

## LONGIDORIDAE (NEMATODA) OCCURRING IN THE TOPCHIDER PARK OF BELGRADE, SERBIA, WITH THE DESCRIPTION OF *PARALONGIDORUS SERBICUS* SP.N.

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**Summary.** A nematode survey carried out in 1998-2000 in the Topchider Park of Belgrade, Serbia, revealed the occurrence of four species of *Longidorus* and two species of *Paralongidorus*. *L. iuglandicola* Liskova, Robbins *et* Brown, 1997 and *L. athesinus*, Lamberti, Coiro *et* Agostinelli, 1991; *L. raskii* Lamberti *et* Agostinelli, 1993; *L. urosbis* Krnjaić, Lamberti, Krnjaić, Agostinelli *et* Radicci, 2000 and *P. milantis* Krnjaić, Lamberti, Krnjaić, Agostinelli *et* Radicci, 2000, which constitute new records for Serbia. *P. serbicus* sp.n. is characterized by body length of 6-7 mm; subacute lip region, continuous with the rest of the body; slightly symmetrically bilobed amphidial pouches; odontostyle length of 112 µm; vulva at mid-body; and bluntly rounded conical tail. The male was not found and the juvenile stages separate into four groups.

Soil samples were collected in 1998-2000 from the rhizosphere of various old trees growing in perennial grass pasture in the Topchider Park, situated south-west of Belgrade, Serbia. They contained populations of four species of *Longidorus* Micoletzky and two species of *Paralongidorus* Siddiqi, Hooper *et* Khan.

Nematodes were extracted from soil by the Cobb's wet sieving technique, killed and fixed in hot 4:1 FA and processed by the slow method and mounted in anhydrous glycerine. Specimens were measured by either an eye-piece scale or a drawing tube.

The species found were: *Longidorus juglandicola* and *L. athesinus*, *L. raskii*, *L. urosbis* and *Paralongidorus milantis* which constitute new records for Serbia; *P. serbicus* is the name given to populations considered to represent an undescribed species.

Descriptions and illustrations are presented in this paper.

### DESCRIPTIONS

#### *LONGIDORUS ATHEBINUS* Lamberti, Coiro *et* Agostinelli, 1991 (Table I; Fig. 1)

Female *habitus* curved ventrally to a closed C; body medium sized, cylindrical tapering gradually towards the extremities. Cuticle finely transversally striated, 2-4 µm thick along body. Lip region continuous with the rest of the body, 4 µm high, slightly flattened frontally and rounded laterally. Amphidial pouches slightly asymmetrically bilobed with indistinct aperture. Odontostyle, odontophore and guide ring typical of the genus. Oesophagus dorylaimoid, with the enlarged basal portion ca. 1/3-1/4 of the entire oesophagus length; the muscular bulb contains three glandular nu-

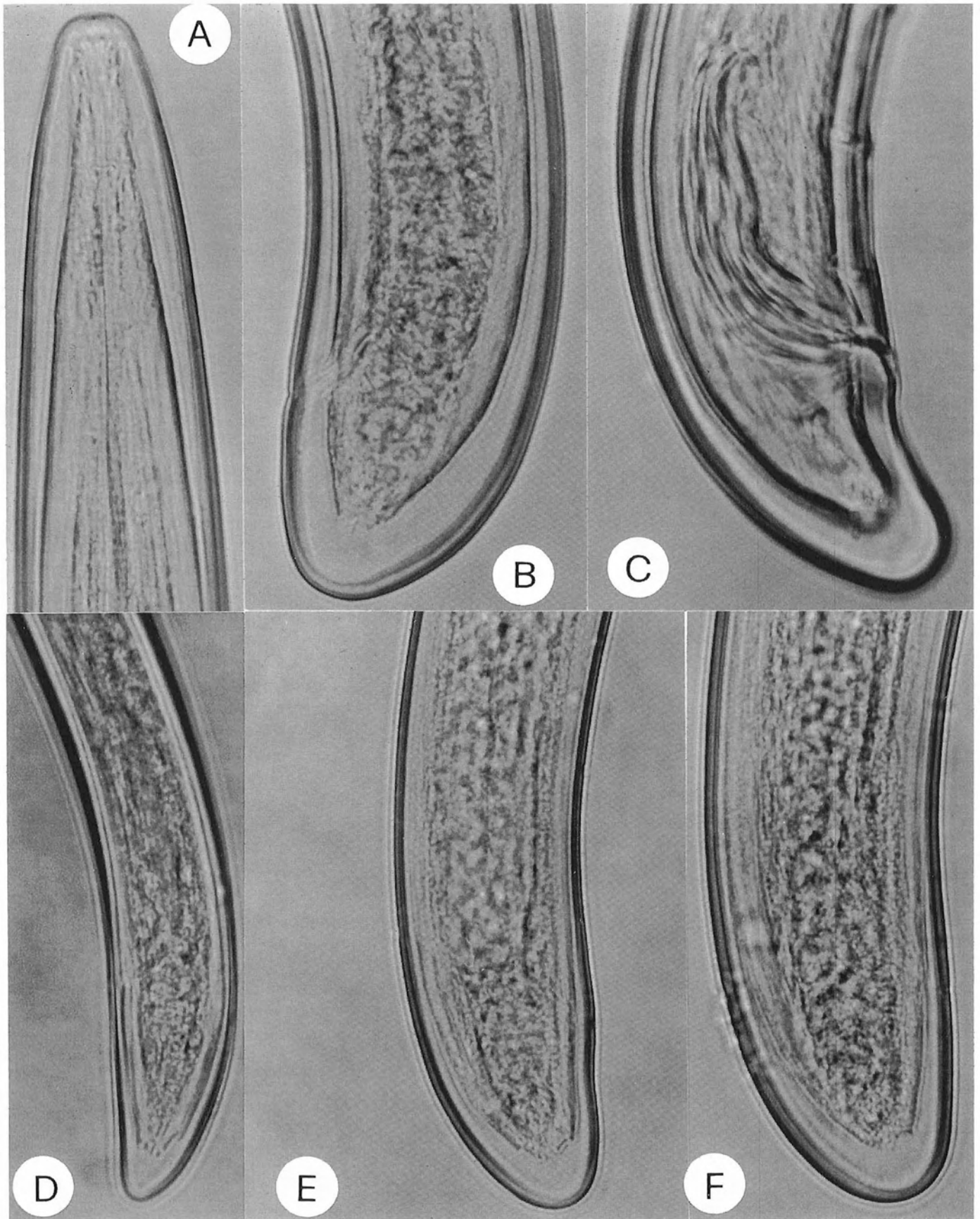
clei (DOG = 20-25%, DOO = 15%, SLGL = 54%, SLGR = 56%, SLO = 53%). Oesophageal-intestinal valve inconspicuous. Vulva a transverse slit at mid-body; vagina strongly cuticularized, extending about 1/2 of the body diameter; reproductive system amphidelphic with equally developed genital branches (500-600 µm long); a sphincter separates the spermatheca from the uterus, which both contain numerous sperms; ovaries opposed, reflexed. Prerectum not defined; rectum as long as about 1/2 the anal body width. Tail conoid, bluntly rounded, ventrally straight and dorsally convex, bearing two caudal pores on each side.

Male frequent, with the posterior region of the body, more coiled than in the female. Testes well developed, apparently functional, ca 700 µm long, filled with sperms measuring 2-3 x 1.5-2 µm. Spicules robust ventrally arcuate; guiding piece lens-shaped, 8-12 µm long and 4-6 µm wide. The adanal pair of supplements is preceded by a row of 9-12 ventromedian supplements. Tail with rounded terminus, ventrally concave and dorsally convex, bearing two caudal pores on each side.

Only three groups of juveniles were found. The first stage was missing, probably lost during the extraction procedures. They are very similar to adult females, but with the tail more elongate, especially in the second stage.

**Remarks** – The identification code for this population of *L. athesinus* is : A 2/3, B 2/3, C 3, D 1, E 3, F 2/3, G 1/2, H 1, I 2, which fits the formula given for this species by Chen *et al.* (1997). However, compared to the type population of *L. athesinus* (Lamberti *et al.*, 1991) this population has larger body size.

*L. athesinus* constitutes a new record for Serbia and is reported for the first time outside Italy. It occurred in the rhizosphere of *Fraxinus excelsior* Guss.



**Fig. 1.** Photomicrographs of *Longidorus athesinus*: A, female anterior region; B, female posterior region; C, male posterior region; D-F, tail of second, third and fourth juvenile stages, respectively.

