

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

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Summary – The authors give a description of *Xiphinema hispidum* sp. n. It was found in the rhizosphere of peach at Quinta do Anjo, Palmela, Portugal. The species is characterized by two equally developed female genital branches, vulva slightly anterior to mid-body, an indistinct pseudo-Z-organ, spiniform structures in the uterus and tail short conical with subdigitate terminus in females and digitate in males. *X. hispidum* sp. n. is similar to *X. belmontense* Roca & Pereira, 1992, *X. diversum* Roca, Lamberti, Santos & Abrantes, 1989, *X. loteni* Heyns, 1986, *X. smoliki* Luc & Coomans, 1988, *X. sphaerocephalum* Lamberti, Castillo, Gomez-Barcina & Agostinelli, 1992, and *X. thorneanum* Luc, Loof & Coomans, 1986.

Résumé – *Xiphinema hispidum* sp. n. (Nematoda : Longidoridae) provenant du Portugal – Les auteurs donnent la description de *Xiphinema hispidum* sp. n. provenant de la rhizosphère de pêcher à Quinta do Anjo, Palmela, Portugal. *X. hispidum* sp. n. est caractérisé par une vulve quelque peu antérieurement située, des branches génitales également développées, un utérus pourvu d'un pseudo-organe Z rudimentaire et d'épines, une queue conoïde portant une digitation terminale. La nouvelle espèce est proche de *X. belmontense* Roca & Pereira, 1992, *X. diversum* Roca, Lamberti, Santos & Abrantes, 1989, *X. loteni* Heyns, 1986, *X. smoliki* Luc & Coomans, 1988, *X. sphaerocephalum* Lamberti, Castillo, Gomez-Barcina & Agostinelli, 1992 et *X. thorneanum* Luc, Loof & Coomans, 1986.

Key-words : *Xiphinema*, Portugal.

During a survey carried out in Portugal populations of *Xiphinema* were collected from several localities and hosts. The specimens were sent to the Istituto di Nematologia Agraria di Bari for a collaborative taxonomic study. Detailed observations revealed the presence of an undescribed species recovered from soil around the roots of peach at Quinta do Anjo, Palmela, Portugal. Morphometric data, description and illustration of the new species named *Xiphinema hispidum* sp. n. are given.

Nematodes were extracted from soil samples by the Cobb wet sieve technique, killed and fixed in 5 % hot formaldehyde and mounted in glycerin by the slow method.

Xiphinema hispidum sp. n.

(Fig. 1)

MEASUREMENTS

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

DESCRIPTION

Female : Habitus in specimens killed by gentle heat usually open C-shaped, almost straight anteriorly and more curved behind the vulva, occasionally J-shaped; body cylindrical, tapering gradually towards the anterior extremity. Cuticle appearing smooth at the anterior region, but with very fine transverse striations along the body and at the posterior region, 2-2.5 μm thick along

the body, more thickened in the neck region, where it measures 2.5-3 μm at the base of lip region, and on the tail where it is 5-5.5 μm thick ventrally and 6.5-7 μm dorsally. Lateral hypodermal cords well visible throughout the length of the body, 10-13 μm wide at mid-body or 24.5-25 % of the corresponding body diameter; lateral body pores, six seldom seven 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, distributed irregularly along the dorsal and ventral sides of the lateral cords; four ventral and three dorsal 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 wide depression; amphids stirrup-shaped, with aperture a straight, transverse slit, occupying almost four fifths of the lip region width, situated in the lip region just anterior to the level of the depression. Odontostyle 2.5-3 μm in diameter; odontophore well developed with conspicuous basal flanges and guide sheath variable in length (Table 1), with guiding ring 3.5-4 μm wide. Oesophagus typical of the genus; dorsal gland nucleus located at the beginning of the oesophageal bulb, the two subventral ones at the middle, or just posteriorly; oesophago-intestinal valve pear-shaped, surrounded by intestinal tissue. Reproductive system amphidelphic, with both genital branches equally developed; ovary small occupying 15-16 % of the entire genital branch; oviduct with a slender part consisting of

