

***Longidorus silvae* Roca, 1993 (Nematoda: Dorylaimida): a first record from the former territory of Yugoslavia and the description of a male specimen**

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Summary. *Longidorus silvae* is reported for the first time from the former territory of Yugoslavia. Morphometric variability of females and four juvenile stages is presented and a male specimen is described for the first time.

Key words: *Longidorus silvae*, male, morphology, variability.

Longidorus silvae Roca, 1993 was described from specimens from woodland in northern Italy and subsequently reported from central Italy (Roca & Lamberti, 1993) and western Slovakia (Lišková & Brown, 1999).

Several soil samples collected in the period 1988-2001 as part of a nematode survey in the former territory of Yugoslavia contained populations of a *Longidorus* species that was identified as *L. silvae*. Morphometrics of specimens from these populations are reported here to provide information on the natural variability of females and the four juvenile stages of *L. silvae*. A male specimen is described for the first time.

MATERIAL AND METHODS

Soil samples were collected in July 1988 from the rhizosphere of *Vitis vinifera* L. at Kubed (UTM:VL14) and of *Carpinus* sp. at Grahovo (UTM:VL56) in Slovenia; in April 1990 from the rhizosphere of *Corylus avellana* L. and *Pteridium aquilinum* (L.) Kuhn at Drinjača (UTM:CQ50), *C. avellana* at Vlasenica (UTM:CP39) and *Carpinus betulus* L. at Poriče (UTM:XJ98) in Bosnia and Herzegovina, and from the rhizosphere of *Pinus nigra* Arn. at Cista Provo (UTM:XJ51) in Croatia; in November 1988, in July 1998 and 2001 from the rhizosphere of *Ruscus aculeatus* L. and *R. hypoglossum* L. at Stari Ladinci (UTM:DR00), Fruška gora Mountain, and in July 2001 from the

rhizosphere of *Sambucus* sp. on Tara Mountain, near Hajdučka česma (UTM:CP76) in Serbia.

Nematodes were extracted by Cobb's wet sieving technique, killed and fixed by hot FP 4-1 and transferred to glycerin by the slow evaporation method and mounted on permanent microscope slides. Measurements were made with an eyepiece scale, except for body length, which was measured with the aid of a drawing tube and map measurer.

DESCRIPTION

***Longidorus silvae* Roca, 1993 (Figs. 1-4)**

Measurements: Tables 1-4.

Female. (Stari Ladinci, Fruška gora Mt, Serbia, *R. aculeatus* and *R. hypoglossum*, n=36). Body assuming a more or less open C posture when killed, almost straight anteriorly and curved behind the vulva; it tapers gradually towards the extremities but slightly widened just anterior to the anus on the ventral side. Lip region subacute, anteriorly flattened and continuous with the rest of the body; labial sensilla prominent. Amphidial pouch distinctly asymmetrically bilobed with a very deep sinus and a longer ventral lobe. The oesophagus basal bulb 119-148 µm long and 23-30 µm wide and occupies slightly more than 1/4 of the oesophagus total length. Nuclei of dorsal and