**Table I.** Morphometrics of *Longidorus athesinus* from Serbia.

n	12♀	6♂	7 J2	5 J3	7 J4
L (mm)	5.5±0.52 4.9-6.5	5.4±0.26 5.1-5.6	1.9±0.13 1.7-2.1	2.6±0.05 2.6-2.7	3.9±0.24 3.6-4.3
a	79.5±7.00 69-92	83.8±11.21 70-100	59±2.73 54-62	69.4±10.26 55-79	64.4±5.74 59-76
b	11.8±1.96 8-15	11.8±1.17 10-13	6±1.15 4-8	7.6±0.89 6-8	10.4±1.90 8-13
c	134±8.52 122-148	126.5±3.33 123-131	45±2.71 42-50	61.8±3.03 59-67	92±5.51 83-100
c'	0.8±0.08 0.7-0.9	0.8±0.04 0.8-0.9	1.7±0.15 1.5-1.9	1.4±0.09 1.2-1.4	0.9±0.10 0.8-1.1
V%	50.3±2.61 47-57	–	–	–	–
Odontostyle µm	88.3±4.79 76-94	90.8±3.06 87-95	56±2.52 51-59	68.4±1.95 66-71	76.4±2.64 74-80
Odontophore µm	64±6.58 53-74	63.3±4.41 59-70	44.1±2.91 41-48	54.8±1.10 54-56	55.1±3.08 49-57
Replacement odontostyle µm	–	–	67.7±3.04 64-72	78.8±1.64 77-80	90±1.46 87-92
Oral aperture to guide ring µm	33.4±1.31 31-36	34.3±1.37 33-36	21.4±1.62 20-25	25.2±0.45 25-26	28.7±1.89 25-30
Tail µm	41±3.54 36-49	42.7±3.14 39-46	44±3.18 39-48	42.4±1.95 39-44	42±1.73 39-44
J (hyalin portion of tail) µm	14.8±1.60 13-18	15±1.10 13-16	9.7±0.76 8-10	11.8±1.10 10-13	12.4±0.53 12-13
Body diam. at lip region µm	16±0.79 15-18	18.3±1.03 17-20	9.7±0.49 9-10	11.8±0.45 11-12	14.6±0.79 13-15
Body diam. at guide ring µm	30.8±2.49 28-36	30.7±0.52 30-31	16.6±1.13 15-18	19.6±1.52 18-21	24.6±1.13 23-26
Body diam. at base of oesophagus µm	56.2±4.09 49-62	55.8±3.13 51-59	30.4±1.90 28-33	36.8±3.27 33-41	52±2.04 48-54
Body diam. at mid-body or vulva µm	68.2±8.64 51-80	69.3±7.09 62-80	31±1.68 29-34	40±5.57 35-49	60.3±5.56 51-67
Body diam. at anus µm	51±8.22 34-60	51.7±3.44 49-58	25±1.46 23-27	31.6±1.34 30-33	46.1±2.41 43-49
Body diam. at beginning of J µm	37.2±5.02 30-44	32.2±1.33 30-33	13±1.73 10-15	19.4±3.58 13-21	30.7±2.50 27-34
Spicules µm	–	66.8±3.54 61-71	–	–	–

***LONGIDORUS RASKII* Lambert *et Agostinelli*, 1993**  
(Table II; Figs 2 and 3)

Female *habitus* ventrally curved to a closed C or single spiral; body medium sized, cylindrical, tapering gradually towards the anterior extremity. Cuticle finely striated, ca 3 µm thick along body, except just behind the lip region, where it is ca. 2 µm thick, in the vulval region, where it is ca 3.5 µm thick and at the tail, where it is ca. 4.5 µm thick. Lip region subacute, rounded, continuous with the rest of the body, ca. 5 µm high. Amphidial pouches not clearly visible, in appearance more or less shallowly, symmetrically bilobed; in some specimens, each lobe seems bilobed; amphidial aperture indistinct. Odontostyle, odontophore and guide ring typical of the genus. Oesophagus dorylaimoid, with the enlarged basal portion ca 1/4 of the entire oesophagus

length; the muscular bulb measures about 135 µm long and 25 µm wide and contains three glandular nuclei (DOG = 27%, DOO = 20%, SLGL = 58%, SLGR = 60%, SLO = 51%). Oesophageal-intestinal valve heart-shaped to irregular shape. Vulva slightly posterior to mid-body, a transverse slit ca. 20 µm wide; vagina heavily cuticularized, extending about 1/2 of the body diameter, reproductive system amphidelphic with almost equally developed branches: the anterior 700-900 µm long and the posterior 700-850 µm; a large and strong sphincter separates the spermatheca from the uterus; the spermatheca contains oblong sperms measuring 2-3 x 1-2 µm; ovaries opposed, reflexed. Prerectum as long as 5-7 times the anal body width; rectum as long as 2/3 the anal body width. Tail bluntly rounded, bearing 2-3 caudal pores on each side.

Male with the posterior region of the body more

**Table II.** Morphometrics of *Longidorus raskii* from Serbia.

n	20♀	5♂	19 J1	17 J2	9 J3	6 J4
L (mm)	6.9±0.64 5.3-8.1	6.8±0.42 6.2-7.2	1.4±0.12 1.2-1.6	2.1±0.24 1.7-2.7	3.7±0.43 2.8-4	5±0.46 4.4-5.7
a	87±8.81 74-106	86.2±9.47 73-96	55.8±11.12 41-88	56.9±7.23 44-71	75.8±5.09 69-86	82±7.21 73-92
b	13.7±1.49 11-17	12.8±0.84 12-14	5.2±1.03 4-7	6.5±1.12 5-10	10±1.66 8-12	11.8±1.83 10-14
c	160.8±13.63 133-181	165±14.53 150-184	44±5.15 33-53	66.3±8.08 57-84	93.8±9.12 81-102	121.5±12.53 107-140
c'	0.8±0.08 0.7-1	0.8±0.07 0.7-0.9	1.9±0.31 1.4-2.6	1.3±0.11 1-1.5	1.1±0.12 0.95-1.3	0.9±0.12 0.7-1
V%	53.6±1.80 50-57	–	–	–	–	–
Odontostyle µm	102.5±3.86 98-110	109±3.16 104-112	53.3±5.92 41-61	61.1±3.54 52-61	76.6±3.21 74-82	87.3±2.26 84-89
Odontophore µm	59.6±7.66 49-77	67.4±6.19 57-72	37.6±5.22 30-48	44.3±4.21 39-56	54.4±7.26 38-59	60±6.39 49-66
Replacement odontostyle µm	–	–	61±5.02 49-69	73.8±3.53 67-79	90.4±2.92 87-95	101.7±6.44 92-107
Oral aperture to guide ring µm	36.4±2.48 33-43	35.4±3.51 31-39	19±1.80 15-21	22±1.25 20-23	25.3±1.32 23-28	29.5±1.64 28-31
Tail µm	43±3.48 35-49	41.4±3.58 37-47	31±3.14 27-41	32.5±2.48 30-38	39.8±4.02 34-48	41±2.76 38-46
J (hyalin portion of tail) µm	15.2±2.62 11-20	11.8±1.64 10-13	7.4±0.84 7-10	7.2±0.53 7-9	9±1.12 7-10	9.2±0.98 8-10
Body diam. at lip region µm	15.3±0.66 14-16	16±1.00 15-17	7.4±0.50 7-8	9.5±0.80 8-10	10.4±0.73 10-12	13.3±1.51 11-15
Body diam. at guide ring µm	31.5±2.91 29-37	33.8±2.32 30-37	13.6±1.07 12-15	16.1±1.71 13-21	21.6±1.51 20-25	25.3±2.88 21-30
Body diam. at base of oesophagus µm	65.1±5.16 56-80	62.4±1.52 61-65	23.2±2.36 18-28	32.6±2.32 30-36	44.1±5.04 36-49	52.8±6.91 42-61
Body diam. at mid-body or vulva µm	80.5±7.45 69-94	77±1.22 75-78	25.3±2.60 21-30	36.8±4.13 31-46	49.2±7.05 38-59	59.8±11.05 48-79
Body diam. at anus µm	57.2±3.87 46-62	52±2.12 49-54	16.4±2.31 13-23	25.8±2.16 23-31	38.3±4.03 32-41	48.2±5.38 42-57
Body diam. at beginning of J µm	41.7±4.19 34-50	27.6±5.59 21-34	10.2±1.32 8-13	16.1±2.19 13-21	25.8±2.82 21-28	31.2±2.40 30-36
Spicules µm	–	83.6±4.16 79-90	–	–	–	–

coiled than in the female. Testes well developed and functional, filled with sperms. Spicules thick, ventrally curved, with lateral guiding pieces ca. 20 µm long and 5 µm wide. The adanal pair of supplements is preceded by a row of 10-13 ventromedian supplements. Tail dorsally convex and deeply concave ventrally, with bluntly rounded terminus; it bears three pores on each side.

