

## THE GENUS *TYLENCHUS* BASTIAN, 1865 IN ROMANIA (NEMATODA: TYLENCHIDAE)

M. Ciobanu<sup>1</sup>, E. Geraert<sup>2</sup> and I. Popovici<sup>1</sup>

<sup>1</sup> Institute of Biological Research, Department of Taxonomy and Ecology, 48 Republicii Street, 3400 Cluj-Napoca, Romania

<sup>2</sup> Vakgroep Biologie, Ledeganckstraat 35, 9000 Gent, Belgium

**Summary.** Specimens of *Tylenchus butteus*, *T. davainei*, *T. elegans*, *T. maius* and *T. naranensis* collected from various habitats located mainly in the Romanian Carpathians are studied by light microscope. Brief descriptions, measurements, illustrations and data referring to their occurrence in Romania and their habitats are provided. *T. elegans* and *T. naranensis* are new records for the Romanian nematode fauna. The male of *T. naranensis* is reported, described and illustrated for the first time.

Four species of *Tylenchus* Bastian, 1865 have been reported from Romania: *T. butteus* Thorne *et* Malek, 1968 was reported from either mountainous and timberline spruce forests and also from subalpine scrubs located in the Retezat Mts., at altitudes ranging from 1500-1950 m (Popovici, 1993); *T. davainei* Bastian, 1865 was first reported in Romania by Micoletzky (1917, quoted in Andrásy, 1959). Andrásy did not provide any indication about the location from where this species was collected. Later on *T. davainei* was reported from grasslands and agricultural fields near Cluj-Napoca town (Popovici, 1974), subalpine scrub and grasslands from the Retezat Mts. (Popovici, 1993), grasslands located in the Someşan Plateau, Bihor and Trascău Mts. (Popovici and Ciobanu, 1997; Popovici, 1998). *T. maius* Andrásy, 1979 was collected from the Carpathians beech forests by Popovici (1989); no indication about the sampling site was provided. Later on *T. maius* was reported from beech forests located between 1150-1250 m in the Retezat Mts. (Popovici, 1993); and *T. arcuatus* Siddiqi, 1963 (Popovici, 1993).

During several ecological surveys, nematodes were collected and stored in the nematode collection at the Institute of Biological Research. This paper is a contribution towards an inventory of the species belonging to the genus *Tylenchus* in Romania.

Data on the distribution of these species were included in the Romanian nematode fauna database.

### MATERIALS AND METHODS

Soil samples were collected between 1988 and 1998 by the third and first author. Eleven sites distributed mainly in the Romanian Carpathians (grasslands, forests, crack of cliffs and one technogenic soil) were sampled (Table I).

Nematodes were extracted using the centrifugal method of de Grisse (1969), killed and preserved in a 4 % formaldehyde solution, heated at 65 °C, mounted in anhydrous glycerin (Seinhorst, 1959) and examined with a Reichert light microscope.

**Table I.** Site locations, vegetation and soil types of a nematological survey in Romania.

Site no.	Locality	Altitude (m)	Geographical position	Plant association	Soil type
1	Ciucaş Mts.	1900	45°26'N-25°52'E	-	Undeveloped soil
2	Gurghiu Mts.	1530	46°57'N-25°06'E	<i>Hieracio rotundati-Piceetum</i>	Acid brown
3	Harghita Mts.	1500	46°35'N-24°23'E	<i>Hieracio rotundati-Piceetum</i>	Acid brown
4	Măgura Mt.	950	47°22'N-24°54'E	<i>Festuco rubrae-Agrostetum</i>	Argilluvic brown
5	Metaliferi Mts.	950	46°26'N-23°17'E	<i>Astrantio-Trisetetum flavescens</i>	Cambic rendzina
6	Rarău Mts.	950	47°27'N-25°34'E	<i>Hieracio rotundati-Piceetum</i>	Ferrilluvic podzol
7	Rodnei Mts.	525	47°25'N-24°46'E	-	Technogenic soil <sup>2</sup>
8	Someşan Plateau	350	46°45'N-23°35'E	<i>Jurineo transsilvanicae-Stipetum pulcherimae</i>	Chernozem
9	Transylvanian Plain	370-450	46°46'N-23°58'E	<i>Salvio nutantis-Festucetum rupicolae</i>	Not available
10	Trascău Mts.	400	46°30'N-23°41'E	<i>Melico-Phleetum montani</i>	Lithic rendzina
11	Vrancei Mts.	850	45°55'N-26°40'E	<i>Leucanthemo waldsteinii-Fagetum</i>	Lithic brown

