# Xiphinema belmontense sp. n. (Nematoda : Longidoridae) from Portugal

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Summary – The authors give a description of Xiphinema belmontense sp. n. It was found in the rhizosphere of apple trees at Quinta da Torre, Colmeal da Torre, Belmonte, province of Beira Baixa, Portugal. The new species is similar to X. aequum Roca & Lamberti, 1988, X. coxi coxi Tarjan, 1964, X. coxi europaeum Sturhan, 1985, X. dissimile Roca et al., 1988, X. diversum Roca et al., 1989, X. lusitanicum Sturhan, 1983 and X. pseudocoxi Sturhan, 1985. X. belmontense is characterized by the pseudo-Z-organ, spiniform structures in the uterus and anteriorly situated vulva.

Résumé – Xiphinema belmontense sp. n. (Nematoda : Longidoridae) provenant du Portugal – Les auteurs donnent une description de Xiphinema belmontense sp. n. Cette nouvelle espèce a été prélevée dans la rhizosphère de pommier à Quinta da Torre, Colmeal da Torre, Belmonte, province de Beira Baixa, Portugal. X. belmontense sp. n. appartient au groupe des espèces à vulve antérieure, branches génitales également développées et pourvues d'une différentiation utérine (pseudo-organe Z et épines) et à queue conoïde, convexe dorsalement et pourvue d'une digitation terminale. La nouvelle espèce est proche de X. aequum Roca & Lamberti, 1988, X. coxi coxi Tarjan, 1964, X. coxi europaeum Sturhan, 1985, X. dissimile Roca et al., 1988, X. diversum Roca et al., 1989, X. lusitanicum Sturhan, 1983 et X. pseudocoxi Sturhan, 1985. X. belmontense sp. n. est caractérisé par la présence d'épines dans l'utérus et la position antérieure de la vulve.

Key-words : Xiphinema.

Soil samples were collected by Mrs. Ana Maria Monteigas and Mr. Acacio Pina at Quinta da Torre, Colmeal da Torre, Belmonte, province of Beira Baixa, Portugal. Specimens of *Xiphinema* were sent by Dr. Pereira to the Istituto di Nematologica Agraria as a suspected new species. Examination of this material by the senior author confirmed Dr. Pereira's opinion and the species is described here as *Xiphinema belmontense* sp. n.

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.

### Xiphinema belmontense sp. n. (Fig. 1)

**M**EASUREMENTS

Females, male and juveniles : see Table 1.

*Holotype* (female) : L = 3.7 mm; a = 65; b = 7.8; c = 72; c' = 1.3; V = 39.7; odontostyle = 135.5  $\mu$ m; odontophore = 76.5  $\mu$ m; total stylet length = 212  $\mu$ m; oral aperture to guiding ring = 123  $\mu$ m; tail length = 51  $\mu$ m; h (hyaline portion of the tail) = 16  $\mu$ m; body diameter at lip region = 13  $\mu$ m; body diameter at guiding ring = 40.5  $\mu$ m; body diameter at base of oesophagus = 51  $\mu$ m; body diameter at vulva = 56.5  $\mu$ m; body diameter at anus = 39  $\mu$ m; body diameter at beginning of h = 15.5  $\mu$ m.

Allotype (male) : L = 3.7 mm; a = 64; b = 7.5; c =

69; c' = 1.3; odontostyle = 133.5  $\mu$ m; odontophore = 77.5  $\mu$ m; oral aperture to guiding ring = 123.5  $\mu$ m; tail length = 53.5  $\mu$ m; h = 22.5  $\mu$ m; body diameter at lip region = 13.5  $\mu$ m; body diameter at guiding ring = 41.5  $\mu$ m; body diameter at base of oesophagus = 51  $\mu$ m; body diameter at mid-body = 57.5  $\mu$ m; body diameter at anus = 43  $\mu$ m; body diameter at beginning of h = 20.5  $\mu$ m; spicules = 92.5  $\mu$ m; gubernaculum = 18.5  $\mu$ m; cloaca to double papilla = 26  $\mu$ m; double papilla to first supplement = 102.5  $\mu$ m.