Juveniles separated into four stages (Fig. 3) with body posture as a J in the first and second stages and as an open C in the third and fourth stages. Tail terminus conoid with rounded terminus in the first two stages and bluntly rounded in the second two stages.

**Remarks** – The identification code for this population of *L. raskii* is: A 3/4, B 2/3, C 3/4, D 1, E 2, F 3/4, G 1/2, H 1, I 2, which fits the formula given for this

species by Chen *et al.* (1997). However, compared to the type population of *L. raskii* this population is slightly larger in size (L = 7.4-7.5 mm long in the Swiss populations) as reported in the previous descriptions (Lamberti and Agostinelli, 1993; Lamberti *et al.*, 2001).

The secondary lobation of the amphidial lobes could be a unique feature of this Serbian population of *Longidorus*. However, the quality of the material studied does not clearly establish whether this character, observed in some specimens only, is an artefact or a particular feature sufficient to establish a new species. This will be eventually proposed when better material is available and after biomolecular analysis.

*L. raskii* occurred in the rhizosphere of *Platanus acerifolia* (Art.) Willd and of *Pinus excelsa* Wall., in grassland. It is reported for the first time outside Switzerland.

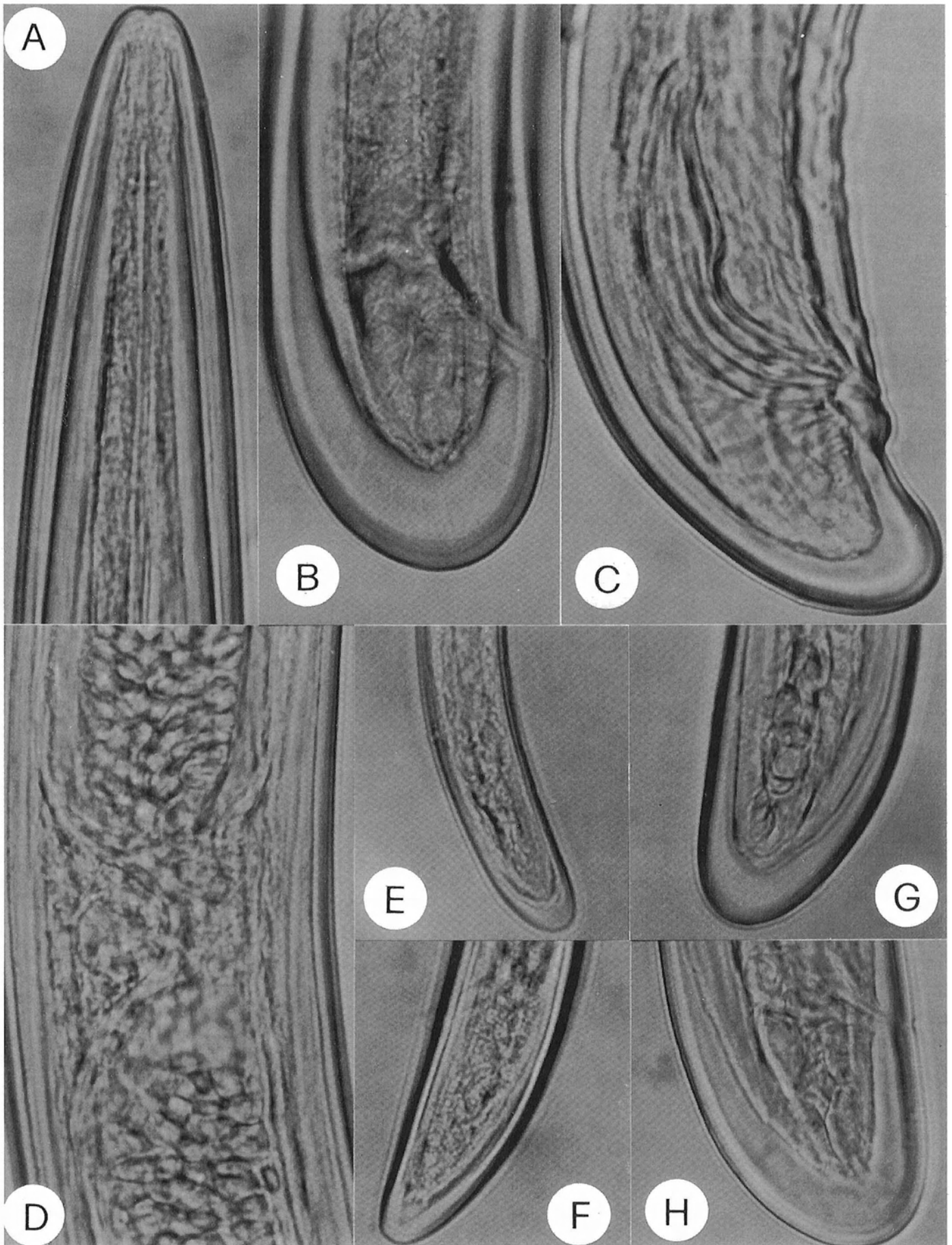


Fig. 2. Photomicrographs of *Longidorus raskii*: A, female anterior region; B, female posterior region; C, male posterior region; D, testes with sperms; E-H, tail of first, second, third and fourth juvenile stages, respectively.

*LONGIDORUS JUGLANDICOLA* Liskova,  
Robbins *et* Brown, 1997  
(Table III; Fig. 4)

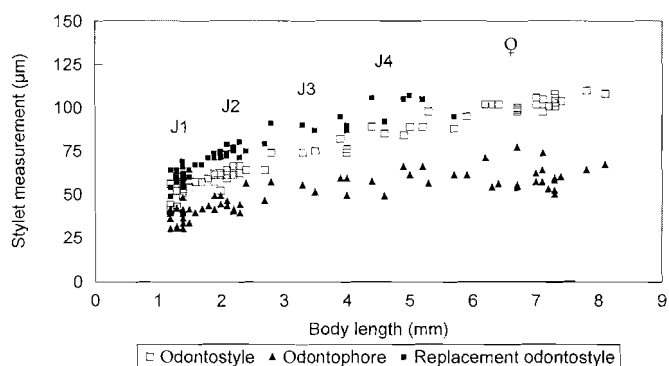


Fig. 3. Scatter diagram plotting body and odontostyles length of individual juveniles and females of *L. raskii*.

Female *habitus* ventrally curved to a more or less closed C; body medium sized, cylindrical, tapering toward the anterior extremity. Cuticle finely transversally striated, 2.5-3.5  $\mu\text{m}$  thick along body, except at the tail region where it is ca. 4.5  $\mu\text{m}$  thick on either side. Glandular bodies are visible in the lateral hypodermal chords. Lip region cylindrical, flattened frontally and rounded laterally, separated from the rest of the body by a very shallow depression. Amphidial pouches symmetrically bilobed. Odontostyle, odontophore and guide ring typical of the genus. Oesophagus dorylaimoid, with the basal bulb occupying 1/3 to 1/4 of the oesophagus total length; the basal bulb measures 110-125  $\mu\text{m}$  long and 20-25  $\mu\text{m}$  wide and contains three glandular nuclei lo-

Table III. Morphometrics of *Longidorus juglandicola* from Serbia.