<sup>1</sup> Mts.-Mountains; <sup>2</sup> soil from mining spoil containing Pb and Zn impurities under bioremediation.

The papers of Andrásy (1979), Brzeski (1996, 1998) and Maqbool and Shahina (1987) were used for identification, taxonomy and comments of species.

All measurements in the tables are in  $\mu\text{m}$ ; average values and range were calculated for each measurement.

Plant associations' classification was used according to Coldea (1991). Soil types were classified according to the Romanian System of Soil Classification (Conea *et al.*, 1980).

## RESULTS

Five species were found: *T. butteus*, *T. davainei*, *T. elegans* de Man, 1876, *T. maius* and *T. naranensis* Maqbool *et al.*, 1987; *T. elegans* and *T. naranensis* represent new records for Romania; *T. arcuatus* was not found during our sampling.

## DESCRIPTIONS

### *TYLENCHUS BUTTEUS* Thorne *et* Malek, 1968

(Table II; Fig. 1)

Female body ventrally arcuate, cuticular annulation distinct. Lateral field with outer margin weakly crenated. Head continuous, with 4-5 fine annules. Stylet 11  $\mu\text{m}$  in length. Anterior portion of oesophagus shorter than posterior one. Vulva-anus distance shorter or equal

to tail length. Spermatheca elongated, not offset, filled with sperm about 3  $\mu\text{m}$  in diameter. Tail end pointed; in one female tail terminus hook-shaped.

Male not found.

Distribution. Spruce forest located in the Harghita Mts. (Eastern Carpathians), site no. 3 (Table I). By reporting *T. butteus* from the Harghita Mts. we broaden its geographical distribution in Romania.

Remarks. Our measurements come close to those made in the original description by Thorne and Malek (1968). *T. butteus* was found in the same type of habitat from which it was first collected in Romania by Popovici (1993) (spruce forest on acid soil located at 1500 m altitude). This might suggest its specialization for wet acid soils.

### *TYLENCHUS DAVAINI* Bastian, 1865

(Table II)

Female body ventrally curved, C-shaped, cuticular annulation distinct. Lateral field with outer margin crenated. Head from continuous to off-set, with 4-5 annules. Stylet 14-19  $\mu\text{m}$  in length. Vulva-anus distance longer than tail length. Spermatheca oval, empty or filled with sperm 2-3  $\mu\text{m}$  in diameter. Tail terminus pointed.

Male more slender than female. Stylet 16-19  $\mu\text{m}$  in length. Bursa well developed, crenated, spicule 20-30  $\mu\text{m}$  in length.

