

MORPHOLOGY AND DISTRIBUTION OF *Longidorus euonymus* (NEMATODA) FROM ROMANIA

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Abstract

Longidorus euonymus Mali et Hooper, 1974 from three localities in Romania is described and illustrated on the basis of adult and juvenile specimens. This species was recovered in association with barley, strawberry, blackberry, cherry, sour cherry, plum and represents a new geographical record for Romanian longidorid fauna.

Key words: Longidoridae, new record.

INTRODUCTION

The genus *Longidorus* Micoletzky, 1922, includes a number of large ectoparasitic nematode species that are polyphagous on many plants, including various agricultural crops, and that cause damages by direct feeding on root cell as well as by transmitting nepoviruses (Taylor and Brown, 1997). Peneva et al. (2013) listed 158 *Longidorus* species and their associated type host plants. Hitherto, *Longidorus elongatus* de Man, 1876 was the only one *Longidorus* species recorded in Romania (Popovici, 1973).

Longidorus euonymus was originally described by Mali and Hooper (1974) from the rhizosphere of spindle trees (*Eunoymus europaeus* L.) that were often infected with euonymus mosaic virus (EMV) in different localities of the Bratislava district (Slovakia). With one exception (Syria by Lamberti et al., 1999), this species has been recorded from Continental Europe only (Oro et al., 2005).

Longidorus euonymus has a wide plant host range, being associated with numerous annual, perennial and woody plants: grasses, corn, strawberry, carrot, blackberry, black currant, rose, nettle, grapevine, peach, tobacco, quince, willow, apple, walnut (Lamberti et al., 1983), *Pinus nigra* and *Pinus sylvestris* (Peneva and Choleva, 1992a) from Bulgaria; poplar, cherry, (Oro et al., 2005), *Sambucus nigra* L.,

Amorpha fruticosa L. (Barsi and Lamberti, 2003) from Serbia; natural grassland from Lithuania (Stanelis, 2003); wheat, barley, potato from Slovakia (Liskova and Brown, 2003), plum from Czech Republic (Kumari and Decraemer, 2007). It is interesting to mention that Barsi (1994) described a bivulval female of *L. euonymus* in the rhizosphere of poplar from former Yugoslavia.

MATERIALS AND METHODS

Soil samples containing *L. euonymus* were collected from Moscu (Galați county), Mărăcineni (Argeș county) and Voinești (Dâmbovița) in the rhizosphere of barley (*Hordeum vulgare* L.), strawberry (*Fragaria x ananasa* Duch), blackberry (*Rubus fruticosus* L.) cherry (*Prunus avium* L.), sour cherry (*Prunus cerasus* L.) and plum (*Prunus domestica* L.) at a depth of 20-40 cm.

Nematodes were extracted from 200 cm³ soil by a sieving and decanting technique, heat killed at 55-60°C for two minutes and fixed in a 4% formaldehyde solution. The specimens were processed and subsequently mounted on permanent microscopic glass slides (Seinhorst, 1959).

Photographs were taken using an Axio Imager. M2-Carl Zeiss compound microscope equipped with a digital camera (ProgRes C7) and specialized software (CapturePro Software

2.8). Measurements were made using a system of Olympus BX41 light microscope, a digitising tablet (CalComp Drawing Board III, GTCO CalCom Peripherals, Scottsdale, AZ, USA), Digitrak 1.0f programme (Philip Smith, Scottish Crop Research Institute, Dundee, UK) or Leica DMLB microscope fitted with Leica DFC 295 camera and LAS V 4.2 software.

RESULTS AND DISCUSSIONS

Longidorus euonymus Mali et Hooper, 1974

Description (Figures 1-6; Tables 1-4)

Females: habitus a more or less open C to a single spiral, when killed; body slender, cylindrical. Lip region slightly expanded, flat frontally and rounded laterally. Amphidial pouches more or less asymmetrically bilobed. Tail conical, dorsally convex with mostly bluntly rounded terminus.

Moscu (*H. vulgare*) population. Cuticle thickness at postlabial region 2-3 μm , at mid-body 3-4 μm , on postanal region 5-6 μm . Pharyngeal bulb measuring 121 (114-127) μm x 18 (16-19) μm ; anterior uterus 234 (192-262) μm long; posterior uterus 282 (195-260) long; rectum 30.4 (26-39) μm long; prerectum 363.2 (237-488) μm long.

