

Description of three populations of *Xiphinema dentatum* Sturhan, 1978 from Yugoslavia and observations on *X. turcicum* Luc & Dalmaso, 1964 (Nematoda : Longidoridae)

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Summary - Three populations of *X. dentatum* originating from a mountainous region of Yugoslavia are described. The morphological and biometrical characteristics are studied and compared with those of other previously described populations of *X. dentatum* for a reappraisal of the variability and limits of this species. Spines have been observed for the first time in the uterus of specimens of the type population of *X. turcicum*. © Orstom/Elsevier, Paris

Résumé - Description de trois populations de *Xiphinema dentatum* Sturhan, 1978 provenant de Yougoslavie et observations sur *X. turcicum* Luc & Dalmaso, 1964 (Nematoda : Longidoridae) - Trois populations de *Xiphinema dentatum* provenant de régions montagneuses de Yougoslavie sont décrites. Les caractéristiques morphologiques et biométriques sont étudiées et comparées avec celles des autres populations de *X. dentatum* précédemment décrites pour réévaluer la variabilité et les limites de cette espèce. Des épines ont été observées pour la première fois dans l'utérus de spécimens de la population type de *X. turcicum*. © Orstom/Elsevier, Paris

Keywords: Longidoridae, Nematoda, taxonomy, *Xiphinema dentatum*, Yugoslavia.

Three soil samples from mountains in Yugoslavia yielded populations of *Xiphinema* first identified as *X. turcicum* Luc & Dalmaso, 1964 (Krnjaić & Krnjaić, 1987; Radivojević, 1991) or *X. dentatum* Sturhan, 1978. Careful examination of these populations showed that they all pertain to *X. dentatum*.

The three populations studied here have the following origin:

Pop. 1: Zlatibor mountain (UTM grid CP 93), north-eastern side of the Kriva Breza hill, Yugoslavia, altitude 1000 m; soil under meadow.

Pop. 2: Durmitor mountain (UTM grid CN 47), Yugoslavia, altitude 1500 m, soil under coniferous *Abieti-Fagetum serbicum* forest.

Pop. 3: Goch mountain (UTM grid DP 81), Gvozdac hill, Dobra Voda, Yugoslavia, altitude 1000 m; soil under forest.

As the original description of the species (Sturhan, 1978) is rather short and consists mostly of a comparison with *X. globosum* Sturhan, 1978, another species described in the same article, a detailed description of pop. 1 is given below, together with comparative data for the two other populations and the previously described populations of *X. dentatum*.

Nematodes were extracted from soil samples by modified Cobb's and Baerman's methods, killed and fixed with FA 4:1, FAA or TAF, by Seinhorst's (1966, 1973) procedure, and processed to pure glycerol by

slow method involving 2.5 and 5 % glycerol in 30 % ethanol.

Xiphinema dentatum Sturhan, 1978

POPULATION 1 (Figs 1-3)

MEASUREMENTS

See Tables 1-3.

DESCRIPTION

Females: Body ventrally arcuate, open C-shaped after fixation, almost cylindrical, tapering markedly only in the anterior region. Cuticle smooth under light microscope, distinctly thicker in tail region. Body pores: up to four dorsal pores in stylet region; two single (left and right) rows each with about 90 lateral pores positioned as follow: 15-17 pores in lateral position in the oesophageal region, 20-30 pores in laterosubdorsal position between cardia and vulva, and 40-60 pores between vulval and rectal region; some of these laterosubdorsal pores, particularly in vulval and prerectal region, shifted to a laterosubventral position; one row of some 40-60 ventral pores along the whole body except in the vicinity of vulva and anus. Lip area rounded, offset by a slight constriction. Amphids with wide slit-like aperture, at a level slightly anterior to head constriction, and occupying about 95 % of the

Table 1. Morphometrics of adults of three populations of *Xiphinema dentatum* from Yugoslavia (All measurements in μm except *L* in mm).