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

| | Holotype | Allotype | Paratype females | males | J1 | J2 | J3 | J4 |
|-------------------------|----------|----------|------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| n | 1 | 1 | 40 | 8 | 3 | 3 | 4 | 11 |
| L (mm) | 3.7 | 4.8 | 3.6-4.5 (4.0 \pm 0.21) | 3.9-4.9 (4.5 \pm 0.33) | 1.3-1.5 (1.4 \pm 0.01) | 1.5-1.7 (1.6 \pm 0.16) | 1.8-2.2 (2.0 \pm 0.13) | 2.4-3.2 (2.9 \pm 0.19) |
| a | 93.5 | 119.5 | 90.5-110.0 (99.5 \pm 4.93) | 101.5-117.5 (108.5 \pm 5.25) | 52.0-59.0 (55.5 \pm 5.13) | 54.7-61.7 (57.6 \pm 3.65) | 67.4-73.5 (69.8 \pm 2.72) | 75.3-94.8 (85.5 \pm 5.75) |
| b | 7.5 | 10.6 | 6.0-9.5 (8.5 \pm 0.56) | 9.2-10.5 (9.8 \pm 0.52) | 4.5-5.0 (5.0 \pm 0.40) | 4.2-5.0 (4.5 \pm 0.40) | 5.2-5.9 (5.5 \pm 0.34) | 5.8-9.1 (6.9 \pm 0.78) |
| c | 78.5 | 97.5 | 71.0-96.5 (84.0 \pm 7.24) | 90.0-112.0 (105.8 \pm 7.56) | 21.5-22.0 (21.8 \pm 0.37) | 23.8-26.4 (24.9 \pm 1.29) | 31.4-34.9 (32.7 \pm 1.32) | 47.2-54.7 (50.5 \pm 2.15) |
| c' | 1.65 | 1.5 | 1.4-1.8 (1.6 \pm 0.11) | 1.2-1.4 (1.3 \pm 0.07) | 3.3-3.8 (3.5 \pm 0.34) | 3.1-3.2 (3.1 \pm 0.04) | 2.6-2.9 (2.8 \pm 0.12) | 1.8-2.3 (2.2 \pm 0.12) |
| V | 46.8 | ... | 45.5-49.5 (47.5 \pm 0.99) | ... | ... | ... | ... | ... |
| Lip reg. diam. | 12.5 | 13.0 | 11.5-16.0 (12.5 \pm 0.73) | 12.5-13.5 (13.0 \pm 0.44) | 9.5-10.0 (10.0 \pm 0.42) | 10.0-11.0 (10.5 \pm 0.34) | 10.0-11.0 (10.5 \pm 0.32) | 11.0-12.5 (11.5 \pm 0.45) |
| Lip reg. height | 4.5 | 5.5 | 3.5-6.5 (5.5 \pm 0.54) | 4.0-7.0 (5.5 \pm 0.94) | 4.7-4.7 (4.7 \pm 0.0) | 4.0-5.0 (4.5 \pm 0.29) | 4.0-5.0 (4.5 \pm 0.32) | 4.0-5.5 (5.0 \pm 0.41) |
| Odontostyle | 125.5 | 127.0 | 114.0-130.5 (122.5 \pm 2.92) | 123.5-131.1 (127.5 \pm 2.84) | 60.5-64.0 (62.5 \pm 1.50) | 75.0-76.5 (75.5 \pm 0.74) | 77.0-82.0 (79.5 \pm 1.92) | 99.5-103.0 (101.0 \pm 1.19) |
| Odontophore | 71.0 | 69.0 | 69.5-75.5 (72.5 \pm 1.31) | 66.0-75.5 (70.0 \pm 3.34) | 45.5-50.5 (48.0 \pm 3.74) | 48.0-51.0 (50.0 \pm 1.48) | 52.0-56.0 (54.0 \pm 1.59) | 62.0-66.0 (63.5 \pm 1.30) |
| Stylet | 196.5 | 196.0 | 186.0-200.5 (195.0 \pm 3.04) | 194.0-204.5 (198.0 \pm 4.33) | 106.0-114.5 (110.5 \pm 5.24) | 123.0-127.0 (125.5 \pm 2.21) | 129.5-136.0 (133.0 \pm 3.21) | 161.5-167.5 (165.0 \pm 2.09) |
| Repl. odontostyle | ... | ... | ... | ... | 73.5-74.5 (74.0 \pm 0.67) | 77.0-80.0 (78.5 \pm 1.51) | 96.0-103.0 (100.0 \pm 2.54) | 117.5-125.5 (122.0 \pm 2.55) |
| Flanges width | 11.0 | 12.5 | 8.0-13.0 (11.5 \pm 0.89) | 10.0-11.5 (11.0 \pm 0.61) | 7.5-8.5 (8.0 \pm 0.42) | 8.5-9.5 (9.0 \pm 0.34) | 8.5-9.5 (9.0 \pm 2.54) | 9.5-11.5 (10.5 \pm 0.56) |
| Guide ring | 107.0 | 116.5 | 94.5-119.0 (106.5 \pm 4.95) | 107.5-118.0 (110.5 \pm 3.47) | 59.0-62.5 (60.5 \pm 2.50) | 61.5-64.0 (63.0 \pm 1.22) | 59.5-70.0 (64.0 \pm 4.68) | 76.5-90.5 (86.0 \pm 3.23) |
| Guide sheath | 17.0 | 16.5 | 3.0-15.5 (11.0 \pm 2.97) | 7.0-15.5 (12.5 \pm 2.74) | 8.5-8.5 (8.5 \pm 0.0) | 8.5-9.5 (9.0 \pm 0.34) | 6.0-14.5 (9.5 \pm 4.04) | 1.5-10.5 (7.5 \pm 2.52) |
| Phar. bulb length | 127.0 | 100.5 | 111.5-144.0 (122.5 \pm 5.86) | 99.5-116.0 (107.5 \pm 5.12) | 71.0-72.5 (71.5 \pm 0.83) | 73.5-76.0 (75.0 \pm 1.22) | 88.0-98.0 (94.0 \pm 4.29) | 90.5-118.0 (106.5 \pm 7.78) |
| Phar. bulb diam. | 19.0 | 19.5 | 16.0-21.5 (19.0 \pm 1.13) | 19.5-23.0 (21.0 \pm 1.17) | 14.0-15.0 (14.5 \pm 0.42) | 12.0-14.5 (13.5 \pm 1.48) | 13.5-16.0 (14.5 \pm 0.87) | 16.5-19.5 (17.5 \pm 0.87) |
| Ant. gen. br. | 388.0 | ... | 264.5-700.0 (400.5 \pm 44.66) | ... | ... | ... | ... | ... |
| Post. gen. br. | 347.0 | ... | 288.0-482.5 (372.0 \pm 44.37) | ... | ... | ... | ... | ... |
| Ant. gen. br. (%) | 10.5 | ... | 7.0-14.0 (10.0 \pm 1.22) | ... | ... | ... | ... | ... |
| Post. gen. br. (%) | 9.5 | ... | 7.0-13.5 (9.5 \pm 1.16) | ... | ... | ... | ... | ... |
| Body diam. (mid-body) | 40.0 | 40.5 | 37.0-42.5 (40.0 \pm 1.28) | 38.0-45.5 (42.0 \pm 2.20) | 23.5-26.5 (25.0 \pm 2.08) | 26.5-27.5 (27.0 \pm 0.59) | 27.0-32.0 (28.0 \pm 2.05) | 28.0-37.5 (33.5 \pm 2.69) |
| Body diam. (anus level) | 29.0 | 33.5 | 28.5-33.0 (30.0 \pm 0.99) | 30.5-36.0 (33.0 \pm 1.60) | 17.0-19.0 (18.0 \pm 1.25) | 19.0-20.5 (20.0 \pm 0.90) | 20.5-23.0 (21.5 \pm 1.05) | 23.5-27.0 (26.0 \pm 0.94) |