Mărăcineni (*R. fruticosus*) population. Cuticle thickness at postlabial region 2.5-3 μm , at mid-body 3.5 μm , on postanal region 4-5 μm . Pharyngeal bulb measuring 120 μm x 17.5 μm ; anterior to nerve ring 185, 195 μm ; anterior uterus 240, 245 μm long; posterior uterus 257, 270 μm long; rectum 30-35 μm long; prerectum 283, 285 μm long.

Mărăcineni (*F. x ananassa*) population. Cuticle thickness at postlabial region 2 μm , at mid-body 3-4 μm , on postanal region 4-5 μm . Pharyngeal bulb measuring 107, 116 μm x 18 μm ; anterior to nerve ring 182, 181 μm ; anterior uterus 199, 189 μm long; posterior uterus 177, 199 μm long; rectum 32, 28 μm long; prerectum 270, 235 μm long.

Voinești (*P. avium*) population. Cuticle thickness at postlabial region 2-3 μm , at mid-

body 3-6 μm , on postanal region 4.5-5 μm . Pharyngeal bulb length 117 (110-122) μm x 17.9 (17-19) μm ; anterior uterus 279.4 (233-330) μm long, posterior uterus 256 (337-280) μm long, rectum 25.6 (23-27) μm long, prerectum 311(238-432) μm long.

Male: not found.

Juveniles: Separated in four juvenile stages: on barley, strawberry and cherry all stages present; on blackberry first stage juvenile not found (Figures 3-6). They resemble adults except body size and tail which is conoid and almost of the same length in all juvenile stages; tail in first stage juvenile elongate conoid and in successive stages it becomes progressively blunter and wider, bluntly conoid in the fourth stage.

The morphometrics overlapped for *L. euonymus* populations from Moscu, Voinești and Mărăcineni, except for the size of pharyngeal bulb for Mărăcineni (strawberry) population. Length of hyaline part of tail and body diameter of hyaline part was longer and wider (9.5-11 μm vs 8-10 μm ; 20-21 μm vs 10-19 μm).

The morphometric characters recorded from Romanian populations were within the range of original description (Mali and Hooper, 1974) and of those reported for Bulgarian (Peneva and Choleva, 1992a) and Serbian (Oro et al., 2005; Barsi and Lamberti, 2003) populations.

The most abundant was barley population (35 spec./ 200 cm^3 soil) followed by cherry (15 spec./ 200 cm^3 soil), blackberry and strawberry (6 spec./ 200 cm^3 soil) populations.

CONCLUSIONS

Measurements and morphological data of female specimens and juvenile stages of *L. euonymus* are provided for the first time for Romanian populations. This species was relatively common in the studied area occurring in 6 out of 34 sites sampled.

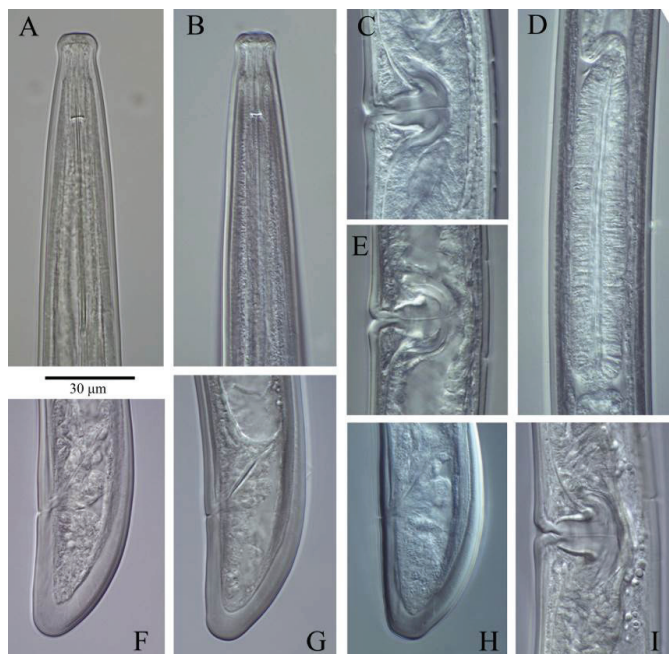


Figure 1. *Longidorus euonymus*. Females. A, B, anterior ends; C, E, I, vaginal regions; D, pharyngeal bulb; F-H, variations in tail shape. Origin of populations: A, F, G, I – Mărăcineni; B-E, H – Voinești; Scale bar: 30 µm