n	23 ♀	7 ♂	4 J2	7 J3	16 J4
L (mm)	6.9±0.51 61-8	6.6±0.39 6.2-7.1	2.1±0.18 1.9-2.3	3.6±0.26 3.4-4.2	5±0.45 4.3-5.7
a	114.2±8.83 87-128	119±6.62 109-127	69.3±6.02 61-75	87.7±8.90 80-106	103.6±8.29 87-115
b	15.7±2.05 12-21	15±1.68 13-18	8±1.41 7-10	11.4±3.46 9-19	13±2.21 10-18
c	166.2±14.79 135-199	152±7.48 144-165	46±2.16 44-49	81.1±9.15 67-95	112.3±11.12 89-130
c'	0.9±0.09 0.7-1	0.9±0.08 0.8-1	2±0.18 1.8-2.2	1.3±0.17 1-1.5	1.1±0.10 0.9-1.2
V%	53±1.69 50-57	—	—	—	—
Odontostyle $\mu\text{m}$	87.2±3.93 80-95	90.1±4.02 82-95	54±4.08 49-59	67.3±4.35 61-74	77.1±3.63 72-82
Odontophore $\mu\text{m}$	63.5±3.73 56-69	62.6±3.10 59-69	41±4.08 36-46	49.3±2.93 45-52	58±5.89 49-75
Replacement odontostyle $\mu\text{m}$	—	—	67.5±3.87 64-73	76±3.24 72-82	87.8±5.97 82-103
Oral aperture to guide ring $\mu\text{m}$	33.4±1.02 31-36	33.4±1.13 31-34	20.3±0.96 19-21	25±0.58 24-26	28.4±2.00 26-31
Tail $\mu\text{m}$	41.7±4.11 33-51	42.7±1.89 41-46	46±4.97 41-52	45.3±3.30 43-51	44.5±3.74 39-49
J (hyalin portion of tail) $\mu\text{m}$	17.3±2.37 14-21	18±2.48 15-22	9±1.15 8-10	10±1.00 8-11	13.4±1.59 11-16
Body diam. at lip region $\mu\text{m}$	19.8±0.87 18-21	20.3±0.43 20-21	11.5±1.00 11-13	14±1.07 13-15	16.7±1.35 13-18
Body diam. at guide ring $\mu\text{m}$	28.8±1.62 25-31	27.6±1.99 25-30	17.5±1.00 16-18	20.4±0.53 20-21	25±1.63 23-28
Body diam. at base of oesophagus $\mu\text{m}$	47.8±3.79 39-56	47.6±1.72 46-50	28±2.94 25-31	36.4±2.94 33-39	42±3.49 39-49
Body diam. at mid-body or vulva $\mu\text{m}$	60.5±3.90 51-69	56.1±4.67 49-62	31±4.76 26-36	42.7±3.99 38-49	49.3±5.16 39-64
Body diam. at anus $\mu\text{m}$	47.4±3.53 41-54	45±3.46 41-50	22.5±5.00 20-30	36±3.56 33-41	42.3±3.55 36-46
Body diam. at beginning of J $\mu\text{m}$	36.1±3.26 30-43	30.3±1.98 26-32	10.8±1.50 10-13	21.3±1.11 20-23	27.4±2.66 21-31
Spicules $\mu\text{m}$	—	65.1±2.04 61-67	—	—	—



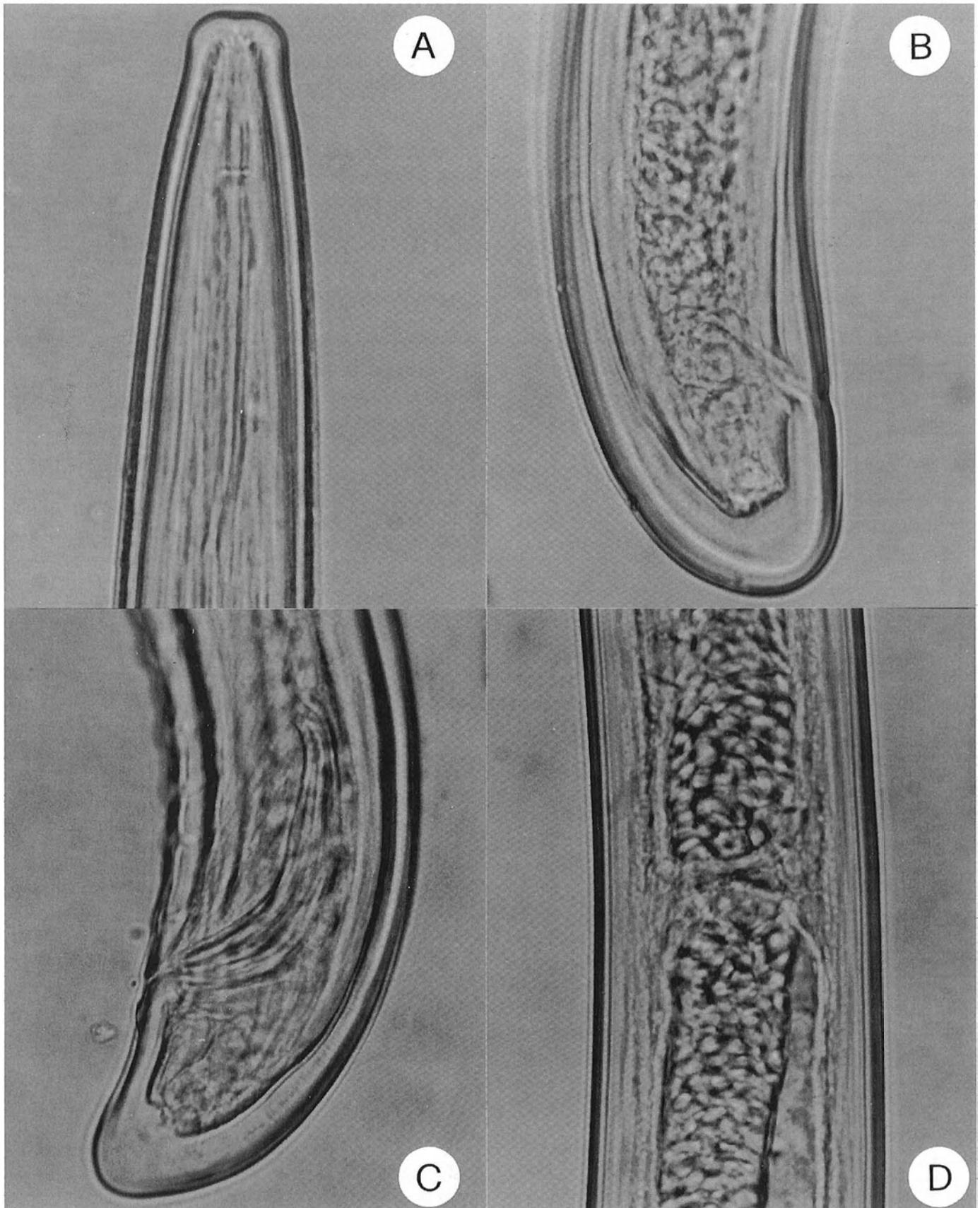


Fig. 4. Photomicrographs of *Longidorus juglandicola*: A, female anterior region; B, female posterior region; C, male posterior region; D, testes with sperms.

cated: DOG = 20-25%, DOO = 18-20%, SLGL = 56-58%, SLGR = 54-56%, SLO = 52-54%.

Oesophageal-intestinal valve heart shaped to amor-

phous. Vulva a transverse slit, slightly posterior to mid-body; vagina with thick walls, occupying ca. 1/2 of the corresponding body diameter; reproductive system am-

phidelpic with equally developed branches, each one in the range of 700  $\mu\text{m}$ ; a large sphincter separates the uterus from the oviduct distally enlarged; numerous oblong sperms (3.5 x 2.5  $\mu\text{m}$ ) are contained in the uteri; ovaries opposed, reflexed. Prerectum between 400 and 600  $\mu\text{m}$  long; rectum as long as 1/2-2/3 anal body width. Tail bluntly rounded, dorsally convex and ventrally straight, bearing two caudal pores on each side.

Male less frequent, with the posterior region of the body more coiled, than female. Testes well developed, functional, 400-500  $\mu\text{m}$  long filled with sperms. Spicules robust, ventrally arcuate; guiding piece lens-shaped 10-16  $\mu\text{m}$  long and 4-6  $\mu\text{m}$  wide. The adanal pair of supple-

ments is preceded by a row of 12-17 ventromedian supplements. Tail dorsally convex and ventrally slightly concave, conoid with rounded terminus, bearing two caudal pores on each side.

Only three juvenile stages occurred in our samples, the first stage missing probably lost during the extraction procedures. The tail of the second and third juvenile stages are more elongate compared to the preadult and adult stages.

**Remarks** – The identification code for this population, according to Chen *et al.*, (1997) is: A 2/3, B 3/4, C 3, D 2/3, E 2, F 3/4, G 2/3, H 1/2, I 2, which fits the code