	Females				Males		
	Pop. 1	Pop. 2	Pop. 3	Previous pops*	Pop. 1	Pop. 3	Previous pops**
n	35	30	24	83	24	5	1
L	4.4 \pm 0.23 (3.9-4.9)	4.6 \pm 0.25 (4.1-5.1)	4.1 \pm 0.67 (3.8-4.7)	(2.99-3.90)	4.2 \pm 0.32 (3.5-4.8)	4.0 (3.6-4.4)	3.65
a	59.5 \pm 3.28 (52.9-67.6)	63.6 \pm 3.08 (58.2-73.4)	56.0 \pm 5.96 (51.4-64.8)	(46-67)	64.8 \pm 4.00 (56.6-75.8)	65.4 (59.6-70.1)	60.8
b	8.1 \pm 0.47 (7.1-9.4)	7.8 \pm 0.66 (6.7-9.7)	7.5 \pm 0.42 (6.8-8.2)	(5.9-9.0)	7.9 \pm 0.67 (7.2-9.2)	7.4 (6.9-8.0)	8.0
c	(113.7 \pm 11.16 (79.2-132.7)	108.3 \pm 22.60 (93.9-135.8)	127.3 \pm 10.66 (111.6-156.2)	(85-122)	100.0 \pm 7.48 (86.0-111.7)	104.1 (95.4-122.7)	92.6
c'	0.7 \pm 0.09 (0.6-1.0)	0.7 \pm 0.07 (0.6-0.9)	0.6 \pm 0.04 (0.5-0.7)	(0.65-0.85)	0.8 \pm 0.04 (0.7-0.8)	0.7 (0.7-0.8)	0.84
V	42.0 \pm 1.28 (39.8-45.5)	46.0 \pm 1.37 (43.3-48.7)	42.2 \pm 1.20 (39.7-44.0)	(43.7-52.3)			
Lip reg. diam.	16.6 \pm 0.56 (16-18)	(16-16) ²	16.3 \pm 0.61 (15-17)	(12.0-16.3)	16.9 \pm 0.54 (16-18)	16.6 (16-17)	15.5
Lip reg. height	6.3 \pm 0.59 (5-8)	(6-6) ²	6.1 \pm 0.81 (5-7)		6.1 \pm 0.69 (5-7)	6.3 (6-7)	
Odontostyle	144.9 \pm 5.90 (128-155)	153.3 \pm 3.49 (145-160)	159.2 \pm 3.56 (152-165)	(122-148)	146.5 \pm 7.33 (138-158)	157.4 (155-160)	128.2
Odontophore	93.2 \pm 2.75 (88-100)	101.8 \pm 3.47 (92-108)	98.8 \pm 2.95 (92-102)	(76-84)	91.5 \pm 2.65 (88-98)	92.8 (85-100)	77.9
Stylet	238.1 \pm 7.43 (215-255)	255.3 \pm 5.32 (245-265)	258.0 \pm 5.12 (248-267)	(206-229)	237.9 \pm 8.20 (210-250)	250.2 (241-260)	206.1
Flange width	14.3 \pm 0.89 (12-15)	(17-18) ²	15.2 \pm 0.71 (14-16) ⁴		15.0 \pm 0.98 (13-17)	14.0	
Guide ring	120.1 \pm 3.40 (112-128)	139.8 \pm 11.62 (100-160)	127.7 \pm 5.39 (108-136)	(104-143)	115.2 \pm 8.27 (102-140)	122.4 (118-129)	124.4
Guide sheath	11.5 \pm 2.64 (5-15)	(6-8) ²	12.4 \pm 2.25 (5-15)		10.2 \pm 2.73 (4-14)	12.3 (9-15)	
Oes. bulb length	101.9 \pm 4.74 (93-113)	(100-100) ²	99.0 \pm 3.75 (92-105)		94.6 \pm 7.90 (78-110)	97.5 (95-100)	
Oes. bulb width	33.2 \pm 2.22 (29-38)	(33-36) ²	32.9 \pm 1.95 (30-37)		30.5 \pm 2.78 (25-35)	30.8 (28-33)	
Ant. gen. branch	583.6 \pm 82.52 (400-763)	729.1 \pm 60.30 (625-820)	674.3 \pm 54.18 (570-780)				
Post. gen. branch	658.9 \pm 90.06 (500-925)	739.5 \pm 54.24 (600-803)	648.0 \pm 80.74 (440-790)				
Ant. gen. branch (%)	13.0 \pm 1.88 (8.5-17.7)	16.0 \pm 1.51 (12.7-18.5)	16.0 \pm 1.22 (12.7-17.4)				
Post. gen. branch (%)	14.7 \pm 2.11 (10.9-19.8)	16.2 \pm 1.27 (12.5-18.5)	15.5 \pm 2.06 (10.2-19.1)				
Body diam. (mid body)	74.7 \pm 4.49 (65-82)	72.8 \pm 2.92 (63-78)	74.5 \pm 6.50 (62-82)	(56-84)	64.4 \pm 5.77 (53-73)	61.2 (51-70)	60.0
Body diam. at anus	54.1 \pm 2.31 (47-57)	57.5 \pm 1.97 (53-60)	55.8 \pm 2.60 (51-60)	(42.5-57.0)	55.1 \pm 2.04 (51-60)	54.2 (51-56)	46.5
Prerectum	445.3 \pm 72.05 (330-600) ¹	558 ³	507.2 \pm 69.13 (370-645)		678.2 \pm 96.08 (510-885) ⁶	559.0 (500-590)	
Rectum	43.8 \pm 4.35 (35-52)	(43-46) ²	43.5 \pm 3.62 (40-56)				
Tail	39.4 \pm 4.15 (34-52)	41.6 \pm 3.25 (37-50)	33.2 \pm 2.60 (28-38)	(29-42)	41.5 \pm 1.72 (39-45)	38.4 (36-42)	

End of Table 1 next page

Table 1. (cont.).

	Females				Males		
	Pop. 1	Pop. 2	Pop. 3	Previous pops*	Pop. 1	Pop. 3	Previous pops**
Hyaline part of the tail	15.0 ± 2.41 (10-19)	(11-15) ²	11.3 ± 1.20 (9-13)	(9-16)	12.3 ± 1.72 (9-16)	10.2 (9-12)	
Testes					454.6 (350-525) ⁵ 397.6 (338-475) ⁵	357.3 (242-455) 347.5 (223-455)	
Testes (%)					10.3 (8.6-11.1) ⁵ 9.0 (8.3-10.3) ⁵	9.0 (6.8-10.3) 8.7 (6.3-10.3)	
Spicules					90.6 ± 5.03 (78-100)	93.0 (90-100)	70

¹ n=26; ² n=2; ³ n=1; ⁴ n=18; ⁵ n=15; ⁶ n=19.

* Populations previously described by Surhan (1978), Barsi (1989, 1996), and Liökov (1994).