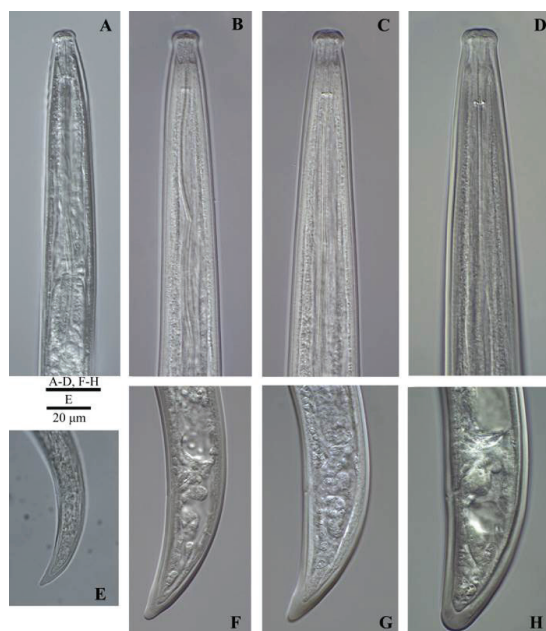


Figure 2. *Longidorus euonymus*. Juveniles. A-D, Anterior ends of first – to fourth-stage juveniles; E-H, Tails of first- to fourth – juvenile stages, females and male. Populations: A, E – Moscu; B, C, F, G – Mărăcineni; D, H – Voinești; Scale bars: 20 µm

Table 1. Measurements of *Longidorus euonymus* on barley (*Hordeum vulgare*) from Moscu (mean \pm standard deviation, with range), in micrometers, except body length (mm)

Character	Female	J1	J2	J3	J4
n	11	1	2	7	14
L	6.76 \pm 0.61 5.98-7.87	1.40	1.64, 2.26	3.28 \pm 0.28 2.84-3.60	4.89 \pm 0.33 4.52-5.41
a	156.1 \pm 11.1 138.3-174.6	62.5	75.5, 90.8	93.5 \pm 9.7 77.7-103.7	131.0 \pm 18.8 109.7-175
b	17.7 \pm 2.0 14.7-21.3	6.5	6.4, 8.1	10.4 \pm 1.4 7.5-11.7	14.0 \pm 2.2 11.1-18.7
c	146.5 \pm 14.4 116.1-171.9	29.3	35.9, 47.0	63.2 \pm 7.4 55.1-74.0	100.7 \pm 10.4 79.9-113.1
c'	1.3 \pm 0.2 1.0-1.6	3.2	2.8, 2.5	2.1 \pm 0.2 1.8-2.5	1.6 \pm 0.2 1.4-2.1
V (%)	50.9 \pm 1.9 48.6-54.3	-	-	-	-
G1 (%)	6.6 \pm 0.7 5.0-7.3	-	-	-	-
G2 (%)	6.3 \pm 0.5 5.3-7.0	-	-	-	-
d	0.3	2.1	2.2, 2.1	2.2 \pm 0.1 2.0-2.4	2.1 \pm 0.2 1.9-2.3
d'	0.8 \pm 0.1 0.8-1.1	1.5	1.6, 1.5	1.6 \pm 0.1 1.4-1.8	1.5 \pm 0.1 1.4-1.7
Anterior end to guiding ring	28.6 \pm 1.2 27-31	16	18, 19	22.9 \pm 0.9 21-24.5	25.4 \pm 1.4 23-27
Odontostyle	84.2 \pm 3.0 80-89	51	58, 60	65.5 \pm 2.4 62-69	73.5 \pm 2.1 71-77
Replacement odontostyle	-	55	63, 64	73.1 \pm 2.9 70-77	83.3 \pm 3.2 77-88
Odontophore	62.3 \pm 5.7 54-76	33	41, 41	51.2 \pm 2.8 47-56	57.8 \pm 2.3 54-61
Pharynx length	385.5 \pm 31.2 320-435	218	258.5, 278	320.3 \pm 38.8 277-379	355.7 \pm 47.8 271-423
Tail	46.5 \pm 4.6 39-53	48	46, 48	52.1 \pm 3.5 49-60	48.9 \pm 4.7 41-59
Length of hyaline part	8.8 \pm 1.1 7-11	8	6.5, 6	8.9 \pm 2.1 6-12	8.0 \pm 1.4 6-11
Body diameter at: - lip region	13 \pm 1.1 11-15	8	8, 9	10.5 \pm 0.7 9.5-11.5	11.9 \pm 0.6 11-13
- guiding ring	19 \pm 0.7 18-20	12	13, 14	16.4 \pm 0.6 16-18	17.8 \pm 0.9 16-20
- base of pharynx	36 \pm 1.7 34-38	22	21, 26	30.7 \pm 1.3 29-32	34.0 \pm 1.4 31-36
- mid-body/at vulva	43.3 \pm 1.9 41-46	22.5	22, 25	35.4 \pm 4.3 30-42	38.1 \pm 4.2 30-44
- anus	35.6 \pm 5.4 32-51	15	16, 19	24.8 \pm 1.7 22-27	30.3 \pm 1.6 28-33
- hyaline part	13.1 \pm 1.8 10-16	6	6, 7	10.4 \pm 1.3 8-12	13.7 \pm 1.3 12-15