Table 1 (continued)

| | Holotype | Allotype | Paratype females | males | J1 | J2 | J3 | J4 |
|---------------------|----------|----------|----------------------------------|--------------------------------|-------------------------------|--------------------------------|--------------------------------|-------------------------------|
| Rectum | 28.0 | 35.5 | 27.0-43.5 (32.0 ± 3.18) | 31.5-44.0 (36.0 ± 3.95) | 15.5-16.0 (15.5 ± 0.42) | 16.5-17.5 (17.0 ± 0.59) | 16.0-25.5 (19.5 ± 3.66) | 22.5-30.0 (26.0 ± 2.44) |
| Tail | 47.5 | 50.0 | 42.5-53.0 (47.5 ± 2.95) | 38.0-50.0 (43.0 ± 3.60) | 62.5-64.5 (63.5 ± 1.66) | 59.0-64.5 (62.5 ± 3.24) | 57.0-66.0 (60.0 ± 3.60) | 50.0-63.0 (57.0 ± 3.34) |
| Hyaline tail tip | 15.5 | 17.5 | 11.0-29.5 (16.5 ± 2.65) | 14.5-19.0 (16.5 ± 1.41) | 11.5-14.0 (13.0 ± 1.66) | 12.5-13.5 (13.0 ± 0.59) | 13.0-17.5 (14.5 ± 1.89) | 14.5-22.0 (17.5 ± 2.34) |
| Prerectum | 659.0 | 682.5 | 390.0-1000.0 (639.0 ± 125.62) | 459.0-788.0 (611.0 ± 126.3) | 176.5-188.0 (182.5 ± 8.32) | 235.5-294.0 (264.5 ± 29.41) | 317.5-400.0 (355.5 ± 33.69) | 341.0-576.5 (479.5 ± 62.9) |
| Spicules | ... | 67.0 | ... | 60.0-73.0 (66.5 ± 4.11) | ... | ... | ... | ... |
| Lateral guid. piece | ... | 13.0 | ... | 11.5-17.0 (14.5 ± 2.17) | ... | ... | ... | ... |