** Populations previously described by Barsi (1996).

head diameter. Hemizonid at 260 (243-278) µm from anterior end; hemizonion not seen with confidence. Spear and guiding ring conform to the genus. Vestigium 2-3 µm in length, variously located in the slender

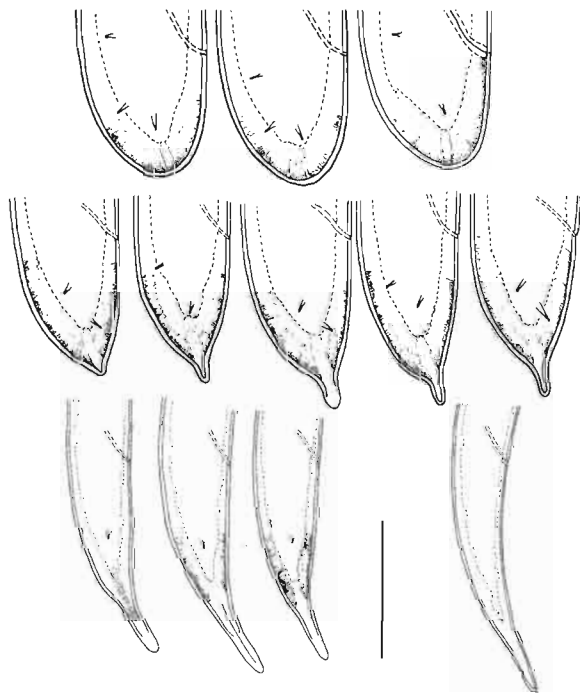


Fig 2. Variations of juvenile tail shape of *Xiphinema dentatum*, population 1. A-C: J4; D-H: J3; I-K: J2; L: J1.

part of oesophagus, generally in the anterior third of the oesophagus, sometimes in the odontophore region, up to 50 µm (usually 10-20 µm) anterior to the base of the odontophore. Slender part of the oesophagus 200 × 10 µm, usually outstretched in hot-fixed specimens (in living specimens, slender part often coiled posteriorly); oesophageal bulb 102 × 33 µm with prominent dorsal nucleus and two smaller ventrosublateral nuclei. Reproductive system amphidelphic, with two equally developed genital branches; vulva a transverse slit, 30 µm long; vagina occupying about 50 % of the body diameter; perivaginal sphincter shallow; ovejektor kidney-shaped, with numerous drop-like projections on its internal surface; uterus devoid of spines; well developed pseudo-Z organ in front of a large *pars dilatata ueri* with circular muscles present but very weakly developed; clearly visible longitudinal 'striation' reflecting projections of the wall toward lumen; several tooth-like apophyses present, varying in shape, size and number: four to six pyramidal apophyses present, radially arranged on the internal surface of the wall; their (25 × 8 µm) bases attached to the wall and shaped like elongated stars with sharp peaks separated by rounded depressions; when viewed from the side, these apophyses tapering toward lumen axis and having ridges and depressions corresponding to the sharp peaks and depressions of the base forming a sharp distal edge 10-15 µm away from the base; other apophyses (up to ten) often present and less regularly arranged and shaped, all or some of them being smaller and appearing like fragments (halves, thirds) of the 'regular' ones; structure of apophyses constant, regardless of their shape and

Table 2. Morphometrics of juveniles of three populations of *Xiphinema dentatum* from Yugoslavia (All measurements in μm except L in mm).

