterine wall. Prerectum well visible; rectum one body width long or slightly more. Tail conical with ventral profile almost straight or slightly ventrally curved, dorsal profile regularly curved and rounded extremity, ventrally oriented respect to the body axis. Two caudal pores are visible on each side of the tail.

Male: General appearance similar to female with posterior part of the body more curved. Morphology and anatomy similar to those of the female except in the genital apparatus and somatic structures associated with it; precloacal pair of papillae preceded by two or three ventral supplements. Distances of preanal supplements are given in Table 2. Tail different from that of female: it is shorter with ventral profile slightly curved and dorsal one more curved, ending with a large and long mucro, measuring 11-12 μm . Three caudal pores are visible on each side of the tail.

Table 2. Distance of the preanal supplements in twenty-one paratype males (in μm).

N	Cloaca-double pap.	Double pap. -S1	S1-S2	S2-S3
1	13.0	66.0	33.5	28.5
2	17.5	72.0	22.0	23.5
3*	17.5	73.5	41.0	-
4	14.5	67.0	33.0	26.5
5	11.0	72.0	40.0	24.5
6	14.5	66.0	28.0	19.5
7	15.5	73.5	25.5	20.0
8	15.5	82.5	24.5	-
9	14.5	74.5	32.5	17.5
10	16.5	76.5	24.0	-
11	14.5	71.0	26.5	-
12	13.0	63.5	36.5	17.5
13	13.0	76.0	26.5	23.5
14	13.5	83.5	30.0	-
15	16.0	71.0	36.5	-
16	14.0	81.0	29.5	-
17	14.0	64.5	31.0	28.0
18	15.5	76.5	26.0	-
19	14.5	70.5	23.0	37.5
20	13.5	64.5	32.0	28.0
21	14.5	66.5	29.5	28.0

Juveniles: Morphologically similar to adult but smaller; tail of first stage elongate-conoid, bearing two caudal pores on each side.

TYPE HOST AND LOCALITY

Rhizosphere of yellow lupin (*Lupinus luteus* L.) at Herdade dos Barrões, Couço, Coruche, province of Ribatejo, Portugal.

TYPE SPECIMENS

Holotype, allotype, eleven paratype females, fourteen 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 each of the following collections: Muséum National d'Histoire Naturelle, Paris, France; Entomology and Nematology Department, Rothamsted Experimental Station, Harpenden, Herts, England; Plant Nematology Laboratory Collection, United States Department of Agriculture, Beltsville, Maryland, USA.

DIAGNOSIS AND RELATIONSHIPS

Xiphinema lupini sp. n. is characterized by two female genital branches equally developed, vulva almost at mid-body, rudimentary pseudo-Z-organ, spiniform structures in the uterus and tail regularly short conical. Males are abundant in *X. lupini* sp. n.

The code in the polytomous key (Loof & Luc, 1990) is the following: A4, B2+3, C3, D3+4, E5+6, F4+5, G2, H3, I2, J2, K2, L2.

In general appearance *X. lupini* sp. n. resembles the species of the *X. elongatum*-group (group 7 in Loof & Luc, 1990), but really it belongs in group 5, in having a rudimentary pseudo-Z-organ and spiniform structures in the uterus. Among the species belonging to this group *X. lupini* sp. n. resembles *X. rarum* Heyns, 1979, from which it differs in having a longer and more slender body ($L = 3.7-4.8$ vs $2.56-3.11$ mm, "a" value $116-142.5$ vs $55-67$), longer odontostyle ($107.0-117.5$ vs $85-95$ μm), differently shaped lip region (separated from the rest of the body by a shallow depression in *X. rarum*) and habitus (strongly ventrally curved in *X. rarum*). Also the structure of the pseudo-Z-organ is different: globular inclusions are smaller and rather thinner than in *X. rarum* where they are closely-associated (Kruger & Heyns, 1987). Among the species belonging to the *X. elongatum*-group, *X. lupini* sp. n. closely resembles *X. conurum* Siddiqi, 1964 and *X. italiae* Meyl, 1953. From *X. conurum* the new species differs in having slender body ("a" value $116-142.5$ vs $74.5-104.5$), shorter odontophore ($56-63$ vs $62-72$ μm) and tail ($46.5-63.5$ vs $50-85$ μm), longer basal bulb ($116.5-146$ vs $95-137$ μm) and slightly posterior situated vulva ($V = 48.3-54.4$ vs $44.4-52.6$). In *X. lupini* sp. n. males are abundant and sperm were found occasionally in the uterus

of some females; the supplements are three or two (see Table 2) four in *X. conurum* (Luc & Aubert, 1985). Finally, *X. lupini* sp. n. is characterized by the presence in the uterus of a rudimentary pseudo-Z-organ and spini-form structures, not observed in *X. conurum*. From *X. italiae*, the new species differs mainly in having uterine differentiations (pseudo-Z-organ and spiniform structures) and male abundant *vs*, very rare in *X. italiae*. Compared with biometrical data reported by Martelli *et al.* (1966) in the redescription of *X. italiae*, the new species differs in having longer and slender body ($L = 3.7-4.8$ *vs* $2.3-2.78$ mm; "a" value $116-142.5$ *vs* $75-84$), longer odontostyle ($107-117.5$ *vs* $87-96$ μm), distance of oral opening to guiding ring ($99-105.5$ *vs* $76-87$ μm) and basal bulb ($116.5-146$ *vs* $95-110$ μm), posterior situated vulva ($V = 48.3-54.4$ *vs* $45-46$), shorter tail ($46.5-63.5$ *vs* $70-80$ μm), higher "c" ($65-87$ *vs* $30-40$) and lower "c'" ($2.1-2.8$ *vs* $3.2-4.3$) values. Furthermore, both female genital branches are longer than in *X. italiae* ($335.5-459.0$ *vs* $188-248$ μm and $282.5-441.0$ *vs* $150-193$ μm , anterior and posterior genital branches, respectively), and males of *X. lupini* sp. n. are different in the tail shape being more rounded dorsally with digitate terminus.

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