discoid cells, and a *pars dilatata* composed of globular cells, separated from the uterus by a conspicuous sphincter muscle; uterus consisting of a long and wide *pars dilatata uteri*, not containing sperm, a narrow tubular portion separated from the ovejector by a slight constriction. In the lumen of the tubular portion of the uterus there are several differentiations: a variable number of globular bodies, generally rounded, 2-3 µm in diameter, in the portion close to the *pars dilatata uteri* where generally is located the "Z" differentiation; spini-form structures, 4-5 µm long and slender, 1-1.5 µm in diameter, in the entire lumen of the tubular portion, orientated mainly parallel to the axis, distributed irregularly and apparently attached to the uterine wall. Transverse muscle filaments of the tubular portion are visible and protrusions of the muscle cells (Coomans *et al.*, 1992) are observed on the uterine wall. No sperm was seen inside the uteri. Prerectum well evident; rectum one body widths long or slightly more. Tail short conical, rounded dorsally and less so ventrally, with subdigitate terminus generally in line with the body axis and without blind canal. Three 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 female except for the reproduction apparatus and the somatic structures associated with it; testes well developed; spicules curved, not cephalated; lateral guiding pieces well sclerotized, slightly curved and bifid at distal end. Precloacal pair of papillae preceded generally by four, exceptionally three or six, medioventral supplements (Fig. 1). Distances of preanal supplements are given in Table 2. Tail shorter than that of female, more rounded dorsally, with the terminal peg more slender and in line with ventral side of the body; five, exceptionally six, body pores are visible on each side of the tail.

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 peach, Quinta do Anjo, Palmela, Portugal.

TYPE SPECIMENS

Holotype, allotype, 24 paratype females, 3 paratype males and juveniles in the Collection of the Istituto di Nematologia Agraria del Consiglio Nazionale delle Ricerche, Bari, Italy; ten paratype females and two paratype males in the Collection of Estação Agronómica Nacional, Instituto Nacional de Investigação Agrária, Departamento Fitopatologia, Oeiras, Portugal; two paratype females and one paratype male 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 hispidum sp. n. is characterized by two equally developed female genital branches, vulva slightly anterior to mid-body, an indistinct pseudo-Z-organ, spini-form structures in the uterus and tail short conical with subdigitate terminus in females and digitate in males.

The code in the polytomous key (Loof & Luc, 1990) is the following: A4 B2 + 3 C4 D45 E5 F4 G2 H2 I2 J4 K2 L2