	J1				J2			
	Pop. 1	Pop. 2	Pop. 3	Previous pops*	Pop. 1	Pop. 2	Pop. 3	Previous pops*
n	22	29	24	15	20	30	23	15
L	1.2 \pm 0.08 (1.1-1.4)	1.2 \pm 0.09 (1.1-1.5)	1.2 \pm 0.05 (1.1-1.3)	(1.0-1.2)	1.8 \pm 0.08 (1.6-2.0)	1.7 \pm 0.12 (1.5-1.9)	1.5 \pm 0.09 (1.4-1.7)	(1.2-1.6)
a	40.4 \pm 1.75 (37.5-44.2)	39.8 \pm 2.22 (34.2-43.8)	44.1 \pm 1.51 (40.3-48.1)	36.3-47.0)	43.7 \pm 1.90 (41.9-48.5)	44.6 \pm 2.26 (40.9-50.3)	46.5 \pm 1.56 (43.8-49.1)	(38-47)
b	4.4 \pm 0.40 (3.6-5.0)	3.9 \pm 0.32 (3.5-4.7)	3.8 \pm 0.27 (3.3-4.6)	(3.8-4.6)	5.0 \pm 0.36 (4.4-5.6)	4.3 \pm 0.44 (3.5-5.1)	4.4 \pm 0.32 (3.9-5.0) ¹²	(3.9-5.4)
c	15.2 \pm 1.31 (13.3-17.7)	12.2 \pm 0.86 (10.6-14.1)	14.1 \pm 0.78 (12.7-15.8)	(10.0-15.8)	23.6 \pm 1.05 (22.0-25.5)	21.5 \pm 1.84 (17.7-26.1)	24.7 \pm 1.23 (23.0-28.1)	(21.8-29.6)
c'	4.0 \pm 0.41 (3.2-4.7)	5.0 \pm 0.32 (4.5-5.6)	4.7 \pm 0.36 (3.9-5.3)	(3.8-4.7)	2.5 \pm 0.16 (2.2-2.8)	2.7 \pm 0.26 (2.1-3.3)	2.4 \pm 0.14 (2.0-2.6)	(2.0-2.7)
Lip reg. diam.	9.4 \pm 0.49 (9-10)	---	9.4 \pm 0.50 (9-10)	(8-9)	11.5 \pm 0.51 (11-12)	11.2 (10-12) ⁸	11.1 \pm 0.46 (10-12)	(9-10)
Lip reg. height	3.1 \pm 0.35 (3-4)	---	3.9 \pm 0.45 (3-5)		4.0 \pm 0.32 (3-5)	3.8 (3-4) ⁸	4.5 \pm 0.51 (4-5)	
Odontostyle	62.4 \pm 1.14 (60-65)	64.5 \pm 2.94 (57-70)	68.7 \pm 1.68 (65-71)	(59-65)	76.2 \pm 1.36 (73-78)	79.5 \pm 2.31 (75-83)	83.4 \pm 1.59 (80-86)	(68-78)
Repl. odontostyle	74.9 \pm 1.54 (72-78)	78.4 \pm 5.52 (65-85)	84.6 \pm 1.82 (81-88)	(68-77)	105.6 \pm 3.49 (100-115)	105.2 \pm 6.80 (85-113)	104.9 \pm 3.82 (98-113)	(89-101)
Odontophore	43.4 \pm 1.50 (40-46)	48.3 \pm 3.27 (42-53)	49.3 \pm 1.76 (47-53)	(41-49)	57.8 \pm 2.07 (55-62)	63.8 \pm 3.39 (55-70)	61.0 \pm 1.82 (58-65)	(51-58)
Stylet	105.8 \pm 1.66 (104-110)	112.4 \pm 5.75 (100-120)	117.3 \pm 4.02 (113-123)	(100-114)	134.0 \pm 2.86 (128-139)	143.3 \pm 3.49 (137-150)	144.5 \pm 2.47 (138-147)	(123-135)
Flange width	8.1 \pm 0.57 (7-9)	---	9.3 \pm 0.73 (8-11)		10.4 \pm 0.69 (9-11)	11.1 (10-12) ⁹	10.6 \pm 0.66 (10-12)	
Guide ring	46.3 \pm 1.73 (43-50)	56.0 \pm 5.15 (45-68)	50.5 \pm 1.62 (47-53)	(49-57)	60.7 \pm 2.18 (57-65)	79.1 \pm 3.04 (72-83)	66.7 \pm 1.34 (64-70)	(60-73)
Guide sheath	2.5 \pm 1.20 (1-5) ¹	---	2.9 \pm 1.63 (0-5)		4.5 \pm 2.70 (0-7) ⁵	3.0 (0-7) ¹¹	5.5 \pm 2.98 (0-9)	
Oes. bulb length	57.6 \pm 5.72 (48-68)	---	60.3 \pm 2.72 (55-68)		62.2 \pm 5.53 (50-70)	69.2 \pm 3.91 (63-76) ¹⁰	70.7 \pm 4.22 (65-80)	
Oes. bulb width	17.3 \pm 1.16 (15-19)	---	15.5 \pm 1.62 (12-19)		22.6 \pm 1.46 (20-25)	18.5 \pm 1.27 (17-21) ¹⁰	19.0 \pm 1.75 (17-24)	
Body diam. (mid body)	30.0 \pm 2.61 (25-33)	30.9 \pm 2.15 (27-35)	26.5 \pm 1.28 (25-31)	(25-30)	40.0 \pm 2.96 (33-45)	37.5 \pm 3.44 (32-43)	33.2 \pm 2.81 (29-39)	(30-38)
Body diam. at anus	19.9 \pm 1.96 (17-23)	20.3 \pm 1.55 (18-23)	17.7 \pm 0.91 (17-21)	(16-19)	30.1 \pm 1.93 (25-32)	28.9 \pm 2.19 (25-33)	26.3 \pm 2.03 (24-32)	(23-29)
Prerectum	199.5 \pm 23.6 (170-250) ²	---	170.3 (118-226) ⁴		245.0 \pm 21.82 (218-295) ⁶	241 (218-268) ¹¹	227.6 \pm 36.14 (150-292) ³	
Rectum	11.9 \pm 1.77 (10-15) ³	---	11.9 \pm 2.15 (10-17) ⁵		17.0 \pm 1.75 (15-22) ⁷	18.8 (17-20) ⁹	17.0 \pm 1.34 (14-20)	
Tail	79.5 \pm 4.04 (68-86)	101.0 \pm 9.05 (85-115)	82.9 \pm 4.52 (72-90)	(71-87)	73.7 \pm 2.77 (68-79)	77.7 \pm 5.00 (67-90)	62.2 \pm 3.06 (54-69)	(54-67)
Hyaline part of the tail	24.7 \pm 1.62 (21-28)	---	36.5 \pm 2.72 (30-41)	(21-33)	29.1 \pm 1.64 (27-33)	34.8 \pm 2.74 (28-38) ¹⁰	30.6 \pm 2.48 (26-35)	(15-27)

End of Table 2 next page

size, *i.e.*, refractive, apparently solid, sharp, and porous, with one or more larger and numerous smaller translucent areas; *pars dilatata uteri* large, usually filled with numerous spherical cells, doubtfully

representing spermatozoans, as sperm-producing males being very rare in this population (see below); uterus-oviduct junction with moderately developed sphincter; *pars dilatata oviductus* corn-ear shaped, con-

Table 2. (cont.).