#### DESCRIPTION

Female : Habitus in specimens killed by gentle heat usually almost straight anterior to the vulva, more curved behind the vulva, with increasing curvation towards the tail end, occasionally C-shaped; body cylindrical, tapering very gradually towards the anterior extremity. Cuticle apparently smooth, 3-3.5 µm thick along the body, more thickened in the neck region, where it measures 4-4.5 µm at the base of the lip region, and in the caudal region where it is 6-6.5  $\mu$ m ventrally and 8.5-9 µm dorsally in the post anal region. Lateral hypodermal cords readily visible throughout the length of the body, 15-16 um wide at mid-body or 28-28.5 % of the corresponding body diameter; lateral body pores, 7-8 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 level of the anterior end of the midintestine, distributed irregularly along the dorsal and ventral sides of the lateral cords; five dorsal and four

	J1	]2	]3	J4	Female	Male
n	4	14	8	28	25	14
L (mm)	1.3-1.6	1.6-2.2	2.3-2.5	2.3-3.1	3.1-4.7	3.4-4.4
	$(1.5 \pm 0.17)$	$(1.9 \pm 0.16)$	$(2.4 \pm 0.07)$	$(2.6 \pm 0.24)$	$(3.9 \pm 0.38)$	$(3.9 \pm 0.35)$
a	46.2-54.4	51.7-63.9	56.8-66.2	54.9-70.0	58.4-72.3	60.2-72.9
	(49.7 ± 3.52)	(56.0 ± 3.27)	(61.0 ± 3.51)	$(61.9 \pm 3.72)$	$(66.0 \pm 3.49)$	$(65.8 \pm 3.27)$
b	4.5-5.5	4.6-5.8	5.2-5.9	4.9-7.6	6.7-9.3	6.6-8.8
	$(5.0 \pm 0.46)$	$(5.1 \pm 0.38)$	$(5.5 \pm 0.25)$	$(5.8 \pm 0.62)$	$(8.1 \pm 0.67)$	$(7.8 \pm 0.59)$
c	21.6-27.2	27.0-34.4	38.7-45.8	40.0-58.0	63.1-96.7	55.5-93.7
	$(23.2 \pm 2.70)$	$(30.1 \pm 1.91)$	$(42.2 \pm 2.68)$	$(46.5 \pm 4.46)$	(79.5 ± 6.96)	$(76.9 \pm 9.50)$
c′	2.7-3.5	2.3-3.0	1.6-1.9	1.3-2.2	1.0-1.4	1.0-1.5
	$(3.1 \pm 0.31)$	$(2.5 \pm 0.20)$	$(1.8 \pm 0.13)$	$(1.7 \pm 0.19)$	$(1.2 \pm 0.09)$	$(1.2 \pm 0.13)$
V					36.3-41.9	
					$(39.2 \pm 1.47)$	
Odontostyle	64.1-82.3	84.1-93.5	93.5-108.8	90.6-113.5	125.9-140.6	113.0-143.0
	$(70.3 \pm 8.35)$	(88.3 ± 2.77)	$(103.1 \pm 5.96)$	$(107.6 \pm 4.49)$	$(132.6 \pm 3.87)$	$(133.1 \pm 8.32)$
Odontophore	41.2-53.0	51.2-57.7	59.4-68.8	60.6-73.5	70.0-115.3	68.2-80.0
	(47.5 ± 5.11)	$(54.3 \pm 1.94)$	(63.6 ± 2.82)	(65.6 ± 2.31)	(79.2 ± 8.29)	$(75.1 \pm 3.63)$