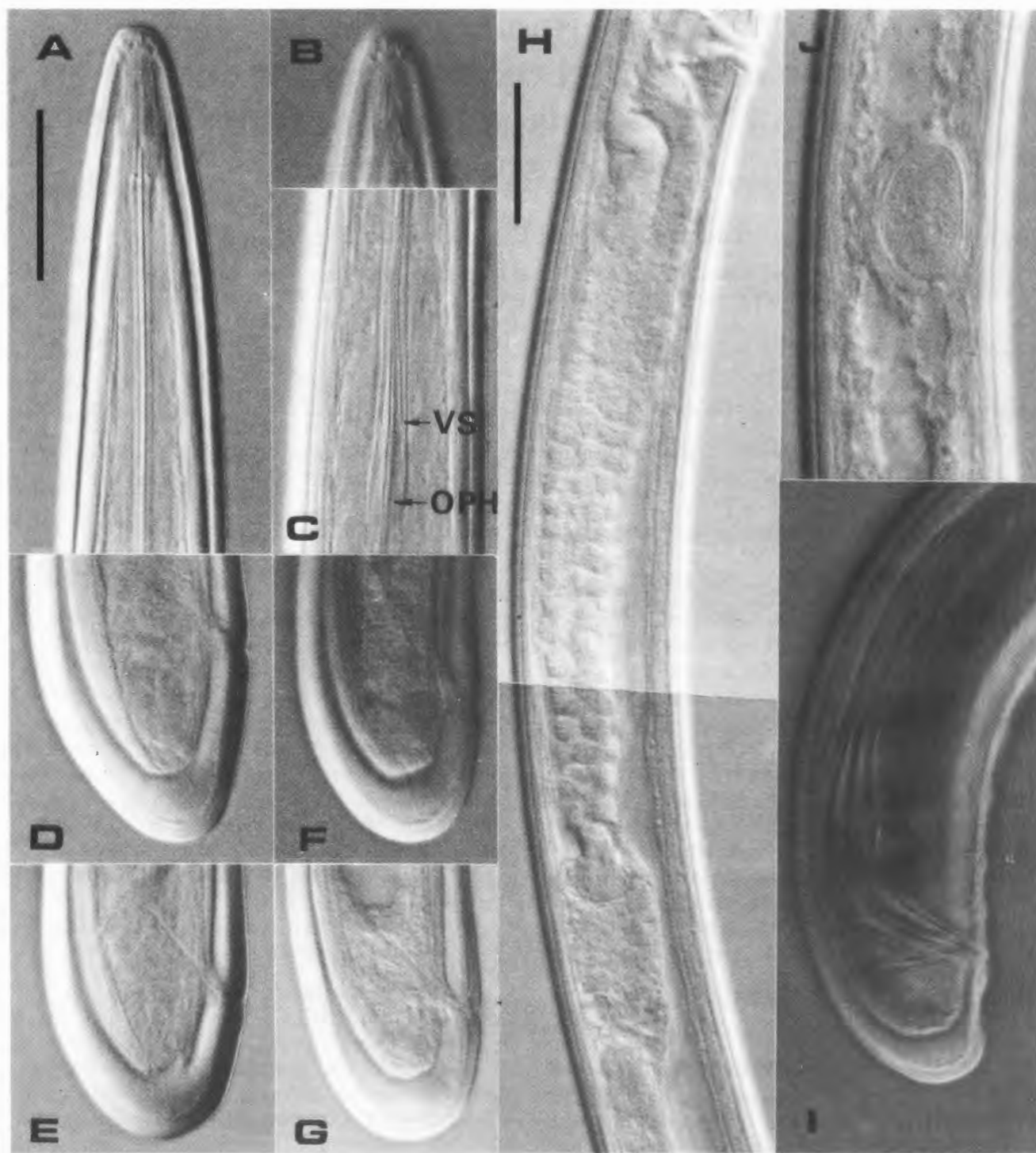


Fig. 1. Photomicrographs of *Longidorus silvae*. A: Female anterior region; B: Female amphidial pouch; C: Posterior end of odontophore and ventral sinus (OPH = posterior end of odontophore; VS = Posterior end of ventral sinus); D-G: Female tail; H: Posterior branch of the genital tract; I: Male tail; J: "Genital primordium" of the male. A-G, I, J: Scale bar - 50 µm; H: scale bar - 50 µm.

Table 1. Morphometric characters of a population of *Longidorus silvae* from Serbia (all measurements in μm , except for L in mm).