	J3				J4			
	Pop. 1	Pop. 2	Pop. 3	Previous pops**	Pop. 1	Pop. 2	Pop. 3	Previous pops**
n	24	25	21	11	24	24	24	5
L	2.3 ± 0.16 (2.0-2.6)	2.3 ± 0.13 (2.0-2.6)	2.2 ± 0.16 (1.9-2.5)	(1.6-2.1)	3.1 ± 0.17 (2.8-3.5)	3.3 ± 0.29 (2.8-3.8)	3.0 ± 0.27 (2.7-3.5)	(2.3-2.8)
a	49.6 ± 2.63 (44.4-54.1)	51.0 ± 2.88 (43.0-58.6)	50.1 ± 2.30 (45.6-55.2)	(44-51)	55.6 ± 4.00 (48.7-61.7)	58.3 ± 2.70 (53.8-63.8)	59.5 ± 3.89 (53.2-68.0)	(45-56)
b	5.4 ± 0.39 (4.6-6.2)	4.9 ± 0.47 (4.2-6.1)	5.1 ± 0.34 (4.6-5.7) ³	(4.4-5.7)	6.1 ± 0.34 (5.4-6.7)	6.1 ± 0.84 (4.7-8.0)	5.7 ± 0.43 (5.2-6.6)	(5.0-6.0)
c	39.6 ± 4.95 (31.5-50.5)	47.5 ± 4.96 (37.9-58.6)	58.9 ± 6.31 (48.0-71.1)	(38-57)	74.1 ± 7.44 (61.8-87.2)	72.0 ± 7.32 (62.2-88.6)	86.0 ± 6.63 (76.0-101.3)	(52-70)
c'	1.6 ± 0.19 (1.2-1.9)	1.3 ± 0.13 (1.1-1.5)	1.0 ± 0.09 (0.9-1.2)	(1.0-1.4)	0.9 ± 0.10 (0.7-1.1)	1.0 ± 0.09 (0.8-1.2)	0.7 ± 0.06 (0.6-0.9)	(0.8-1.1)
Lip reg. diam.	12.8 ± 0.48 (12-14)	12.5 (12-13) ¹³	12.8 ± 0.62 (12-14)		14.4 ± 0.50 (14-15)	----	14.5 ± 0.51 (14-15)	
Lip reg. height	4.5 ± 0.66 (3-5)	4.0 (4-4) ¹³	4.6 ± 0.50 (4-5)		5.3 ± 0.55 (4-6)	----	5.6 ± 0.49 (5-6)	
Odontostyle	103.9 ± 2.51 (98-108)	106.3 ± 2.90 (100-113)	105.3 ± 4.24 (100-112)	(87-97)	125.0 ± 3.48 (120-132)	127.3 ± 5.05 (117-135)	129.8 ± 3.60 (122-137)	(104-114)
Repl. odontostyle	125.4 ± 6.23 (117-142)	123.3 ± 7.52 (105-130)	130.0 ± 4.03 (118-135)	(103-122)	150.5 ± 5.82 (140-160)	149.6 ± 7.40 (138-160)	158.8 ± 3.18 (153-163)	(132-139)
Odontophore	68.2 ± 2.32 (65-73)	74.7 ± 3.17 (70-85)	72.6 ± 3.72 (62-78)	(60-68)	80.3 ± 2.16 (77-85)	88.0 ± 3.04 (83-95)	86.7 ± 2.73 (81-92)	(74-85)
Stylet	172.0 ± 3.33 (165-177)	181.0 ± 5.20 (173-198)	177.8 ± 6.04 (171-187)	(152-162)	204.9 ± 4.00 (198-213)	215.3 ± 6.23 (202-225)	216.5 ± 5.50 (204-225)	(178-190)
Flange width	12.0 ± 1.02 (10-14)	12.3 (11-13) ¹³	12.8 ± 0.60 (12-14)		13.6 ± 1.06 (12-15)	----	14.7 ± 0.71 (13-16)	
Guide ring	78.9 ± 3.28 (73-83)	94.4 ± 7.44 (80-108)	84.6 ± 2.75 (79-90)		97.4 ± 2.92 (92-103)	118.6 ± 7.15 (108-140)	101.7 ± 3.53 (96-107)	
Guide sheath	5.8 ± 2.02 (2-10)	3.8 (2-6) ¹³	7.0 ± 2.73 (0-11)		5.9 ± 3.15 (0-11)	----	7.3 ± 4.61 (0-15)	
Oes. bulb length	78.5 ± 4.53 (72-90)	78.5 (74-83) ¹³	75.2 ± 3.68 (70-83)		87.6 ± 5.02 (80-97)	----	87.1 ± 6.52 (68-95)	
Oes. bulb width	24.3 ± 1.99 (20-27)	21.8 (20-23) ¹³	24.4 ± 1.70 (22-27)		28.0 ± 2.57 (24-33)	----	27.7 ± 1.94 (22-32)	
Body diam. (mid body)	45.7 ± 3.71 (39-50)	44.9 ± 3.08 (40-53)	43.5 ± 4.00 (36-49)		55.6 ± 5.20 (49-66)	57.0 ± 5.82 (48-70)	52.5 ± 4.53 (45-59)	
Body diam. at anus	37.0 ± 2.03 (33-40)	37.1 ± 1.63 (35-41)	36.7 ± 2.68 (32-41)		46.4 ± 1.95 (43-50)	48.4 ± 2.74 (43-53)	47.0 ± 2.81 (40-52)	
Prerectum	295.1 ± 38.80 (197-385)	(227-268) ¹⁴	292.7 ± 37.07 (208-350) ⁵		376.9 ± 38.72 (275-462)	----	393.1 ± 37.85 (312-475)	
Rectum	24.6 ± 2.04 (21-29)	24.3 (23-26) ¹³	23.3 ± 2.58 (20-28)		35.7 ± 3.00 (30-41)	----	31.5 ± 2.23 (28-36)	
Tail	57.7 ± 6.34 (46-64)	48.7 ± 4.22 (40-55)	37.2 ± 3.19 (31-42)	(35-47)	42.1 ± 3.52 (36-51)	46.3 ± 3.90 (40-55)	35.0 ± 2.61 (30-41)	(36-45)
Hyaline part of the tail	23.1 ± 4.82 (8-28)	10.3 (9-12) ¹³	9.9 ± 0.79 (8-11)		13.8 ± 1.73 (10-16)		10.5 ± 1.18 (8-13)	