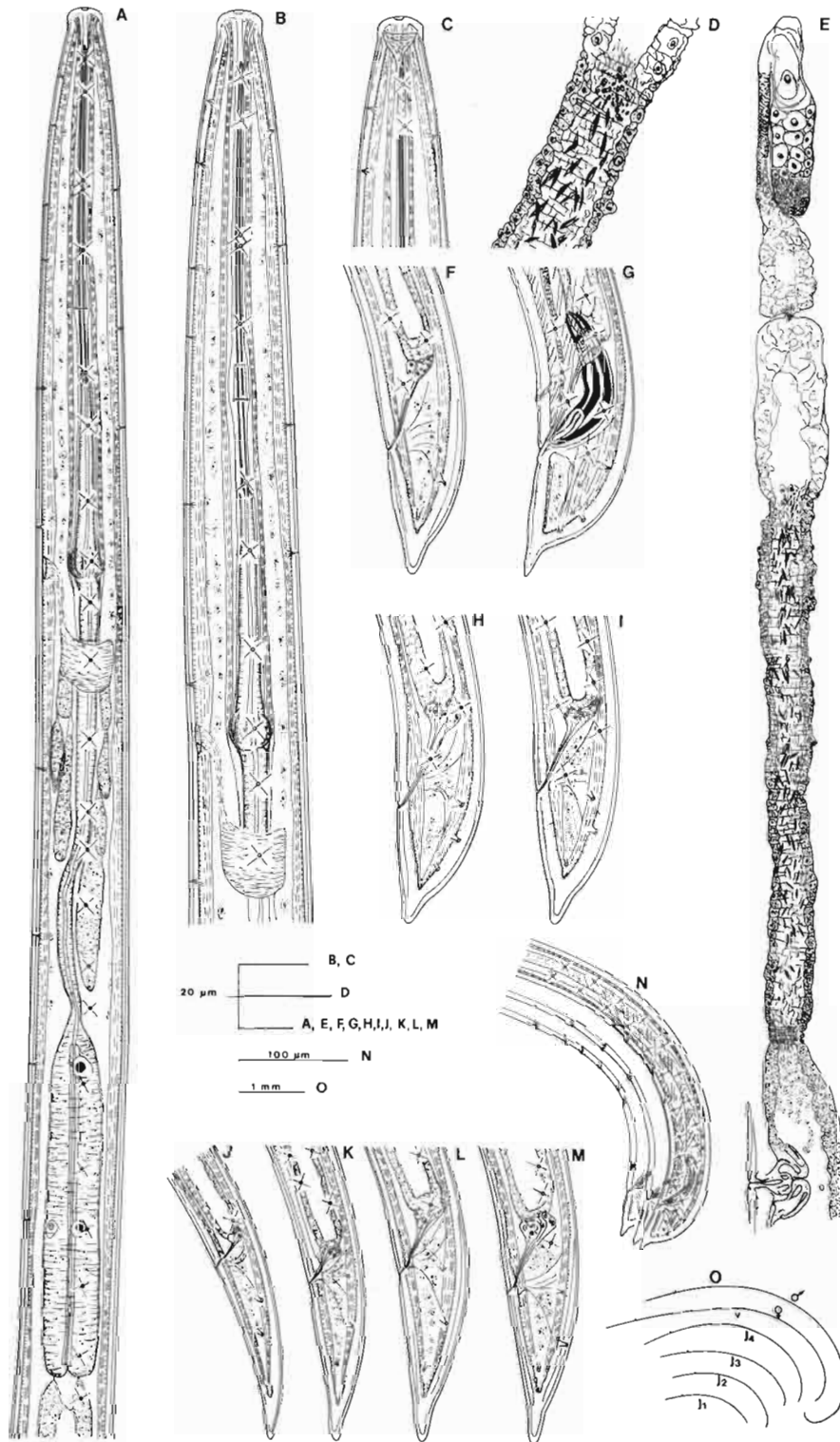


Fig. 1. *Xiphinema hispidum* sp. n. A, B : Female, anterior region; C : Head end (surface view); D : Pseudo-Z-organ; E : Anterior branch of the female genital tract; F, H, I : Female, posterior region; G : Male, posterior region; J-M : Posterior region of juveniles, J1, J2, J3, J4, respectively; N : Posterior body region of male; O : Posture of adult stages and juveniles.

Table 2. Distances of the preanal supplements in nine paratype males (in μm).

| N | Cloacal opening Double pap. | Double pap. S1 | S1-S2 | S2-S3 | S3-S4 | S4-S5 | S5-S6 |
|----|--------------------------------|-------------------|-------|-------|-------|-------|-------|
| 1 | 22.5 | 88.5 | 26.0 | 30.5 | 22.5 | ... | ... |
| 2 | 20.0 | 68.0 | 37.0 | 32.5 | 18.0 | ... | ... |
| 3 | 22.5 | 75.5 | 44.0 | 26.5 | 25.5 | ... | ... |
| 4 | 20.0 | 76.5 | 23.0 | 27.5 | 19.5 | ... | ... |
| 5 | 21.5 | 74.5 | 33.0 | 27.5 | 19.5 | ... | ... |
| 6 | 23.5 | 91.0 | 37.5 | 30.5 | 16.5 | ... | ... |
| 7 | 17.5 | 90.0 | 38.0 | 37.0 | ... | ... | ... |
| 8* | 20.5 | 75.5 | 29.0 | 34.5 | 18.0 | ... | ... |
| 9 | 21.0 | 60.0 | 13.5 | 29.0 | 23.5 | 16.5 | 35.5 |

* Allotype.