Locality	Stari Ledinci, Fruška gora Mountain				
Host	<i>Ruscus aculeatus</i> , <i>R. hypoglossum</i>				
n	36 ♀♀	16 J1	21 J2	13 J3	14 J4
L	7.23±0.52 (6.35-8.11)	1.63±0.13 (1.51-1.97)	2.41±0.16 (1.93-2.64)	3.83±0.15 (3.56-4.05)	5.05±0.48 (4.23-5.71)
a	106±6.2 (96-118)	61±2.4 (57-65)	68±1.9 (65-72)	79±2.7 (74-83)	91±4.0 (86-101)
b	12.3±0.8 (10.8-15.4)	4.7±0.5 (4.2-5.9)	6.1±0.4 (5.4-6.9)	8.0±0.2 (7.3-8.3)	9.4±0.8 (8.0-10.5)
c	180±16.3 (153-212)	27±1.2 (26-31)	62±2.5 (57-68)	88±4.1 (80-95)	123±9.7 (107-142)
c'	0.8±0.1 (0.7-0.9)	3.1±0.1 (2.8-3.3)	1.4±0.1 (1.3-1.5)	1.1±0.05 (1.0-1.2)	0.9±0.03 (0.8-0.9)
d	2.8±0.2 (2.4-3.1)	3.0±0.1 (2.9-3.3)	3.1±0.1 (2.8-3.3)	3.0±0.1 (2.8-3.2)	2.9±0.1 (2.7-3.1)
d'	2.0±0.1 (1.9-2.3)	2.0±0.05 (1.9-2.1)	2.0±0.1 (1.8-2.1)	2.1±0.1 (1.9-2.2)	2.1±0.1 (1.9-2.2)
J'	0.4±0.03 (0.4-0.5)	2.2±0.1 (1.9-2.4)	0.4±0.04 (0.3-0.5)	0.4±0.04 (0.3-0.4)	0.4±0.02 (0.4-0.4)
V%	50±1.3 (47-53)	—	—	—	—
Odontostyle	131±3.6 (121-141)	78±1.7 (76-83)	86±2.0 (83-90)	102±1.8 (98-105)	116±3.0 (110-123)
Odontophore	81±3.3 (74-88)	49±2.3 (44-53)	58±2.5 (51-61)	66±3.1 (60-71)	74±3.7 (66-81)
Total stylet	212±4.7 (201-226)	127±2.9 (123-134)	144±3.5 (136-151)	168±3.6 (160-174)	190±5.7 (179-201)
Replacement odontostyle	142±1.6 (140-144)	87±1.7 (83-90)	102±3.4 (95-111)	115±3.1 (111-120)	130±6.1 (121-149)
Oral aperture to guide ring	42±1.9 (36-45)	23±0.5 (22-24)	29±0.8 (27-31)	34±1.1 (32-35)	37±1.5 (34-39)
Tail	40.5±3.3 (34-48)	60±3.0 (57-67)	39±2.5 (31-43)	44±2.3 (40-47)	41±2.1 (37-45)
J (hyaline portion of tail)	17±1.1 (15-19)	29±1.8 (27-33)	9.0±1.1 (5.2-10.4)	11.7±1.5 (7.5-13.4)	13±0.6 (12.5-14)
Body diam. at lip region	15±0.6 (14-16)	7.5±0.2 (6.9-7.8)	9.3±0.5 (8.8-10.3)	11±0.2 (11-12)	13±0.4 (12-13)
Body diam. at guide ring	31±1.2 (28-33)	15±0.4 (14-16)	19±0.6 (16-19)	23±0.6 (22-24)	27±1.2 (25-28)
Body diam. at base of oesophagus	58±2.6 (52-63)	27±1.9 (24-31)	34±1.9 (29-36)	45±1.1 (43-46)	52±3.1 (47-59)
Body diam. at mid-body or vulva	68±3.6 (62-78)	27±2.5 (24-33)	35±2.2 (29-39)	48±1.4 (45-50)	55±4.2 (49-61)
Body diam. at anus	51±1.9 (48-55)	19±1.4 (18-23)	28±1.8 (24-31)	40±1.4 (37-43)	46±2.0 (43-50)
Body diam. at beginning of J	39±1.8 (36-42)	13±0.8 (11-14)	22±1.6 (18-24)	30±1.8 (26-33)	35±1.2 (32-36)

d, anterior to guide-ring/body width at lip region (Brown *et al.*, 1994);
d', body width at guiding-ring/body width at lip region (Brown *et al.*, 1994);
J', length of the hyaline region of the tail/hyaline width (Lišková *et al.*, 1997).

Table 2. Morphometric characters of adults from populations of *L. silvae* from Slovenia and Bosnia and Herzegovina (all measurements in μm , except for L in mm).