¹ n=13; ² n=12; ³ n=16; ⁴ n=6; ⁵ n=15; ⁶ n=11; ⁷ n=18; ⁸ n=9; ⁹ n=8; ¹⁰ n=10; ¹¹ n=7; ¹² n=19; ¹³ n=4; ¹⁴ n=3.

* Populations previously described by Surhan (1978) and Barsi (1996).

** Populations previously described by Surhan (1978).

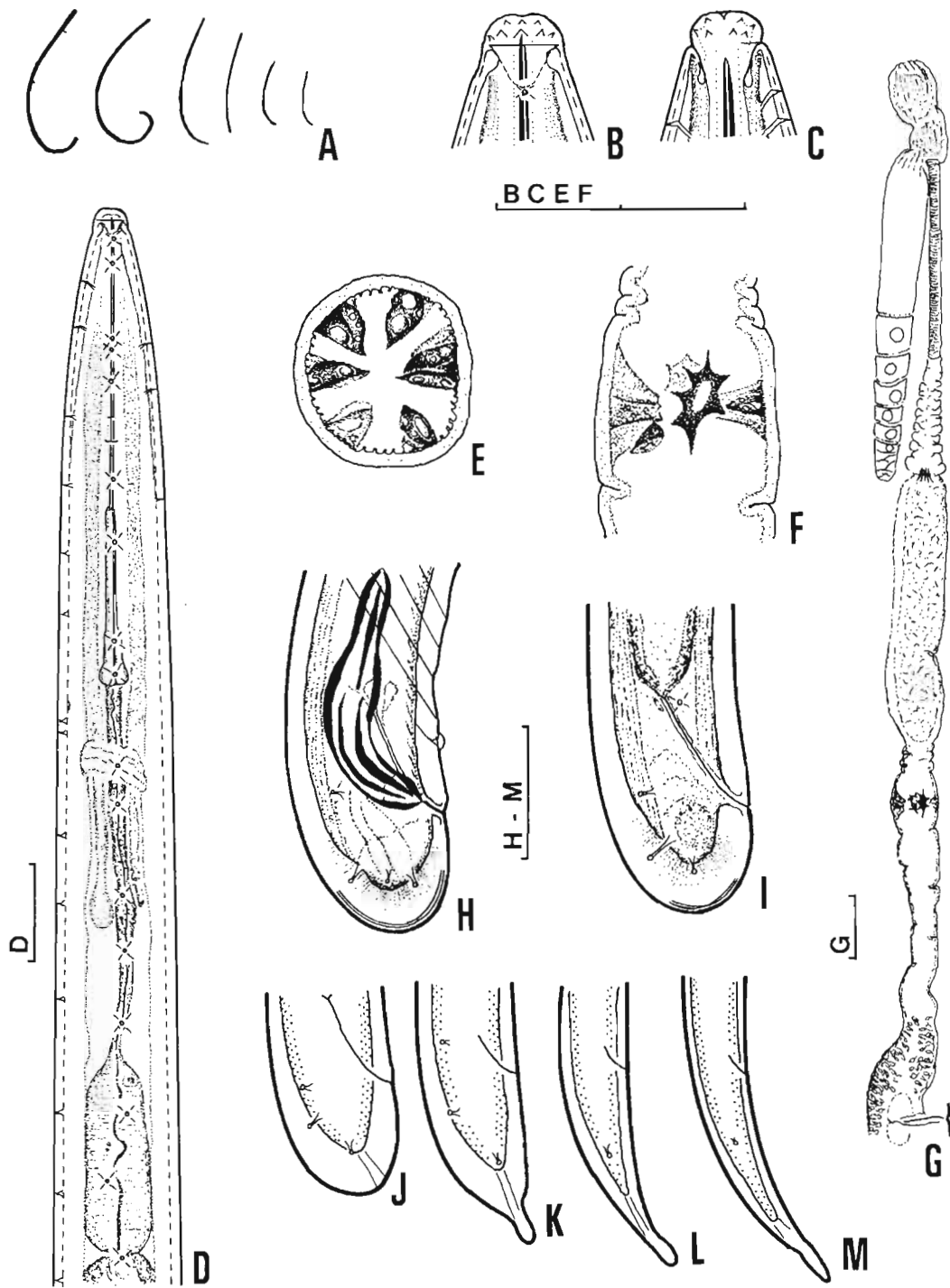


Fig 1. *Xiphinema dentatum*, population 1. A: Female, male, J4, J3, J2, and J1 habitus; B: Female head, lateral view; C: Female head, ventral view; D: Female, neck region; E: Front view of the pseudo-Z organ in a convoluted uterus; F: Side view of the pseudo-Z organ; G: Female anterior genital branch; H: Male tail; I: Female tail; J-M: J4, J3, J2, and J1 tails, respectively (Scale bar=50 μ m).