**Table IV.** Morphometrics of *Longidorus uroshis* from Serbia.

n	24♀	11♂	15 J1	12 J2	9 J3	15 J4
L (mm)	7.3±0.90 6.1-9.5	7.1±0.62 5.6-7.9	1.6±0.12 1.4-1.9	2.5±0.27 2.1-2.9	3.8±0.36 3.3-4.2	5.4±0.52 3.9-6.2
a	103±13.08 79-134	117.1±9.12 102-132	65±7.39 53-81	71.8±9.67 51-88	85±10.79 72-105	100.7±9.30 83-118
b	13.1±2.00 10-20	12.6±1.21 10-15	5.5±0.92 4-7	6.7±0.78 6-8	9.1±0.93 7-10	12.1±2.15 9-17
c	156.8±16.74 113-196	148.2±15.35 125-177	34.2±3.63 29-41	57.8±6.22 49-67	89±19.73 72-136	119.3±21.34 85-188
c'	0.9±0.14 0.6-1.1	1±0.09 0.9-1.2	2.8±0.42 1.9-3.4	1.6±0.15 1.3-1.9	1.2±0.19 0.8-1.5	1±0.17 0.7-1.4
V%	51.3±1.60 49-55	–	–	–	–	–
Odontostyle $\mu\text{m}$	136±6.85 120-151	137±4.74 131-144	79.1±2.92 74-82	87.8±3.66 84-92	102.1±3.41 98-105	122.4±6.17 115-138
Odontophore $\mu\text{m}$	71.5±8.78 54-87	74±8.97 65-90	45.6±4.70 40-53	54.1±5.62 43-62	62.6±7.55 49-74	73.1±10.02 56-85
Replacement odontostyle $\mu\text{m}$	–	–	89.3±3.44 85-98	100.6±5.38 92-112	118±3.18 113-123	135.5±5.30 128-148
Oral aperture to guide ring $\mu\text{m}$	40.2±2.99 34-46	41.2±2.09 38-44	22±1.41 20-25	25.7±1.56 24-30	30.6±0.53 30-31	35.2±2.43 31-39
Tail $\mu\text{m}$	46.1±6.0 38-57	47.2±5.10 40-57	47.2±5.14 40-54	43.2±2.98 39-48	44.3±3.97 35-48	45.5±4.81 41-52
J (hyalin portion of tail) $\mu\text{m}$	15±1.78 10-18	13.5±2.21 10-16	17.2±2.04 13-21	9.6±1.24 7-11	11.1±1.76 8-13	11.6±1.35 8-13
Body diam. at lip region $\mu\text{m}$	16.4±1.31 14-19	17.7±1.74 14-20	8.1±0.74 7-10	10±0.74 8-11	12.6±1.67 10-15	15.3±1.03 13-18
Body diam. at guide ring $\mu\text{m}$	31.1±1.70 28-36	31.3±1.74 28-33	15.1±0.52 14-16	18.6±1.24 16-20	23.8±1.79 21-26	27.4±2.10 23-31
Body diam. at base of oesophagus $\mu\text{m}$	57.6±5.72 40-69	52.8±5.02 48-64	24±2.77 20-30	31.6±3.18 28-38	41.6±3.78 36-48	50±6.29 41-63
Body diam. at mid-body or vulva $\mu\text{m}$	71±6.38 62-90	61±5.97 54-70	25.5±2.77 21-31	34.2±2.98 30-39	44±4.30 38-51	53.5±6.15 43-64
Body diam. at anus $\mu\text{m}$	53.3±3.85 47-62	48.4±3.72 41-54	17±2.02 15-21	27.3±3.08 23-31	36.3±3.24 31-41	44.7±4.82 33-53
Body diam. at beginning of J $\mu\text{m}$	40.2±4.32 34-49	29±3.21 26-34	9±1.73 6-11	15.5±2.65 13-21	27.7±3.04 23-33	31.4±3.81 21-38
Mucro of the tail $\mu\text{m}$	–	–	9.9±1.67 7-13	–	–	–
Spicules $\mu\text{m}$	–	66.7±1.85 64-70	–	–	–	–



for *L. juglandicola* (Liskova *et al.*, 1997).

Morphometrically this population of *L. juglandicola* is identical to the type population from Slovakia (Liskova *et al.*, 1997) and to another population from Serbia

(Barsi and Lamberti, 2002).

*L. juglandicola* was found in the rhizosphere of *Pinus nigra* Arnold, *Quercus robur* L. and *Aesculus hippocastanum* L.

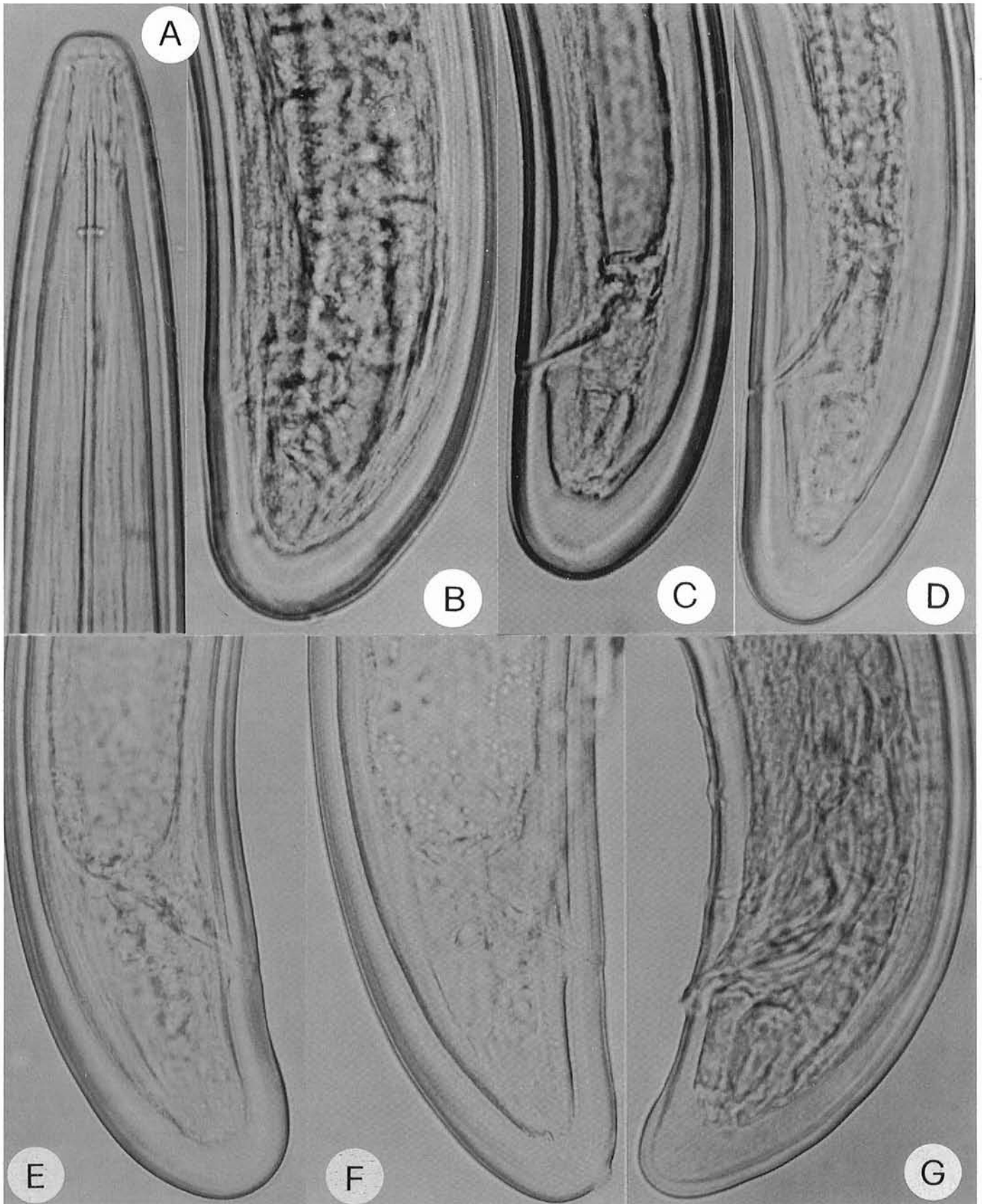


Fig. 5. Photomicrographs of *Longidorus urosbis*: A, female anterior region; B-F, female posterior regions; G, male posterior region.