Locality: Host:	Kubed		Grahovo	Drinjača	
	<i>Vitis vinifera</i>		<i>Carpinus</i> sp.	<i>Corylus avellana</i>	<i>Pteridium aquilinum</i>
n	26 ♀♀	1 ♂	8 ♀♀	13 ♀♀	3 ♀♀
L	5.50±0.42 (4.57-6.56)	5.54	6.61±0.30 (6.24-7.20)	6.49±0.61 (5.49-7.51)	6.73±0.27 (6.47-7.11)
a	90±6.8 (75-104)	97	95±6.2 (88-108)	96±5.8 (89-104)	99±0.1 (99-99)
b	9.9±0.7 (8.4-11.4)	9.8	11.6±0.5 (10.8-12.3)	10.9±0.7 (9.4-12.0)	10.8±0.7 (10.1-11.7)
c	172±17.3 (136-218)	168	174±10.9 (155-187)	171±15.7 (151-203)	182±15.3 (166-203)
c'	0.7±0.04 (0.6-0.8)	0.7	0.7±0.05 (0.7-0.8)	0.7±0.05 (0.6-0.8)	0.7±0.04 (0.65-0.7)
d	3.1±0.2 (2.5-3.8)	3.0	2.8±0.1 (2.7-3.0)	3.0±0.2 (2.7-3.4)	3.1±0.2 (2.8-3.3)
d'	2.2±0.1 (1.7-2.4)	2.0	2.2±0.1 (2.0-2.3)	2.2±0.1 (2.1-2.4)	2.3±0.02 (2.3-2.3)
J'	0.4±0.02 (0.3-0.4)	0.4	0.4±0.04 (0.3-0.4)	0.4±0.03 (0.3-0.4)	0.4±0.01 (0.4-0.4)
V%	49±0.7 (48-51)	—	48±1.5 (46-50)	52±1.2 (50-54)	53±0.5 (52-53)
Odontostyle	129±3.4 (122-137)	124	115±5.4 (108-123)	127±3.2 (122-132)	131±4.1 (126-136)
Odontophore	71±4.7 (64-84)	67	83±1.9 (82-88)	81±5.4 (68-88)	82±3.9 (79-88)
Total stylet	201±6.1 (192-220)	191	199±6.7 (191-211)	209±6.8 (192-220)	214±5.3 (206-219)
Oral aperture to guide ring	40±2.6 (36-48)	41	41±1.8 (39-45)	42±2.6 (38-46)	42±2.1 (39-43)
Tail	32±2.2 (29-38)	33	38±1.8 (35-40)	38±2.5 (34-43)	37±1.6 (35-39)
J (hyaline portion of tail)	14±1.0 (11-15)	13	14±1.1 (12-15)	14±1.7 (11-18)	15±0.6 (14-15)
Body diam. at lip region	13±0.7 (12-16)	14	15±0.6 (14-16)	14±0.5 (13-15)	14±0.3 (13-14)
Body diam. at guide ring	28±1.3 (26-31)	28	32±1.2 (30-34)	31±1.1 (28-33)	31±0.3 (31-31)
Body diam. at base of oesophagus	54±2.1 (49-57)	53	59±3.0 (54-63)	59±3.8 (53-65)	59±0.8 (58-60)
Body diam. at mid-body or vulva	61±3.1 (57-68)	57	69±3.9 (63-74)	68±5.3 (60-81)	68±2.7 (65-72)
Body diam. at anus	45±2.0 (42-51)	46	52±1.7 (48-54)	53±2.1 (49-57)	53±0.5 (53-54)
Body diam. at beginning of J	36±1.5 (34-39)	31	36±1.8 (34-40)	38±2.2 (33-41)	39±1.2 (38-41)
Spicules	—	77	—	—	—