Replacement odontostyle	87.0-104.1	105.9-117.7	121.2-130.6	131.2-140.0		
	(95.0 ± 8.10)	$(110.9 \pm 3.28)$	(127.8 ± 3.17)	$(135.3 \pm 2.76)$		
Total spear length	106.5-132.4	135.9-148.8	158.8-177.7	155.9-185.9	200.6-245.3	184.7-220.0
	(117.8 ± 11.86)	(142.6 ± 3.67)	$(166.7 \pm 6.31)$	$(173.2 \pm 5.11)$	$(212.5 \pm 9.63)$	$(208.2 \pm 9.84)$
Oral aperture to guiding ring	54.7-70.6	71.2-85.3	88.2-103.0	94.1-107.0	117.7-138.2	111.2-139.4
	$(61.8 \pm 7.99)$	(78.8 ± 3.57)	(96.0 ± 5.22)	$(100.5 \pm 3.34)$	$(126.0 \pm 6.20)$	$(124.7 \pm 7.14)$
Tail length	57.0-77.0	52.9-72.3	52.3-61.8	41.2-67.7	40.0-56.5	41.8-62.4
	$(63.8 \pm 9.09)$	(63.7 ± 4.83)	(57.1 ± 2.86)	(56.4 ± 6.02)	(48.9 ± 4.21)	$(50.8 \pm 5.17)$
h (hyaline portion of the tail)	14.7-20.6	17.7-25.9	13.5-24.1	9.4-24.7	10.0-24.7	12.9-22.9
	$(17.8 \pm 2.69)$	$(21.1 \pm 2.19)$	(19.8 ± 3.56)	(20.7 ± 2.98)	(19.0 ± 2.79)	$(18.8 \pm 2.60)$
Body diam. at lip region	5.9-8.8	8.8-10.6	10.6-12.4	10.0-12.4	12.4-13.5	12.9-15.3
	$(7.8 \pm 1.39)$	$(9.4 \pm 0.61)$	$(11.2 \pm 0.66)$	$(11.2 \pm 0.71)$	$(13.1 \pm 0.50)$	$(13.9 \pm 0.64)$
Body diam. at guiding ring	19.4-24.1	24.1-28.2	30.6-34.7	29.4-37.1	38.2-44.1	39.4-47.7
	$(21.9 \pm 2.06)$	$(26.0 \pm 1.14)$	$(32.1 \pm 1.29)$	$(32.7 \pm 1.76)$	$(41.5 \pm 1.72)$	$(42.6 \pm 2.40)$
Body diam. at base of oesophagus	27.1-30.6	28.8-36.5	34.1-42.4	34.7-48.8	45.3-57.7	45.3-58.8
	$(29.0 \pm 1.62)$	(32.9 ± 2.45)	(37.7 ± 2.52)	$(40.1 \pm 3.68)$	(52.0 ± 3.46)	$(52.7 \pm 4.52)$
Body diam. at mid body or vulva	27.1-32.4	30.0-40.0	35.9-44.1	35.3-52.9	51.2-65.9	50.0-69.4
	$(29.6 \pm 2.37)$	(34.2 ± 2.78)	(39.5 ± 2.75)	$(42.3 \pm 4.73)$	(58.7 ± 4.25)	(59.0 ± 5.77)
Body diam. at anus	18.8-22.4	22.4-28.8	28.8-34.7	29.4-37.6	35.3-47.1	40.0-48.2
-	$(20.4 \pm 1.62)$	(25.3 ± 2.20)	$(31.9 \pm 1.96)$	$(33.1 \pm 2.46)$	(41.2 ± 2.82)	$(43.7 \pm 2.50)$
Body diam. at beginning of h	5.9-8.8	8.2-11.8	11.2-18.2	11.8-21.2	17.7-27.7	13.0-29.4
	$(7.5 \pm 1.30)$	$(9.8 \pm 1.12)$	$(14.7 \pm 2.52)$	$(15.6 \pm 2.42)$	(22.0 ± 2.69)	$(21.0 \pm 3.87)$
Spicules						89.4-112.4
						$(94.9 \pm 6.11)$
Lateral guiding piece						16.5-21.8
						$(19.1 \pm 1.66)$