The new species belongs to the *X. coxi*-group, or group 5 in Loof and Luc (1990), among whose species it resembles *X. belmontense* Roca & Pereira, 1992, *X. diversum* Roca, Lamberti, Santos & Abrantes, 1989, *X. loteni* Heyns, 1986, *X. smoliki* Luc & Coomans, 1988, and *X. thorneanum* Luc, Loof & Coomans, 1986. It differs from *X. belmontense* in having a more slender body ("a" value 90.5-110.0 vs 58.4-72.3), higher "c'" value (1.4-1.8 vs 1.0-1.4), more posteriorly situated vulva (V = 45.5-49.5 vs 36.3-41.9), slightly shorter odontostyle (114.0-130.5 vs 125.9-140.6 μm), shorter odontophore (69.5-75.5 vs 70.0-115.3 μm), shorter distance of guiding ring from anterior end (94.5-119.0 vs 117.7-138.2 μm), a rudimentary pseudo-Z-organ and longer spines (spines are small in *X. belmontense*, see Roca & Pereira, 1992); from *X. diversum* in having longer and slenderer body (L = 3.6-4.5 vs 2.7-3.2 mm; "a" value 90.5-110.0 vs 66.3-80.8), higher "c" value (71.0-96.5 vs 55.3-74.3), longer odontostyle (114.0-130.5 vs 97.7-105.3 μm) and odontophore (69.5-75.5 vs 52.9-64.7 μm), a rudimentary pseudo-Z-organ (well developed in *X. diversum*) and presence of the male (not found in *X. diversum*, see Roca *et al.*, 1988); from *X. loteni* in having longer and slenderer body (L = 3.6-4.5 vs 2.77-3.51 mm, "a" value 90.5-110.0 vs 48-64), higher "c" and "c'" values (71.0-96.5 vs 68-80 and 1.4-1.8 vs 0.88-1.11, respectively), shorter odontophore (69.5-75.5 vs 78-80 μm) and female tail short conical with subdigitate terminus (convex-conoid with a ventrally directed peg, see Heyns, 1986, for *X. loteni*); from *X. smoliki* in having more slender body ("a" value 90.5-110.0 vs 66.9-85.1), lower "c" value (71.0-96.5 vs 107.2-167.2), higher "c'" value (1.4-1.8 vs 0.7-1.1), slightly more posterior vulva (V = 45.5-49.5 vs 42.2-46.9), longer odontostyle (114.0-130.5 vs 108-115 μm), longer tail (42.5-53.0 vs 25-36 μm), a rudimentary pseudo-Z-organ with small globules and fe-

male tail short conical with subdigitate terminus (nearly hemispherical, with extremity perfectly rounded or presenting a very slight bulge in *X. smoliki*, see Luc & Coomans, 1988); and from *X. thorneanum* in having longer and slenderer body (L = 3.6-4.5 vs 2.94-3.83 mm, "a" value 90.5-110.0 vs 66.9-76.6), lower "c" value (71.0-96.5 vs 91.9-133.6), higher "c'" value (1.4-1.6 vs 0.9-1.1), longer odontostyle and odontophore (114.0-130.5 vs 89-105 μm and 69.5-75.5 vs 61-67 μm , respectively), longer tail (42.5-53.0 vs 27-36 μm) which is short conical with subdigitate terminus in females (nearly hemispherical, with terminal conical peg in *X. thorneanum*, see Luc *et al.*, 1986).

For the uterine differentiations *X. hispidum* sp. n. closely resembles *X. lanceolatum* Roca & Bravo, 1993, *X. sphaerocephalum* Lamberti, Castillo, Gomez-Barcina & Agostinelli, 1992 and the other species described by Lamberti *et al.*, 1992, from which it differs mainly in having a tail short conical with subdigitate terminus in females (rounded with a slight mammillate projection in the above mentioned species), lip region not hemi-elliptical, habitus more open C, almost J shaped, and spini-form structures more slender. Moreover *X. hispidum* sp. n. differs from all above mentioned species in having slenderer body ("a" value 90.5-110.0 vs 51-84), lower "c" value (71.0-96.5 vs 79-149.6), higher "c'" value (1.4-1.8 vs 0.7-1.1), shorter odontostyle (114.0-130.5 vs 131.5-185.5 μm), odontophore (69.5-75.5 vs 76.5-102.5 μm), and distance of guiding ring from anterior end (94.5-119.0 vs 110.6-161.8 μm) and slight longer tail (42.5-53.0 vs 29.4-54.1 μm).

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