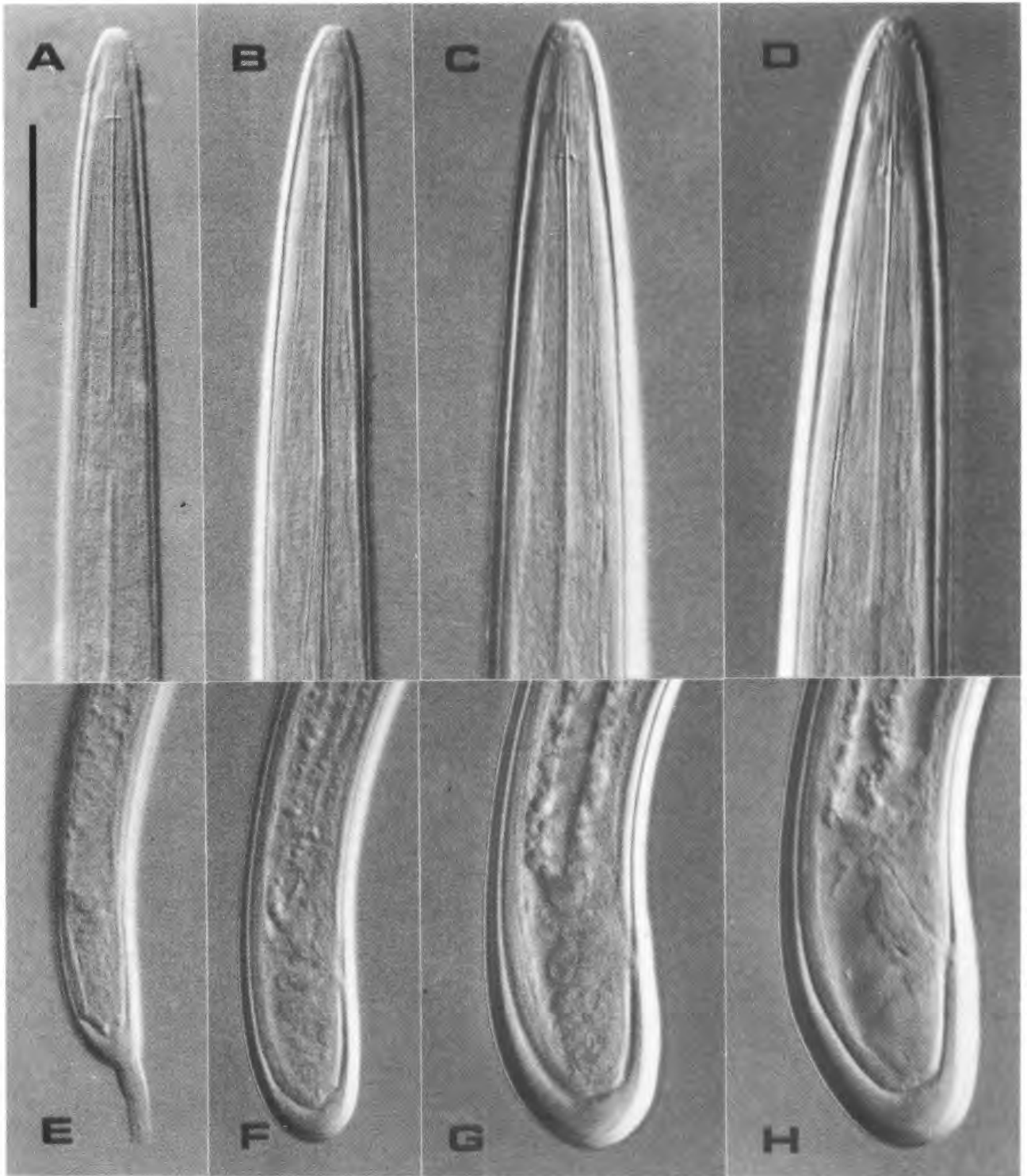


Fig. 2. Photomicrographs of juvenile stages of *L. silvae*. A-D: Anterior region of J1, J2, J3 and J4 stage; E-H: Tail of J1, J2, J3 and J4 stage. Scale bar - 50 μ m.