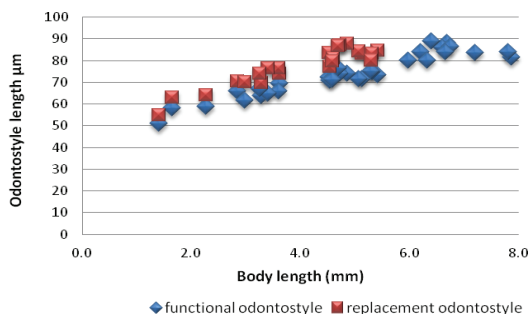


Figure 3. Scatter plot of functional and replacement odontostyle in relation to body length of *Longidorus euonymus*, Moscu population on *Hordeum vulgare*

Table 2. Measurements of *Longidorus euonymus* on strawberry (*Fragaria x ananasa*) from Mărăcini (mean ± standard deviation, with range), in micrometers, except body length (mm)

Character	Female	J1	J2	J3	J4
n	3	1	8	4	3
L	6.57, 6.34, 5.82	1.3	2.06±0.14 1.85-2.32	2.87±0.13 2.68-2.98	3.09, 4.34, 3.68
a	154.3, 169.6, 147.9	66.3	78.8±6.6 70-89	99.4±12.1 85.0-113.7	92.1, 133.2, 111.5
b	17.2, 17.9, 14.6	5.5	7.4±0.5 6.6-8.2	9.3±0.7 8.5-10.1	9.5, 11.3, 11.7
c	142.4, 154.2, 130.6	34.4	41.7±3.8 34.9-46.9	61.1±6.4 54.2-69.6	54.3, 82.7, 87.0
c'	1.4, 1.3, 1.4	2.5	2.7±0.2 2.3-3.1	2.1±0.1 2.1-2.3	2.4, 1.9, 1.5
V (%)	53.2, 54.6, 52.1	-	-	-	-
G1 (%)	6.9, 6.7, 7.5	-	-	-	-
G2 (%)	6.8, 6.2, 6.8	-	-	-	-
d	2.1, 2.2, 2.6	2.5	2.5±0.2 2.2-3.0	0.4	2.1, 2, 1.7
d'	1.5, 1.5, 1.6	2.1	2.1±0.2 1.6-2.3	2.1±0.2 1.8-2.3	1.9, 2.1, 1.9
Anterior end to guiding ring	27, 27, 34	15	19.8±0.8 19-21	22.6±0.8 22-24	26, 25, 23.5
Odontostyle	81, 81.5, 82	48	55.0±1.4 52.5-57	60.6±1.5 58.5-62	64, 71, 64
Replacement odontostyle	-	56	63.0±1.5 60-64.5	68.5±1.3 67-70	79, 80, 77
Odontophore	74, 66, 58	32	41.2±4.9 31-46.5	47.3±3.7 42-50	51, 54, 45
Pharynx length	383, 355, 399.5	240	277.5±15.3 249-299	310.1±28.2 285-349	324, 386, 313
Tail	46, 41, 45	38	49.7±4.1 47-59.5	47.4±3.5 42.5-50	57, 52.5, 42
Length of hyaline part	11, 11, 9.5	6	6.5±0.8 5-8	8.7±1.2 7.5-10	12, 7, 8
Body diameter at: - lip region	13, 12, 13	8	9.4±0.6 8.5-10	10.5±0.5 10-11	11, 12, 11
- guiding ring	20, 18, 21	12	14.1±0.4 13.5-15	15.4±0.6 15-16	16, 17, 18.5
- base of pharynx	36.5, 34, 34	20	24.4±1.4 23-27	27.7±1.4 26-29	30, 30, 32
- mid-body/at vulva	43, 37, 39	20	26.3±2.7 23-30	29.2±2.4 26-32	33.5, 33, 33
- anus	33, 31, 32	15	18.8±1.1 17-20	22.2±1.5 20.5-24	23, 28, 27
- hyaline part	21, 20, 21	6	6.7±0.9 5-8	9.0±0.6 8.5-10	10, 13, 16