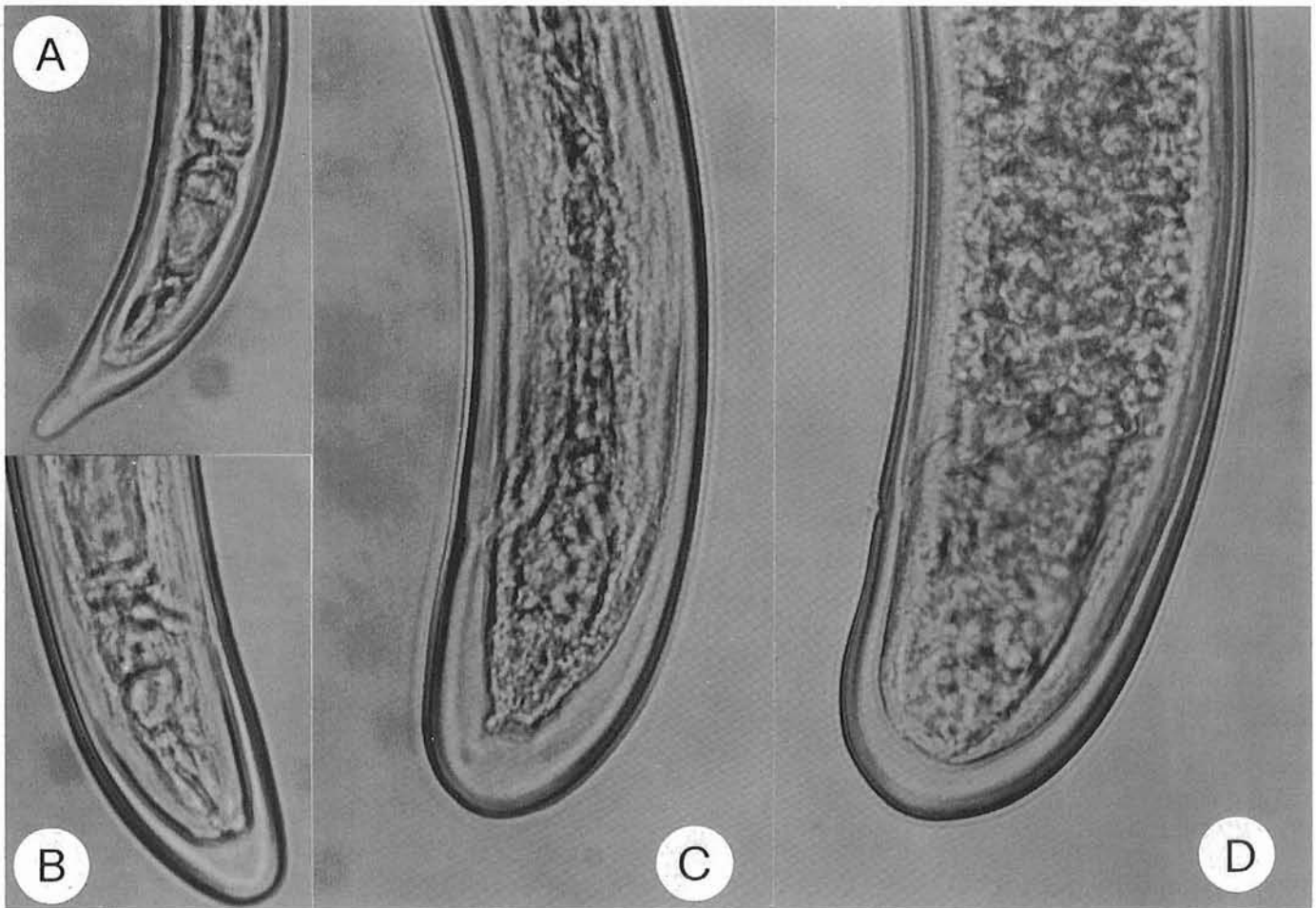


Fig. 6. Photomicrographs of *L. urosbis*: A-D, tail of first, second, third and fourth juvenile stages, respectively.

***LONGIDORUS UROSHIS* Krnjaić, Lamberti,  
Krnjaić, Agostinelli et Radicci, 2000**  
(Table IV; Figs 5 - 7)

Female *habitus* ventrally curved to a closed C or a single spiral; body medium to large sized, cylindrical, tapering gradually towards the extremities. Cuticle finely transversally striated, 1-3  $\mu\text{m}$  thick along body, except in the tail region where it is ca. 6  $\mu\text{m}$  thick on either side. Glandular structures irregularly distributed in the lateral hypodermal chords. Lip region frontally

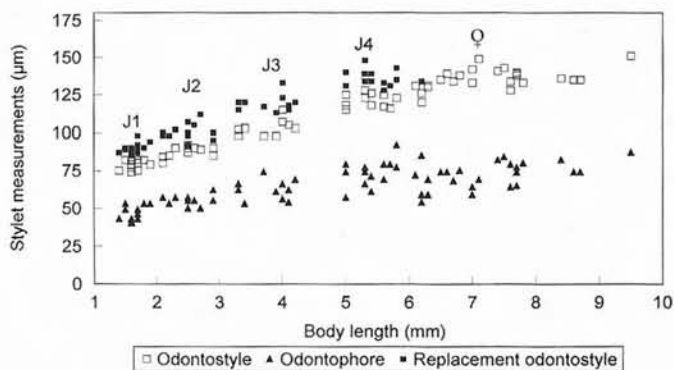


Fig. 7. Scatter diagram plotting body and odontostyles length of individual juveniles and females of *L. urosbis*.

flattened, continuous with the rest of the body, 4-6  $\mu\text{m}$  high. Amphidial pouches slightly asymmetrically bilobed. Odontostyle, odontophore and guide ring typical of the genus. Oesophagus dorylaimoid with the basal bulb measuring 120-145  $\mu\text{m}$  long and 20-30  $\mu\text{m}$  wide, occupying between 1/4 and 1/5 of the total oesophagus length; the basal bulb contains three glandular nuclei. Oesophageal-intestinal valve from shield shaped to amorphous. Vulva at mid-body; vagina thick-walled, occupying 1/2 of the corresponding body diameter; reproductive system amphidelphic with equally developed branches; a large sphincter separates the spermatheca from long, muscularized uteri, containing many sperms; ovaries opposed, reflexed. Prerectum 550-750  $\mu\text{m}$  long; rectum as long as the body diameter at anus. Tail of variable shape, from bluntly rounded to conoid with rounded terminus, dorsally convex and ventrally straight or slightly concave bearing two caudal pores on each side.

Male with the posterior region of the body more coiled than in female. Testes well developed with many sperms. Spicules robust, bent ventrally. The adanal pair of supplements is preceded by a row of 9-15 ventromedian supplements. Tail dorsally convex and ventrally slightly concave, conoid with rounded terminus; it bears two caudal pores on each side.

Juveniles, as indicated in the original description (Krnjaić *et al.*, 2000) separated into four stages (Fig. 7) with the first stage with digitate tail.

**Remarks** – The identification code for this population, according to the Chen *et al.* (1997) polytomous key is: A 4/5, B 2/3, C 3/4, D 3, E 3, F 3/4/5, G 1/2/3, H 1/2, I 2, which fits the code given in the original description (Krnjaić *et al.*, 2000) for *L. urosbis*.

Compared to the type population from Montenegro, *L. urosbis* from Serbia has a larger body.

It is the first time that *L. urosbis* is reported after its original description from Montenegro. It occurred in the rhizosphere of *Quercus robur* L., *Betula nigra* L. and *Taxodium distichum* Rich.

**PARALONGIDORUS MILANIS** Krnjaić,  
**Lamberti, Krnjaić, Agostinelli et Radicci, 2000**  
(Table V; Figs 8 and 9)

Female *habitus* an open C. Body small for the genus and slender, tapering gradually to the extremities. Glandular structures are present in lateral hypodermal cords along body. Lip region, laterally rounded, 4-4.5 µm high, continuous with the rest of the body. Amphidial pouches stirrup shaped with wide (more than half lip region width) slit like aperture. Odontostyle, odontophore and guide ring typical of the genus. Oesophagus dorylaimoid with the muscular bulb ca. 100 µm long and 20 µm wide, occupying 1/4 of the total oesophagus length. The basal bulb contains three nuclei.

**Table V.** Morphometrics of *Paralongidorus milanis* from Serbia.

n	11 ♀	1 ♂	17 J1	26 J2	7 J3	1 J4
L (mm)	4.4±0.29 3.8-4.8	3.9	1.6±0.09 1.5-1.9	2.5±0.25 2-2.9	3.4±0.44 2.9-4	4.8
a	93.7±6.18 86-105	95	64.7±4.61 58-64	74±12.22 51-112	82.7±6.90 73-95	98
b	10.8±1.30 9-14	9	5.6±1.00 5-8	6.8±0.86 6-9	7.9±1.46 6-10	8
c	131.2±16.90 106-173	102	36.7±3.26 29-43	60.2±6.14 50-71	86±6.31 79-98	109
c'	1±0.11 0.8-1.2	1.7	2.5±0.21 2.1-2.9	1.6±0.22 1.2-2	1.3±0.11 1.1-1.4	1
V%	46.8±1.64 44-49	–	–	–	–	–
Odontostyle µm	118.8±4.90 112-130	118	78.8±3.64 72-84	88±2.80 82-93	107±3.18 103-113	115
Odontophore µm	60.7±5.53 50-66	57	42.6±3.00 38-49	43.2±5.51 34-56	53±10.62 41-69	55
Replacement odontostyle µm	–	–	87.1±3.89 84-92	105±5.66 95-118	118.6±4.24 112-126	131
Oral aperture to guide ring µm	33.8±1.22 31-36	33	23.3±1.40 20-25	27±1.55 25-30	30±2.52 26-34	36
Tail µm	34.2±3.94 26-41	38	44.3±3.14 39-51	41.3±2.51 38-46	39.1±4.14 33-46	44
J (hyalin portion of tail) µm	10.8±0.93 10-13	11	17.8±2.56 16-25	9.7±1.32 8-14	10.4±1.99 8-13	12
Body diam. at lip region µm	12.5±0.97 11-14	13	8.8±0.83 8-10	10.1±0.52 9-11	12±1.53 11-15	15
Body diam. at guide ring µm	23.6±1.50 21-25	23	15.3±1.21 13-18	17.7±1.66 15-20	21±2.54 18-25	26
Body diam. at base of oesophagus µm	40.3±2.95 36-44	38	23.4±2.26 18-28	32±3.96 26-46	37±2.54 33-39	46
Body diam. at mid-body or vulva µm	47.3±3.82 41-52	41	25.2±1.85 22-30	35.2±5.19 28-51	40.6±3.60 36-46	48
Body diam. at anus µm	33±1.87 30-36	23	17.5±1.46 15-21	26.3±3.53 20-33	30.1±5.46 20-38	40
Body diam. at beginning of J µm	23±2.08 20-26	21	10.4±1.69 8-14	16.5±3.33 11-26	21.6±4.47 15-30	30
Mucro of the tail µm	–	–	9.4±1.23 8-12	–	–	–