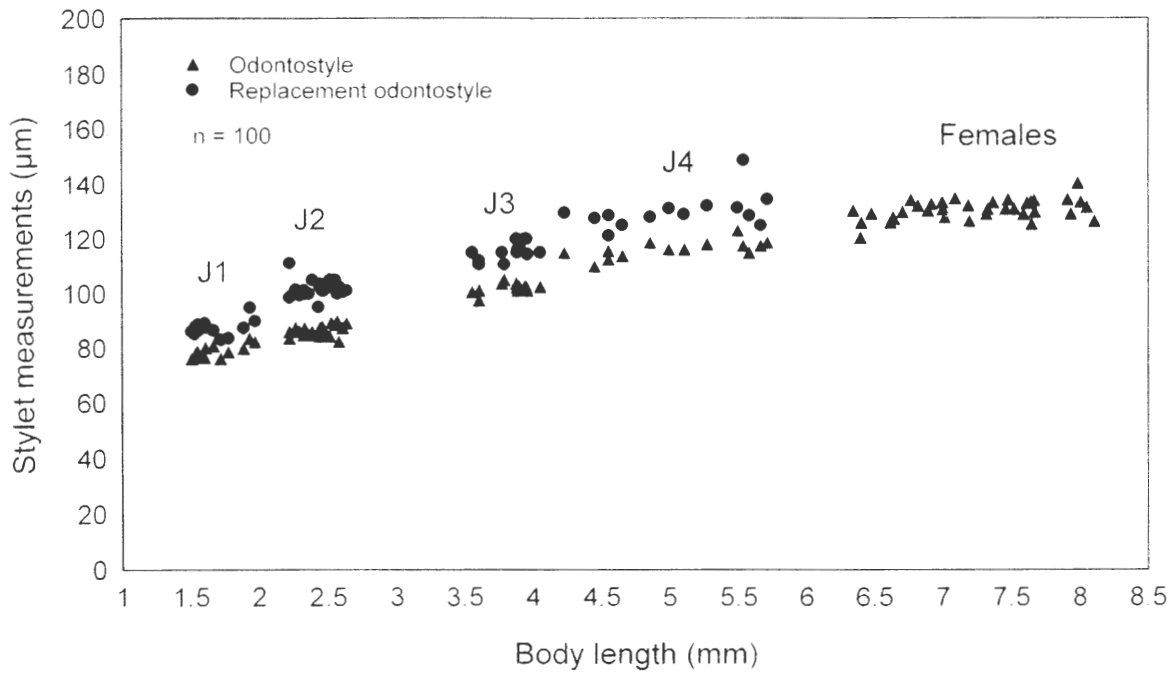


Fig. 3. Scatter diagram plotting body and odontostyles length of individual juveniles and females of *L. silvae* from Stari Ledinci, Serbia.