Distribution. Various habitats (grasslands, mixed and

**Table II.** Measurements of *Tylenchus butteus* and *T. davainei*.

Species:	<i>T. butteus</i>			<i>T. davainei</i>			
	Harghita Mts.	Metaliferi Mts.	Trascău Mts.	Măgura Mt.	Gurghiu Mts.	Rarău Mts.	Vrancei Mts.
N	2 ♀♀	2 ♀♀	2 ♀♀	♀	♀	♀♀	6 ♀♀
L	561.0(540-582)	791.0(722-860)	779.5(721-838)	770	897	757.8(700-806)	971.5(863-1037)
A	31.6(30.9-32.3)	33.1(31.9-34.4)	29.5(26.7-32.2)	25.7	29.9	29.3(27.8-31.8)	29.4(27.2-32.0)
B	5.4(5.1-5.6)	6.9(6.7-7.2)	6.5(6.4-6.5)	6.0	6.4	5.8(5.6-6.2)	6.3(5.6-6.6)
C	5.9(5.4-6.5)	7.2(7.1-7.2)	7.1(7.0-7.1)	8.8	7.2	7.1(6.8-7.6)	8.1(7.5-8.3)
C'	9.1(8.2-10.0)	7.4(7.1-7.7)	7.3(5.9-8.6)	8.8	5.7	6.5(5.9-7.7)	5.6(4.8-6.2)
V%	67.5(66.7-68.4)	67.7(65.4-70.0)	64.1(63.4-64.8)	68.2	65.9	67.9(67.3-68.4)	68.9(66.3-70.3)
Oesophagus	104.5(104.0-105.0)	114.0(108.0-120.0)	120.0(112.0-128.0)	127.5	141.0	129.8(125.0-133.0)	154.0(149.0-156.0)
Procorpus	46.5(45.0-48.0)	60.0(60.0-60.0)	58.5(55.0-62.0)	67.5	75.0	67.4(66.0-70.0)	75.0(72.0-78.0)
Isthmus+bulbus	58.0(56.0-60.0)	48.0(48.0-48.0)	61.5(57.0-66.0)	60.0	66.0	62.4(58.0-65.0)	79.0(74.0-81.0)
Proc./Ist.+bulbus %	44.5(42.9-46.2)	52.8(50.0-55.6)	48.8(48.4-49.1)	52.9	53.2	51.9(50.4-53.6)	48.7(47.4-50.3)
MB	39.0(37.7-40.2)	44.1(40.8-47.3)	43.6(43.2-44.0)	47.6	45.3	46.7(45.1-48.5)	44.4(42.4-48.8)
Excretory pore	81.0(81.0-81.0)	97.5(93.0-102.0)	103.5(95.0-112.0)	117.5	140.0	116.6(109.0-124.0)	137.0(130.0-144.0)
Head - vulva	379.0(360.0-398.0)	537.0(472.0-602.0)	500.0(457.0-543.0)	525.0	591.0	515.0(471.0-551.0)	670.0(593.0-726.0)
Tail	95.0(90.0-100.0)	110.5(100.0-121.0)	110.5(101.0-120.0)	87.5	125.0	106.6(100.0-112.0)	120.5(105.0-127.0)
Vulva-anus	87.0(80.0-94.0)	143.5(137.0-150.0)	169.0(163.0-175.0)	157.5	181.0	136.2(124.0-150.0)	181.0(162.0-195.0)
V-an/tail	0.9(0.8-1.0)	1.3(1.1-1.5)	1.5(1.5-1.6)	1.8	1.4	1.3(1.2-1.4)	1.5(1.4-1.6)
Body width	17.8(17.5-18.0)	24.0(21.0-27.0)	26.5(26.0-27.0)	30.0	30.0	26.0(22.0-29.0)	33.2(27.0-36.0)
Anal body width	10.5(10.0-11.0)	15.0(13.0-17.0)	15.5(14.0-17.0)	10.0	22.0	16.6(13.0-18.0)	21.5(17.0-25.0)
Head width	6.0(6.0-6.0)	7.0(7.0-7.0)	7.0(7.0-7.0)	8.0	8.0	7.0(7.0-7.0)	8.0(8.0-8.0)
Postuter. sac	12.3(12.0-12.5)	15.5(15.0-16.0)	17.5(17.0-18.0)	22.5	18.0	19.0(18.0-20.0)	20.3(20.0-22.0)