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

ventral body pores in the range of the odontostyle. Labial region 12-13  $\mu$ m high, almost hemispherical, broadly rounded laterally and less so frontally, offset from the rest of the body by a shallow depression; amphids stirrup-shaped, with aperture a straight, transverse slit, occupying slightly more than four fifths of the lip region width, situated on the lip region at just less than two thirds of the lip region height. Odontostyle 2-2.5  $\mu$ m in diameter; odontophore well developed with

basal flanges 11-11.5  $\mu$ m wide and guiding " tube " well evident, variable in length from 12 to 16  $\mu$ m, with guiding ring 3.5-4  $\mu$ m wide. Oesophagus dorylaimoid with the anterior part tubular; basal enlarged portion 105-110  $\mu$ m long and 23-24  $\mu$ m wide, containing three nuclei well evident : 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, surrounded by intestinal



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

tissue. Reproductive system amphidelphic, with both genital branches equally developed and reflexed; ovary occupying one fourth-one fifth of the entire genital branch; oviduct with a slender part consisting of discoid cells, and a pars dilatata oviductus not containing sperms and separated from the uterus by a conspicuous sphincter muscle; uterus consisting of a very wide and long pars dilatata uteri, with sperms inside, a pseudo-Z-organ, a tube and an ovejector. Pseudo-Zorgan consisting of a variable number (generally 8-10) of granular structures, each one consisting of a large central portion, irregularly spherical, not refractive, surrounded by a variable number of refractive pieces, petal shaped. Small spines are present in the uterus, irregularly distributed and generally attached to the internal wall of the uterus. Prerectum 550-600 µm long; rectum 1.25 anal body widths long. Tail conoid, rounded dorsally and almost straight to slightly curved ventrally, with terminal peg, generally directed ventrally in respect to the body axis and without blind canal. Two or three body 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 female except in the genital apparatus and the somatic structures associated with it; testes well developed; spicules curved, not cephalated; lateral guiding pieces well sclerotized, almost straight, slightly rounded proximally and bifid at the distal end. Precloacal pair of papillae preceded generally by four ventral supplements (Table 2). Distances of preanal supplements are given in Table 2. Tail similar to that of female, with the terminal peg ventrally located in relation to the body axis; four caudal pores are visible on each side of the tail.

Table 2. Distances of the preanal supplements in fifteen paratype males (in  $\mu$ m).

N	Cloaca- Double pap.	Double pap S1	S1-S2	S2-S3	S3-S4	S4-S5
1	29.5	106	31	34	42.5	22
2	29.5	91	36.5	32.5	64.5	
3	26.5	111.5	36.5	47		
4	29.5	85.5	34	34	39.5	
5	26.5	100	29.5	29.5	31	31
6	26.5	89.5	22	29.5	32.5	
7	29.5	119	34	34	28	
8	28	117.5	36.5	44		
9	29.5	120.5	31	38		
10*	26	102.5	37	34	38	
11	26.5	94	35.5	38	23.5	
12	28	85.5	38	31	34	31
13	25	94	28	35.5	31	
14	25	86.5	29.5	41	29.5	
15	28	113	32.5	32.5	31	

\* Allotype.

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

#### Type host and locality

Rhizosphere of apple trees at Quinta da Torre, Colmeal da Torre, Belmonte, province of Beira Baixa, Portugal.

## Type specimens

Holotype, allotype, nineteen paratype females, eight 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, Laboratoire des Vers, Paris, France; Nematology Department, Rothamsted Experimental Station, Harpenden, Herts, England; Plant Nematology Laboratory Collection, United States Department of Agriculture, Beltsville, Maryland, USA.

#### DIAGNOSIS AND RELATIONSHIPS

Xiphinema belmontense sp. n. is characterized by two female genital branches equally developed, vulva situated anterior to mid-body, pseudo-Z-organ and spiniform structures in the uterus, and tail conoid, curved dorsally and almost straight ventrally, with digitate terminus.