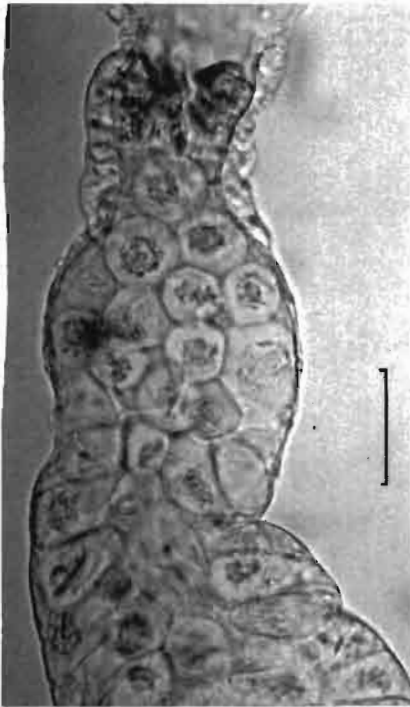


Fig 3. *Xiphinema dentatum*, population 1. Pars dilatata uteri freshly dissected in water, containing numerous spherical cells; the cells are usually present although the sperm producing males are rather rare in this population (Scale bar=30 μ m).

sisting of some twenty uninucleate cells; slender part of oviduct ($150 \times 10 \mu$ m) joining a well marked ovarian sac at its proximal part; ovary long, reflexed. Rectum 35-52 μ m long, nearly one body diameter in length, well developed. Tail short, hemispherical, dorsal curvature well pronounced; terminal blind canal absent; tail cuticle greatly thickened with supplementary layers; usually two pairs of caudal pores and one pair of adanal pores.

Males: Uncommon (24 males for over 6200 females); general morphology and biometrics as in females except for slightly shorter body length, more curved posteriorly body posture, and reproductive system. In 79 % of the males reproductive system incomplete (testes and seminal duct absent). In the others, two testes equally developed, 350-525 μ m long, filled with numerous sperm cells; testes joining at 46.4 (44.4-50.0) % of the body; spicules typical for the genus, 90-100 μ m long, with lateral guiding pieces 17.0-23.5 μ m long. One pair of adanal supplements at 20-26 μ m from the cloaca and one to five (usually three to four) ventral supplements (for distance between supplements, see Table 3). Tail as in females, but often with three pairs of caudal pores.

Table 3. *Xiphinema dentatum*, populations 1 and 3. Distribution of male supplements.

	Distance from anus to:					
	Adanal pair	Sup. 1	Sup. 2	Sup. 3	Sup. 4	Sup. 5
Pop. 1	22	77	117	142	183	223
	23	130	162	194	234	
	23	135	165	202	274	
	24	169	209	249	293	
	24	132	187	230	268	
	23	143	184	229	268	
	23	165	215	263	303	
	23	156	204	241	273	
	26	146	186	236	286	
	25	133	163	213	250	
	23	143	183	228		
	23	183	218	254		
	23	145	194	259		
	24	155	189	232		
	24	147	185	232		
	22	144	181	229		
	26	141	181	226		
	23	153	195	227		
	25	153	198	241		
	20	183	223	271		
22	190	243				
23	178	238				
23	206					
Pop. 3	22	120	148	187	227	258
	21	126	171	208	237	278
	23	143	186	223	259	
	24	143	169	197	222	

Juveniles: Four juvenile stages identified. Tail shape: in J1, regularly conoid, slightly curved ventrally, without blind canal; in J2, regularly conoid, slightly curved posteriorly, distal part (mucro) sometimes demarcated by a dorsal or dorsoventral constriction, with or without slightly pronounced blind canal; in J3, conical, with dorsal curvature more pronounced than ventral curvature, terminal mucro almost always (in more than 90 % of J3's) present, with more or less developed and faint blind canal; in J4, subhemispherical, with dorsal curvature more pronounced than ventral curvature, generally without mucro (a slight terminal

peg rarely observed), with or without a faint blind canal.

REMARKS

Population 1 is characterized by its relatively great body length, anterior position of vulva in females, rare males usually lacking testes and seminal duct; J4 tail with or without faint blind canal, rarely with a terminal peg; J3 tail usually with faint blind canal and (in more than 90 % of J3's) terminal mucro or, rarely, peg.

POPULATIONS 2 AND 3

MEASUREMENTS

(See Tables 1-3).