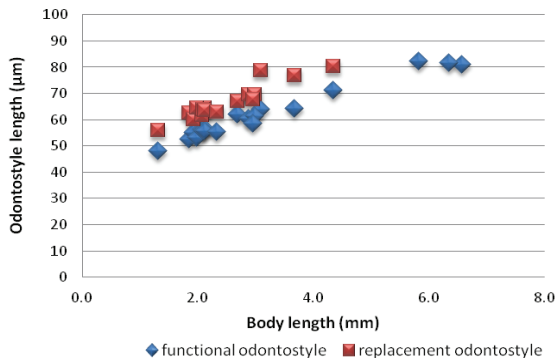


Figure 4. Scatter plot of functional and replacement odontostyle in relation to body length of *Longidorus euonymus*, Mărăcini population on *Fragaria x ananasa* Duch

Table 3. Measurements of *Longidorus euonymus* on blackberry (*Rubus fruticosus*) from Mărăcinieni (mean \pm standard deviation, with range), in micrometers, except body length (mm)

Character	Female	J2	J3	J4
n	3	1	5	2
L	7.40, 7.08 5.76	2.36	3.31 \pm 3.27 3.00 - 3.77	4.75, 4.92
a	170.6, -, 142.2	78.9	99.8 \pm 4.8 96.6-107.9	132.1, 144.7
b	17.5, -, 14.2	8.0	10.5 \pm 1.0 9.0-11.7	12.1, 10.3
c	201.3, -, 169.0	51.5	70.0 \pm 9.1 61.1-78.5	95.7, 111.3
c'	1.2, 1.2, -	2.3	2.1 \pm 0.2 1.9-2.3	1.7, 1.6
V (%)	52.4, 54.6, 50.6	-	-	-
G1 (%)	6.3, -, 8.3	-	-	-
G2 (%)	6.8, -, 9.7	--	-	-
d	2.3, 2.0, 1.7	2.2	2.0 \pm 0.1 1.9-2.1	1.9, 1.6
d'	1.5, 1.4, 1.3	2.2	1.5 \pm 0.1 1.4-1.7	2.0, 2.2
Anterior end to guiding ring	29, 28, 26	21	23.2 \pm 1.4 22-25	26.5, 28
Odontostyle	85, 82, 77	52	62.8 \pm 2.2 60-65	70, 71
Replacement odontostyle	-	61	68.6 \pm 2.2 65-70	75, 81
Odontophore	61, 60, 60	46	52.8 \pm 1.8 50- 55	53, 60
Pharynx length	423, -, 405	297	315.6 \pm 13.4 302-334	392, 480
Tail	37, 42, -	46	48.8 \pm 5.3 42-55	50, 44
Length of hyaline part	9, 11, 7	8.5	8.8 \pm 1.1 7-10	8, 8
Body diameter at: - lip region	-	-	-	8, 8
- guiding ring	13, 14, 14.5	9.5	11.5 \pm 0.3 11-12	12, 12
- base of pharynx	19, 19, 19	16	17.1 \pm 0.8 17-19	18, 18
- mid-body/at vulva	35, -, 34	27	29.8 \pm 2.3 27-33	33, 31.5
- anus	43, -, 40.5	30	33.2 \pm 2.6 30-36	36, 34
- hyaline part	32, 34, 31.5	20	23.8 \pm 3.0 21-27	30, 28
Anterior end to guiding ring	17, 18, 15	8	10.6 \pm 0.7 10-11	12.5, 14