The code in the polytomous key (Loof & Luc, 1990) is the following : A 4, B 2 + 3, C 5 b, D 5, E 3, F 4, G 3, H 2, I 3, J 5 b, K 3, L 2.

The new species belongs to the X. coxi-group (group 5 in Loof & Luc, 1990), among whose species it closely resembles X. pseudocoxi Sturhan, 1985, from which it differs in having longer odontostyle (126-140.5 vs 104-114  $\mu$ m), odontophore (70-115.5 vs 58-64  $\mu$ m) and oral aperture to guiding ring (117.5-138 vs 100-112  $\mu$ m), anterior situated vulva (V = 46.3 % in X. pseudocoxi), more robust body (" a " value 58.5-72.5 vs 80-98), presence of spiniform structures in the uterus and male abundant. Inclusion bodies of X. belmontense sp. n. pseudo-Z-organ are similar to those described by Sturhan in X. pseudocoxi, in having a central portion not refractive, but differs in general shape.

Similarities with species with uterine differentiations, belonging to the same group, are observed. Among those, the most significant is X. diversum Roca, Lamberti, Santos & Abrantes, 1989, also found in Portugal. Although the new species is similar in general morphology, less so for the tail shape and labial region, it differs in the presence of males and biometrically. In general X. belmontense sp. n. is longer in body  $(3.1-4.7 \ vs \ 2.7-3.2 \ mm)$ , odontostyle  $(125.9-140.6 \ vs \ 97.7-105.3 \ \mu m)$ , odontophore  $(70-115.3 \ vs \ 52.9-64.7 \ \mu m)$ , oral opening to guiding ring  $(117.7-138.2 \ vs \ 90-101.2 \ \mu m)$  and has anterior situated vulva (V  $36.3-41.9 \ vs \ 43.7-53.2$ ). Simi-

larities with other species of X. coxi-group are also observed. X. belmontense sp. n. resembles X. aequum Roca & Lamberti, 1988, X. coxi coxi Tarjan, 1964, X. coxi europaeum Sturhan, 1985, X. dissimile Roca, Pereira & Lamberti, 1988 and X. lusitanicum Sturhan, 1983, from which it may be differentiated in having a more anteriorly situated vulva. Furthermore, X. belmontense differs from X. aequum in having shorter and more robust body (L 3.1-4.7 vs 4.1-5.3 mm; " a " value 58.4-72.3 vs 76-109.6), shorter odontostyle (125.9-140.6 vs 139.3-150.6 µm) and presence of pseudo-Z-organ; from X. coxi coxi in having a more robust body (" a " value 58.4-72.3 vs 66-82), longer odontostyle (125.9-140.6 vs 113-127 µm), lower c' value (1-1.4 vs 1.5-2), differently shaped inclusion bodies of pseudo-Z-organ and presence of spiniform structures in the uterus; from X. coxi europaeum in having more robust body (" a " value 58.4-72.3 vs 66-91), longer odontostyle and distance from oral opening to guiding ring (125.9-140.6 vs 114-135 µm and 117.7-138.2 vs 95-126  $\mu$ m, respectively), differently shaped inclusion bodies of pseudo-Z-organ, presence of spiniform structures in the uterus and absence of a blind canal in the tail; from X. dissimile in having a shorter and more robust body (L 3.1-4.7 vs 4.6-5.8 mm; " a " value 58.4-72.3 vs 89.6-118.2) and presence of spiniform structures in the uterus (absent in X. dissimile); from X. lusitanicum in having a shorter body (3.1-4.7 vs 4.4-5.9 mm), odontostyle (125.9-140.6 vs 168-175  $\mu$ m) and oral opening to guiding ring (117.7-138.2 vs 141-159  $\mu$ m), presence of spiniform structures in the uterus, absence of a blind canal in the tail and male abundant (not found in X. lusitanicum).

#### Reference

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