DESCRIPTION

These populations mostly agree with the description given above for population 1 except in some morphometrical (Table 1) and morphological characters in females, males and juveniles. Females with relatively longer odontostyle, 153 and 159 μm for populations 2 and 3, respectively, vs. 145 μm for population 1, longer odontophores, 102 and 99 μm for populations 2 and 3, respectively, vs. 93 μm for population 1, and longer distance between anterior end and guiding ring, 140 and 128 μm for populations 2 and 3, respectively, vs. 120 μm for population 1. Males (found only in population 3) with testes and seminal duct always present vs. usually absent in population 1, and with usually four to five supplements vs. three to four in population 1. Juveniles. J4 with relatively longer odontophores, 88 and 87 μm in populations 2 and 3, respectively, vs. 80 μm in population 1; J3 with relatively lower values for c', 1.3 and 1.0 in populations 2 and 3, respectively, vs. 1.6 in population 1, tails without mucro in populations 2 and 3, respectively, vs. mucro present in population 1, relatively shorter hyaline part of tail, 10 μm in populations 2 and 3, respectively, vs. 23 μm in population 1; J2 with relatively longer odontostyles, 79.5 and 83.5 μm in populations 2 and 3, respectively, vs. 76 μm in population 1, relatively longer distance between anterior end and guiding ring, 79 and 67 μm in populations 2 and 3, respectively, vs. 61 μm in population 1; J1 with relatively higher values of c', 5.0 and 4.7 in populations 2 and 3, respectively, vs. 4.0 in population 1, and relatively longer tail, 101 in population 2 vs. 80 μm in population 1.

REMARKS

Population 2 is characterized by its relatively great body and stylet length, and J1 with relatively longer tail; in J1 tails, the distal part of the mucro sometimes has a distinct swelling, which gives a clavate appearance to the mucro; J2 sometimes have a more abrupt

narrowing of the tail, which gives it the appearance of a J3 tail (see Fig. 2 G, H) with a long mucro; blind canal absent. In J3, blind canal present or absent. In J4, blind canal absent. Population 3 is characterized by relatively long stylet, and rather hemispherical tail in females; rare males usually having testes and seminal duct. In J3 and J4, blind canal absent.

Amended diagnosis and relationships

X. dentatum differs from all other species in the genus by the combination of two characteristics: the presence of a well developed pseudo-Z-organ with several tooth-like apophyses and females presenting a nearly perfectly hemispherical tail devoid of blind canal.

In addition to these diagnostic features, *X. dentatum* is noteworthy for i) metric variability that exists between different populations (Tables 1, 2) with a relatively narrow geographical distribution (see below), ii) variability in J3 tail shape (with or without mucro), and iii) presence or absence of males, which may be functional (complete genital system) or not (atrophied genital system). In any case, this species is probably parthenogenetic since sperms were never observed in the female genital tract.

The code in the polytomous key of Loof and Luc (1990) is amended as follows: A4 - B2 - C6b7b - D6 - E45(6) [instead of 45]- F34(5) [instead of 34] - G3(4) [instead of 4] - H2 - I3 - J6ab7ab [instead of 7b] - K2 - L1.

X. dentatum belongs to group 5 of Loof and Luc (1990) and is close to three species (*X. globosum* Sturhan, 1978, *X. majus* Bos & Loof, 1985, and *X. turcicum* Luc & Dalmasso, 1964) because of tail shape, c' ratio, vulva position, body length, stylet length, head profile, habitus, and J4 and J1 tail shape. It differs from *X. globosum* by tail shape in female and J4 (dorsal curvature more pronounced than ventral curvature vs. dorsal and ventral curvature equal), tail of J3 with vs. without distinct mucro, presence of sharp stellate apophyses vs. globular granules in the pseudo-Z-organ, and males uncommon (usually lacking testes and seminal duct and with three to four supplements) vs. common, with fully developed reproductive system and five to six supplements; it differs from *X. majus* by the position of vulva (V less vs. more than 46 %), the development of the pseudo-Z organ (well vs. slightly developed), tail shape in female and J4 (dorsal curvature more pronounced than ventral curvature vs. dorsal and ventral curvature equal), and female odontostyle length less vs. more than 150 μm ; it differs from *X. turcicum* by the development of the pseudo-Z organ (well vs. slightly developed), absence vs. presence of uterine spines (see below for *X. turcicum*), tail shape in J3 and J2 (with vs. without tail

mucro), and female odontostyle length (less vs. more than 150 µm).

VOUCHER SPECIMENS

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DISTRIBUTION AND HOSTS

X. dentatum is apparently associated with forest trees as it has been recorded so far only from forest soils in Germany (Sturhan, 1978), Yugoslavia (Barsi & Horvatić, 1986; Barsi, 1989, 1996; present study), and Slovakia (Lišková, 1994); meadow (present study) is a new host habitat for this species.

Xiphinema turcicum Luc & Dalmaso, 1964

Study of type and paratype slides deposited in the Muséum National d'Histoire Naturelle, Paris, France, showed the presence of numerous and small spines in the uteri, as previously described for several species of the genus *Xiphinema* that belong to groups 5 and 6 in the polytomous key of Loof and Luc (1990). Therefore, the code in the polytomous key is amended as follows: A4 - B2+3 [instead of 2] - C7b - D6 - E56 - F45 - G34 - H2 - I3 - J7b - K2 - L1.

Having a pseudo-Z organ with numerous small granules, *X. turcicum* is close to the following species: *X. clavatum* Heyns, 1965, *X. malagasi* Luc, 1973, *X. rarum* Heyns, 1979, *X. loteni* Heyns, 1986, *X. lanceolatum* Roca & Bravo, 1993, *X. lupini* Roca & Pereira, 1993, and *X. hispidum* Roca & Bravo, 1994. It differs from the last six species by tail shape (code C: 7 vs. 2-5 in the others). It differs from *X. clavatum* by *i*) body length (code F: 45 vs. 3); *ii*) total spear length (code G: 34 vs. 23); *iii*) tail shape in females and J4 (rounded without mucro vs. clavate without mucro to conoid with mucron), J3 and J2 (conoid without mucro vs. conoid with a long cylindroid process); *iv*) occurrence of males (rare vs. frequent).

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