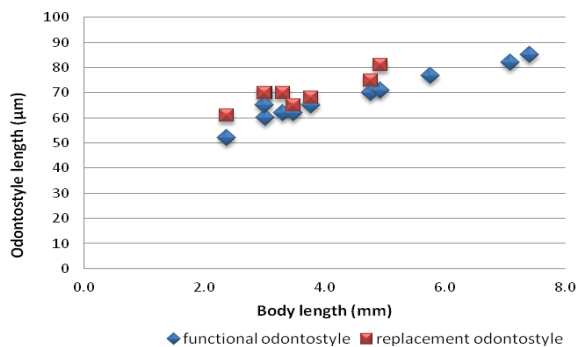


Figure 5. Scatter plot of functional and replacement odontostyle in relation to body length of *Longidorus euonymus*, Mărăcinieni population on *Rubus fruticosus* L.

Table 4. Measurements of *Longidorus euonymus* on *Prunus avium* from Voinești (mean \pm standard deviation, with range), in micrometers, except body length (mm)

Character	Female	J1	J2	J3	J4
n	7	2	8	7	7
L	6.5 \pm 0.47 5.8-7.2	1.41, 1.64	2.1 \pm 0.15 1.9-2.3	3.2 \pm 0.31 2.7-3.5	4.6 \pm 4.2 4.2-5.3
a	151.5 \pm 7.8 139.1-164	64.4, 74.7	81.3 \pm 2.2 79.0-84.4	106.2 \pm 8.4 93.0-115.2	134.9 \pm 21.9 115.5-173.4
b	15.8 \pm 1.5 14.2-18.3	6.7, -	7.7 \pm 0.6 6.6-8.3	10.1 \pm 0.6 8.9-10.9	12.5 \pm 1.8 9.7-14.7
c	140.7 \pm 8.7 126.1-151.2	33.7, 35.7	43.7 \pm 3.3 37.5-47.3	63.2 \pm 3.4 59.3-67.0	98.6 \pm 12.2 83.8-110.0
c'	1.4 \pm 0.05 1.3-1.4	2.8, 2.70	2.5 \pm 0.2 2.3-2.8	2.2 \pm 0.1 2.1-2.5	1.6 \pm 0.1 1.5-1.8
V (%)	51.8 \pm 1.1 50.0-53.1	-	-	-	-
G1 (%)	7.4 \pm 0.74 6.5-8.2	-	-	-	-
G2 (%)	7.3 \pm 0.5 6.7-7.8	-	-	-	-
d	2.1 \pm 0.08 2.0-2.3	2.0-2.1	2.1 \pm 0.2 1.8-2.6	2.1 \pm 0.1 2.0-2.2	2.1 2.0-2.1
d'	1.4 \pm 0.05 1.3-1.5	1.8, 1.75	1.5 \pm 0.1 1.4-1.7	1.5 1.4-1.5	1.4 \pm 0.1 1.2-1.5
Anterior end to guiding ring	28.2 \pm 1.3 26.6-30	16, 17	20.3 \pm 1.5 19-23	23.3 \pm 0.8 22-24	24.6 \pm 0.6 24-25
Odontostyle	81.7 \pm 1.2 80-84	50, 51	55.4 \pm 1.4 53-58	62.7 \pm 2.8 60-67	71.1 \pm 1.8 69-73
Replacement odontostyle	-	55, 55	62.4 \pm 2.9 59-68	70.8 \pm 2.5 67-74	81.7 \pm 2.7 78-85
Odontophore	60.6 \pm 2.6 55-63		45.9 \pm 2.2 42-49	52.3 \pm 2.6 50-55	55.7 \pm 2.8 52-60
Pharynx length	411.8 \pm 24.8 371-450	210	281.4 \pm 26.4 242-315	324.1 \pm 25.2 285-355	379.4 \pm 45.8 330.0-465
Tail	46.3 \pm 1.6 44-48	42, 46	49.5 \pm 2.6 46-53	53.1 \pm 2.1 51-56	47.7 \pm 4.3 41-52
Length of hyaline part	8.7 \pm 0.8 8-10	7, 6	6.8 \pm 1.1 5-8	8.2 \pm 0.5 8-9	7.1 \pm 0.7 6-8
Body diameter at: - lip region	13.1 \pm 0.37 13-14	8, 8	9.7 \pm 0.6 9-10	11.2 \pm 0.2 11-12	11.9 \pm 0.2 12-12
- guiding ring	19.1 \pm 0.4 18-20	14, 14	14.7 \pm 0.7 13.5-16	16.6 \pm 0.4 16-17	16.8 \pm 1.4 14-18
- base of pharynx	30.7 \pm 1.4 34-37	21, -	25.3 \pm 2.0 23-29	28.2 \pm 2.8 23-31	32.3 \pm 1.5 30-34
- mid-body/at vulva	43.0 \pm 1.40 41-45	22, 22	26.4 \pm 1.4 25-28.0	30.7 \pm 2.0 28-33	35.0 \pm 3.1 31-39
- anus	32.5 \pm 0.6 32-33.5	15, 17	19.6 \pm 0.9 18-21	23.7 \pm 1.7 21-25	30.0 \pm 1.6 28-33
- hyaline part	17.6 \pm 0.74 17-19	5, 6	7.4 \pm 0.9 6-8	10.1 \pm 0.7 9-11	13.5 \pm 0.5 12-14