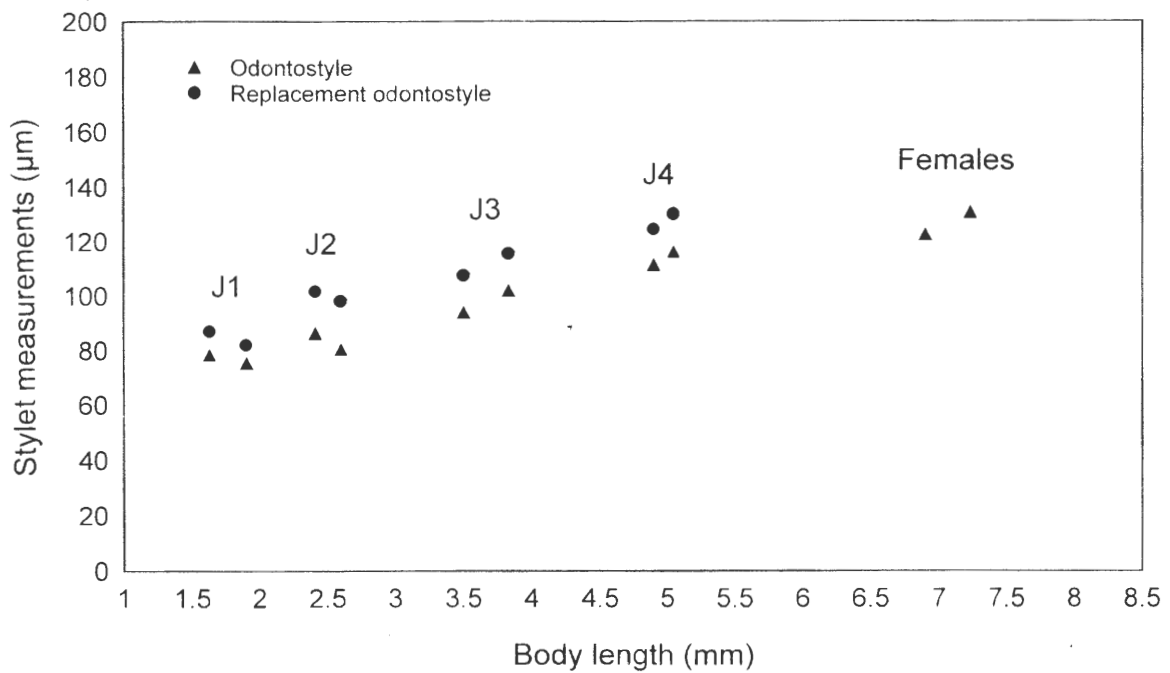


Fig. 4. Scatter diagram plotting mean body and odontostyles length of juveniles and females of *L. silvae* from Italy and Serbia (for details see Table 4).

Table 3. Morphometric characters of females of *L. silvae* from Bosnia and Herzegovina, Croatia and Serbia (all measurements in μm , except for L in mm).

Locality: Host:	<i>Vlasenica</i> <i>C. avellana</i>	Poriče <i>Carpinus betulus</i>	Cista Provo <i>Pinus nigra</i>	Tara Mt., Hajdučka česma <i>Sambucus</i> sp.
N	8	2	1	7
L	6.51±0.56 (5.69-7.40)	7.28, 6.27	7.37	7.56±0.46 (6.62-8.18)
A	100±6.9 (93-116)	102, 109	107	102±6.3 (90-110)
B	11.0±1.4 (7.8-12.6)	11.7, 9.4	11.7	11.9±0.7 (10.3-12.7)
C	183±16.1 (150-203)	176, 161	210	196±31.1 (147-241)
c'	0.7±0.05 (0.65-0.8)	0.7, 0.8	0.7	0.7±0.1 (0.65-0.9)
D	3.0±0.1 (2.8-3.2)	3.2, 3.0	2.8	2.9±0.1 (2.8-3.0)
d'	2.2±0.1 (2.0-2.3)	2.3, 2.2	2.1	2.1±0.1 (2.0-2.2)
J'	0.4±0.04 (0.3-0.5)	0.4, 0.4	0.4	0.4±0.02 (0.4-0.5)
V%	53±0.7 (52-54)	51, 52	52	53±0.6 (52-54)
Odontostyle	130±2.3 (127-136)	132, 129	132	129±4.5 (120-136)
Odontophore	79±2.5 (77-83)	83, 80	78	86±1.4 (84-88)
Total stylet	209±4.3 (203-218)	215, 210	210	215±5.0 (206-223)
Oral aperture to guide ring	42±1.4 (40-45)	44, 42	42	43±1.6 (41-46)
Tail	36±3.1 (30-41)	41, 39	35	39±6.1 (33-53)
J (hyaline portion of tail)	15±1.4 (14-18)	14, 16	16	16±1.0 (15-18)
Body diam. at lip region	14±0.7 (13-15)	14, 14	15	15±0.5 (14-16)
Body diam. at guide ring	30±1.0 (29-32)	31, 31	31	32±1.1 (30-33)
Body diam. at base of oesophagus	58±1.4 (55-59)	60, 56	61	61±2.0 (59-65)
Body diam. at mid- body or vulva	65±4.0 (58-72)	72, 58	69	74±3.2 (70-80)
Body diam. at anus	49±1.3 (46-51)	57, 51	50	52±2.6 (50-58)
Body diam. at beginning of J	37±1.6 (35-39)	39, 38	36	38±2.1 (34-41)

Table 4. Morphometrics of juvenile stages and females of the *L. silvae* populations from Italy and Serbia.

Developmental stages and populations	Body length (mm) (mean)	Odontostyle (μm) (mean)	Replacement odontostyle (μm) (mean)
J1			
Ampezzo, Italy ¹	1.90	75.5	82.0
Stari Ledinci, Serbia ²	1.63	78	87
J2			
Ampezzo, Italy	2.60	80.5	98.0
Stari Ledinci, Serbia	2.41	86	102
J3			
Ampezzo, Italy	3.50	94.0	107.5
Stari Ledinci, Serbia	3.83	102	115
J4			
Ampezzo, Italy	4.90	111.5	124.5
Stari Ledinci, Serbia	5.05	116	130
Females			
Ampezzo, Italy	6.90	122.5	—
Stari Ledinci, Serbia	7.23	131	—