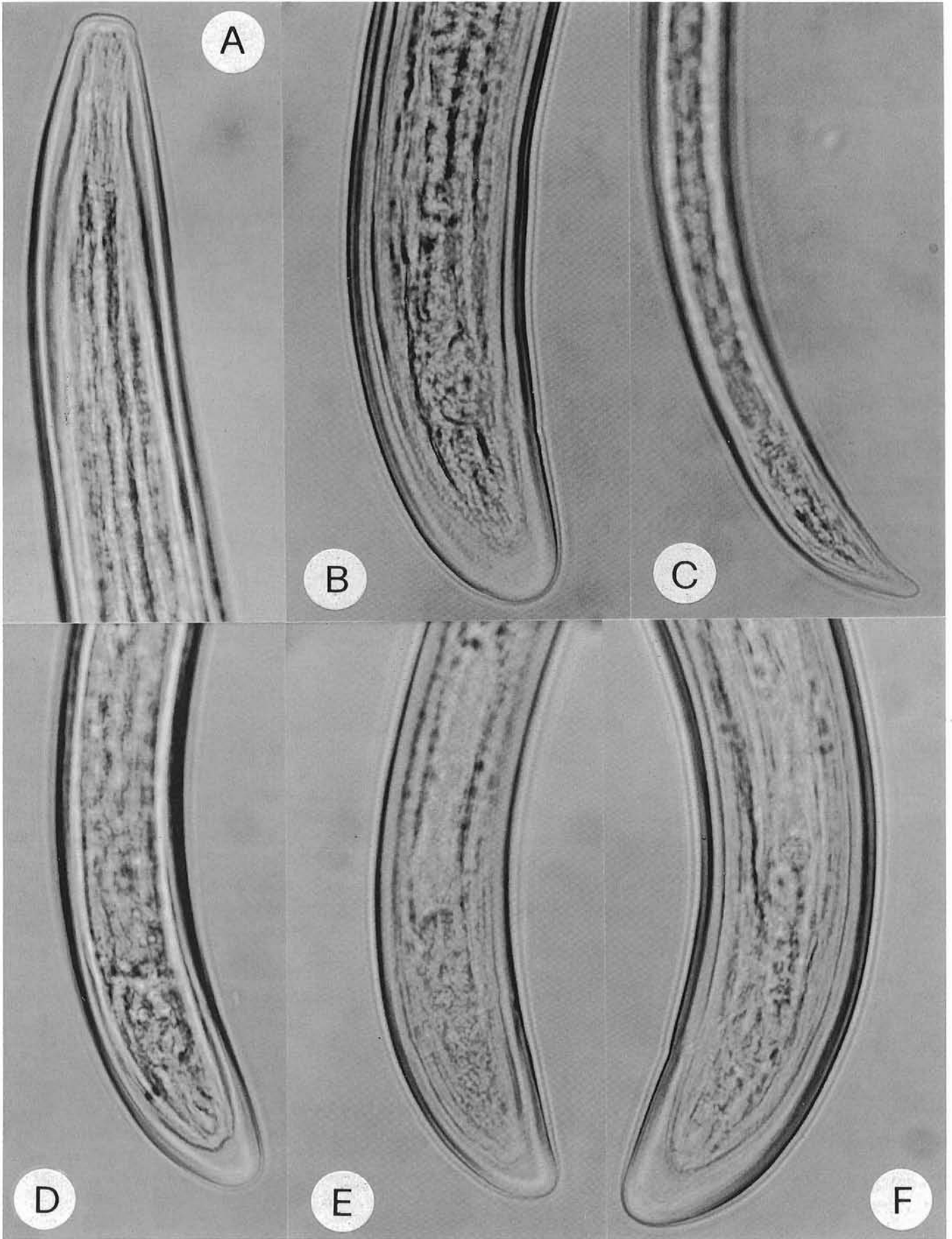


Fig. 8. Photomicrographs of *Paralongidorus milanis*: A, female anterior region; B, female posterior regions; C-F, tail of first, second, third and fourth juvenile stages, respectively.

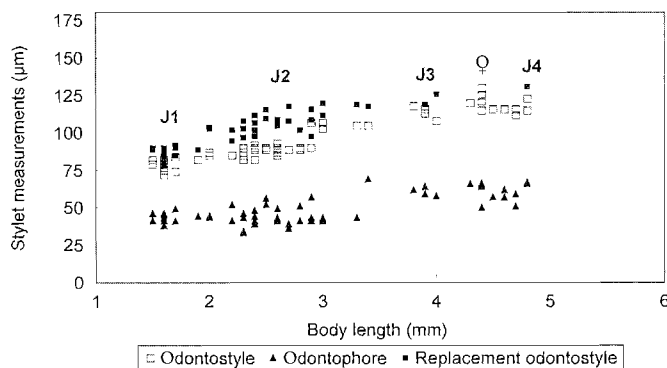


Fig. 9. Scatter diagram plotting body and odontostyles length of individual juveniles and females of *P. milanis*.

Vulva a transverse slit situated slightly anterior to mid-body; vagina thick-walled, occupying 1/2 body diameter; reproductive system amphidelphic with equally developed genital branches; a sphincter separates the uterus from the oviduct; ovaries opposed, reflexed. Pre-rectum as long as 7-11 anal body width. Tail conoid with rounded terminus, dorsally convex and ventrally slightly concave, bearing two caudal pores on each side.

Males are rare in this species (Krnjaić *et al.*, 2000) and only one male was found in this population. It was incompletely developed, with non-functional testes. Spicules are robust, ventrally arcuate, measuring 47 µm with lens-shaped guiding pieces measuring 17 µm long and 4 µm wide. The adanal pair of supplements is preceded by a row of six ventromedian supplements. Tail conical, with rounded terminus, dorsally convex and ventrally slightly concave, bearing two caudal pores on each side.

Juveniles are separated into four groups (Fig. 9). Tail of the first stage juveniles is variable from subdigitate to digitate; only one fourth stages juveniles was found, which has the same size as adult females.

**Remarks** – The identification code for this population of *P. milanis*, according to the polytomous key proposed by Escuer and Arias (1997) is: A 1, B 1, C 1, D 2, E 2, F 2, G 4/5, H 1/2/3, J 2/3, K 2, L 1/2, M 1/2, N 1, O 1, which coincides with the code proposed with the original description (Krnjaić *et al.*, 2000). However, compared to the type population, the Serbian population of *P. milanis* is longer and with a longer odontostyle.

This constitutes the first record of *P. milanis* after its description from Montenegro. It was found in the rhizosphere of *Quercus robur* L. and *Platanus acerifolia* Ait.

**PARALONGIDORUS SERBICUS sp.n.**  
(Table VI; Figs 10-12)

Female *habitus* from an open C to a single spiral. Body medium sized, cylindrical, tapering towards the extremities. Cuticle finely transversally striated, ca. 2.5 µm thick along body. Lip region continuous with the

rest of the body, subacute, 5-6 µm high. Amphidial pouches slightly symmetrically bilobed at the base with slit like aperture, wider than 1/2 of the corresponding body width. Odontostyle, odontophore and guide ring typical of the genus. Oesophagus dorylaimoid with the posterior bulb measuring 110 (98-131) µm long and 20-22 µm wide and occupying 1/5 to 1/4 of the total oesophagus length; it contains three glandular nuclei. Oesophagus-intestinal valve heart-shaped. Vulva a transverse slit 20 µm wide; situated at mid-body; vagina thick-walled, occupying 1/3 to 1/2 of the body diameter. Reproductive system amphidelphic, with almost equally developed genital branches (the anterior 507-615 µm and the posterior 530-590 µm); a robust sphincter separates the uterus from the oviduct; ovaries opposed reflexed. Pre-rectum as long as 8-12 times the anal body width; rectum as long as 1/2-2/3 the anal body width. Tail conoid with broadly rounded terminus, bearing two caudal pores on each side.