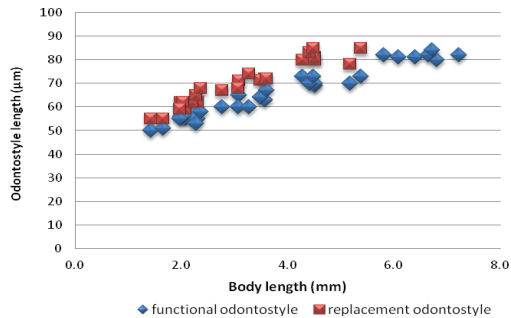


Figure 6. Scatter plot of functional and replacement odontostyle in relation to body length of *Longidorus euonymus*, Voinești population on *Prunus avium* L.

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REFERENCES

- Barsi L., Lamberti F., 2003. Morphometrics of adults and juvenile stages of three longidorid nematodes (Nematoda: Dorylaimida) from Vojvodina Province, Northern Serbia, *Nematologia mediterranea*, 31, p. 65-85.
- Kumari S., Decraemer W., 2007. The genus *Longidorus* (Nematoda: Longidoridae) from Bohemia and South Moravia in the rhizosphere of fruit orchards and vineyards. *Helminthologia*, 44 (4), p. 193-203.
- Lamberti F., Choleva B., Agostinelli A., 1983. Longidoridae from Bulgaria (Nematoda, Dorylaimida) with description of three new species of *Longidorus* and two new species of *Xiphinema*, 11, p. 49-72.
- Liščová M., Brown D.J.F., 1995. The occurrence and distribution of *Longidorus leptcephalus* (Nematoda: Dorylaimida) in the Slovak Republic with comment on the putative “large” and “small” forms. *Nematologia mediterranea*, 23, p. 315-320.
- Oro V., Hubschen J., Karanastasi E., Krnjaic D., Brown D.J.F., Neilson R., 2005. Inter-population variability of *Longidorus euonymus* Mali and Hooper, 1974 (Nematoda: Dorylaimida) and comment upon the number of juvenile developmental stages. *Helminthologia*, 42 (3), p. 155-165.
- Peneva V., Choleva B., 1992a. Nematodes of the family Longidoridae from forest nurseries in Bulgaria. 1. The genus *Longidorus* Micoletzky, 1922. *Helminthologiya*, 32, p. 35-45.
- Peneva V., Lazarova S., De Luca F., Brown J.F., 2013. Description of *Longidorus cholevae* sp. n. (Nematoda, Dorylaimida) from riparian habitat in the Rila Mountains, Bulgaria. *ZooKeys*, 330, 1-26.
- Popvici I., 1973. Nematode din sol în fauna României. *St. Cerc. Biol., Seria Zoologie*, 25, p. 9-15.
- Seinhorst J.W., 1959 A rapid method for the transfer of nematodes from fixative to anhydrous glycerine. *Nematologica*, 4, p. 67-69.
- Stanilis A., 2003. *Longidorus euonymus* Mali & Hooper, 1974 (Nematoda: Dorylaimida) in Lithuanian natural grassland. *Russ. J. Nematol.*, 11, p. 61-62.
- Taylor C.E., Brown D.J.F., 1997. Nematode vectors of plant viruses. Wallingford, U.K. CAB International, P. 286.