¹Roca, 1993; ²Original

subventral glands situated at 26 (21-29)% and 52 (49-55)% (n=20), respectively. Vulva a transverse slit, vagina occupying slightly more than 1/2 of the corresponding body diameter; *pars distalis* vaginae and moderately thick walled *pars proximalis* vaginae 14-18 and 21-26 μm long, respectively. Reproductive system with equally developed genital branches. Ovejector with weak musculature; uterus long, well developed, without any differentiation, separated from ovejector by a weak constriction and from oviduct by a robust sphincter. Prerectum 5-15 times the anal body width; rectum about 0.6 to 0.9 body diameter at anus. Tail short, conically rounded to almost hemispherical, with main curvature dorsally; bearing two caudal pores on each side.

Male. (Kubed, Slovenia, *V. vinifera*, n=1). Morphologically similar to females, with posterior region of the body more coiled. Muscular bulb slender, measuring 21 x 144 μm . Nuclei of dorsal and subventral glands situated at 30% and 56%, respectively. Reproductive system not developed, only a "genital primordium" present (Fig. 1J). Spicules robust, lateral guiding pieces 21 μm long. The adanal pair of supplements is preceded by a row of 12 ventromedian supplements. Post-cloacal papilla developed. Tail short, bluntly rounded, dorsally convex and ventrally slightly concave.

Juveniles. (Stari Ladinci, Fruška gora Mt, Serbia, *R. aculeatus* and *R. hypoglossum*, n=64). Similar to adults, separated into four developmental stages (Fig. 3). The first stage has a digitate tail with a 22 (20-25) μm long mucro; second, third and fourth juvenile stages have bluntly rounded tails.

All stages generally correspond well with those from Italy described by Roca (1993) with the exception of body length, odontostyle, and replacement odontostyle length. Body is shorter in first and second stages and longer in third and fourth stages and in females of the population from Stari Ladinci - Fruška gora Mountain (Table 4 and Fig. 4). Odontostyle and replacement odontostyle are generally longer in all juvenile stages and in females in this population.

Females of *L. silvae* from various populations from the former territory of Yugoslavia are similar to the populations from Italy (Roca, 1993; Roca & Lamberti, 1993). Compared to the type population (Roca, 1993) they show a slightly wider range of body length (4.57-8.11 mm vs 5.9-8.0 mm), odontostyle length (108-141 μm vs 113.5-133.0 μm), tail length (29-48 μm vs 37.0-44.5 μm), vulva position (46-54 μm vs 44.9-50.7 μm) and distance

of oral aperture to guiding ring (36-48 μm vs 37.0-44.0 μm). Differences in the odontophore length were also observed (64-88 μm vs 44.5-70.0 μm). In the original description of *L. silvae* (Roca, 1993) in Fig. 1A and B and in the Fig. 3A in Roca & Lamberti (1993) the posterior end of the odontophore is drawn as being slightly expanded giving the appearance of a reversed Y shape. All the specimens of *L. silvae* examined from the former territory of Yugoslavia had tubular odontophores without any posterior expansion, in agreement with Cho & Robbins (1990). Three paratype females examined in the nematode collection of the Istituto per la Protezione delle Piante (formerly Istituto di Nematologia Agraria del C.N.R.) had more than 70 μm long tubular odontophores without any posterior expansion. Thus, the odontophore lengths given for both populations from Italy (44.5-70.0 and 56.0-64.5 μm , respectively) are probably incorrect, being the length from the anterior end of the odontophore to the posterior end of the ventral sinus (Fig. 1C).

Taking into consideration the existing intraspecific variability of this species, the identification code for *L. silvae* in the polytomous key by Chen *et al.* (1997) should be modified as: A45(6), B23, C34, D1, E23, F(2)34, G12(3), H1, I12.

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Barsi L., Lamberti F. Первое обнаружение на территории бывшей Югославии и описание самца *Longidorus silvae* Roca, 1993 (Nematoda: Dorylaimida).

Резюме. Впервые на территории бывшей Югославии обнаружен вид *Longidorus silvae*. Приводятся данные по морфометрической изменчивости самок и четырех личиночных стадий. Впервые описан самец этого вида.