A single female had a reduced posterior genital branch with an 80 µm long uterus and lacking the remaining structures.

Male not found.

The juveniles separate into four stages (Fig. 12); they are similar to females, with a J posture and with elongate, conical tail in the first stage.

**Type habitat and locality:** rhizosphere of *Populus nigra* L., *Morus nigra* L. and *Aesculus hippocastanum* L. in the Topchider Park in Belgrado, Serbia. It also occurred in other Serbian localities such as Bela Crkva and Medvedja in the rhizosphere of grapevines (*Vitis* sp.), Knjazvac, Zaječar, Niš, Aleksinac and Jajici in various fruit tree nurseries and in the rhizosphere of fig (*Ficus carica* L.) in a glasshouse near Belgrade.

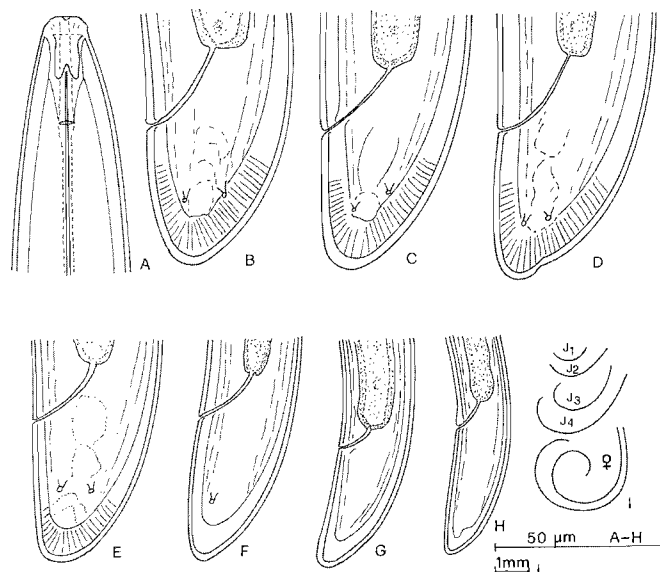


Fig. 10. *Paralongidorus serbicus* sp.n.: A, female anterior region; B-D, female posterior regions; E-H, tail of fourth, third, second and first juvenile stages, respectively; I, *habitus* of dead specimens.





Fig. 11. Photomicrographs of *P. serbicus* sp.n.: A, female anterior region; B-D, female posterior regions; E, vulva region; F-I, first, second, third and fourth juvenile stages, respectively.

**Type material:** holotype female and 20 female and 35 juvenile paratypes at the Istituto per la Protezione delle Piante, Sezione di Bari, Consiglio Nazionale delle Ricerche, Bari, Italy and 13 female and 12 juvenile

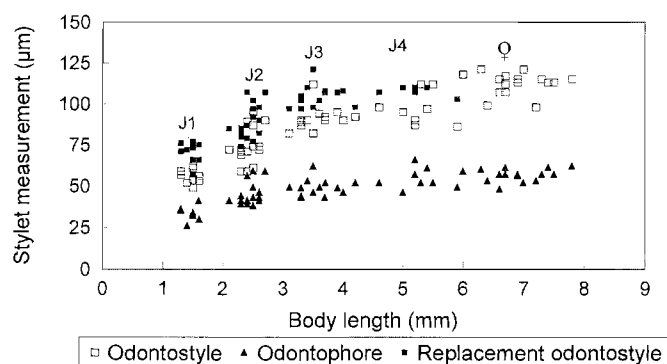
paratypes in the Institute for Plant Protection and Environment, Belgrade, Yugoslavia.

**Diagnosis:** *Paralongidorus serbicus* sp.n. is a mono-



**Table VI.** Morphometrics of *Paralongidorus serbicus* sp.n. from Serbia.

n	Holotype			Paratypes		
	♀	20♀	9 J1	12 J2	9 J3	17 J4
L (mm)	7.4	67 ± 0.65 5.3-7.8	1.5±0.10 1.3-1.6	2.4±0.16 2.1-2.6	2.9±0.63 2.3-4.2	4.2±0.94 3.2-5.9
a	129	117.9±12.21 96-142	59.3±6.91 46-70	78.9±5.68 71-92	83±10.39 64-98	90±11.37 72-116
b	16	15.1±2.53 10-21	6.2±1.09 5-8	8.5±1.17 7-10	8.8±3.03 6-14	12±2.37 7-16
c	172	167.5±20.43 120-200	38±5.29 33-49	58.3±4.83 50-67	69.6±16.09 50-102	94.9±21.12 67-132
c'	1,0	1.0±0.09 0.8-1.1	2.4±0.27 2-2.7	1.6±0.15 1.4-1.8	1.4±0.17 1.1-1.6	1.2±0.19 1-1.6
V%	50	49.2±1.50 47-54	–	–	–	–
Odontostyle µm	113	111.6±6.06 98-121	55.1±4.88 49-62	68.8±5.70 59-74	85.2±10.02 61-95	92.5±6.08 86-112
Odontophore µm	61	56±4.21 48-62	32.4±2.96 26-36	41.3±2.38 38-46	50.9±6.47 39-59	49.6±8.43 38-66
Replacement odontostyle µm	–	–	69.9±5.95 57-76	84.3±6.77 74-98	99.4±4.98 92-107	107.4±4.49 102-121
Oral aperture to guide ring µm	34	35.4±1.42 34-38	19.3±1.12 18-21	24.8±1.11 23-27	27.4±1.81 25-30	30.2±1.48 28-33
Tail µm	43	40.1±2.77 34-44	39.7±5.29 30-46	41.7±3.85 33-46	42.9±3.48 38-48	43.6±2.89 39-49
J (hyalin portion of tail) µm	10	13±3.03 10-20	7.7±0.71 7-9	8.6±1.56 6-10	9.4±1.13 8-11	9.9±1.69 8-14
Body diam. at lip region µm	14	13.2±0.62 12-15	7.7±0.71 7-9	9.6±0.51 9-10	10.4±0.73 9-11	11.5±1.12 9-14
Body diam. at guide ring µm	26	25.7±1.22 24-30	14.6±1.51 12.0-16	15.8±0.45 15-16	17.6±1.33 16-20	19.8±3.00 16-28
Body diam. at base of oesophagus µm	51	46.4±4.43 41-59	22.7±0.71 21-23	29.6±1.68 26-33	32.8±3.19 28-39	39.2±5.63 33-54
Body diam. at mid-body or vulva µm	57	56.9±5.80 51-75	24.6±1.94 22-28	31.9±1.78 30-36	35.6±4.98 28-43	45.9±8.16 36-67
Body diam. at anus µm	43	41.8±4.14 37-57	16.2±1.09 15-18	25.2±1.34 23-28	28.8±3.93 25-36	35.2±4.58 30-44
Body diam. at beginning of J µm	30	28.5±4.36 23-49	10.1±1.62 9-12	14.5±2.78 10-20	16.4±2.01 13-20	21.9±5.73 16-38

**Fig. 12.** Scatter diagram plotting body and odontostyles length of individual juveniles and females of *P. serbicus* sp.n.

sexual species characterized by females with body length of 6-7 mm; sub-acute lip region, continuous with the rest of the body, slightly symmetrically bilobed amphidial pouches, odontostyle length of 112 µm; at mid-body vulva and conical bluntly rounded tail; juvenile stages separate into four groups.

The code in the polytomous key of Escuer and Arias (1997) is: A 3, B 1, C 1, D 2, E 1, F 2/3/4/5, G 3/4, H 1/2, I 2/3, J 2/3, K 2, L 2/3, M 2/3.

**Relationships:** *Paralongidorus serbicus* sp.n. is similar to *P. costatus* (Jacobs *et* Heyns, 1987) Siddiqi, Baujard *et* Mountport, 1993 and to *P. wiesae* (Heyns, 1994) Escuer *et* Arias, 1997. However, it differs from *P. costatus* in its longer body (L = 4 mm in *P. costatus*),

its lower value of  $c'$  (1.6 in *P. costatus*) and its thinner body profile. *P. costatus*, described originally as a *Longidoroides* species (Jacobs and Heyns, 1987), was subsequently transferred to the genus *Paralongidorus* (Siddiqui *et al.*, 1993).

Compared to *P. wiesae*, *P. serbicus* has longer body (L = 4.5 mm in *P. wiesae*), anterior guide ring (43  $\mu$ m from the anterior end in *P. wiesae*) and higher  $c$  value (123 in *P. wiesae*). *P. wiesae* was originally described within the genus *Longidoroides* (Heyns, 1994).

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