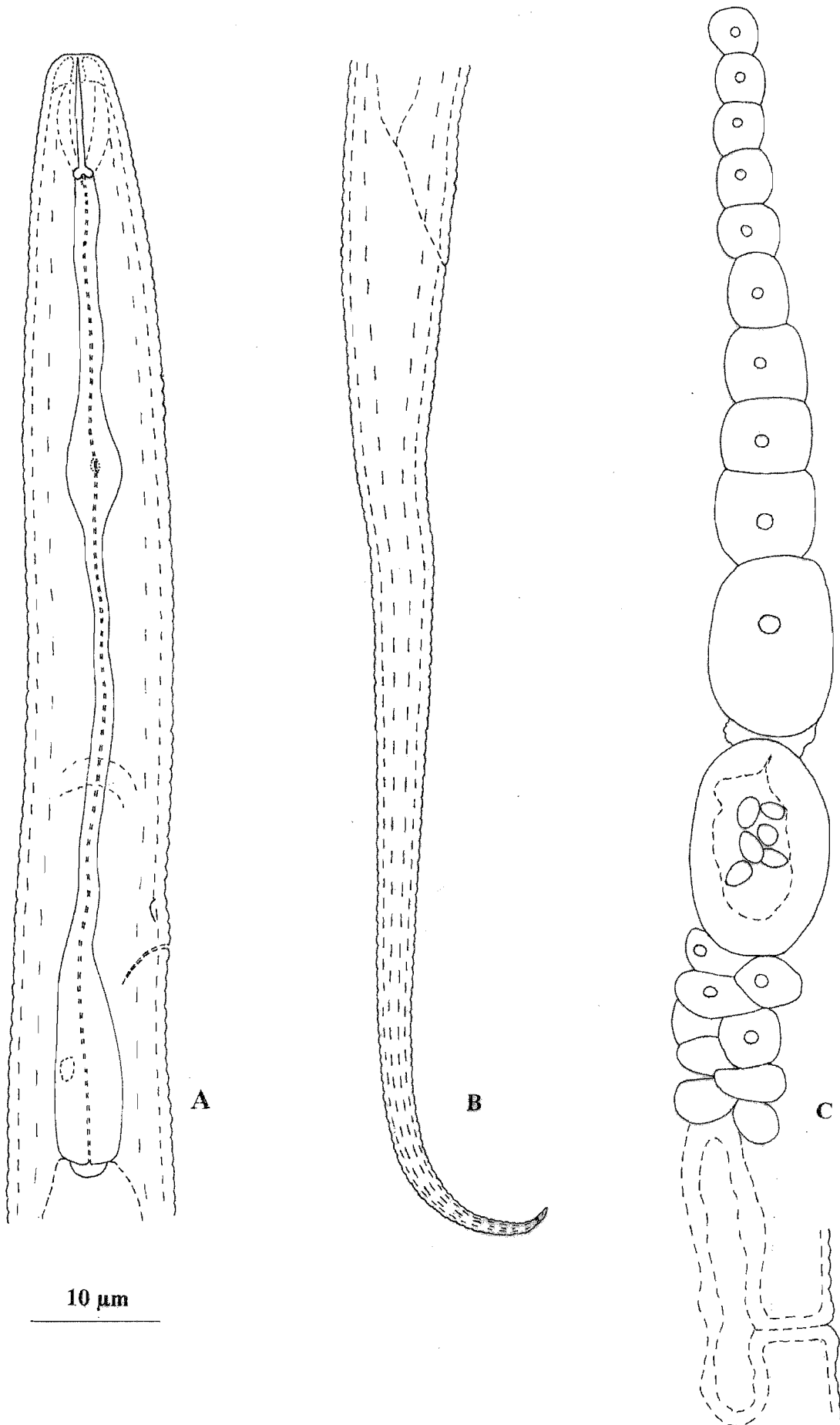


Fig. 1. *Tylenchus butteus*: A, anterior part of female; B, posterior part of female; C, female reproductive system.

spruce forests, undeveloped soil in the cracks of cliffs) located in the Carpathians Mountains, altitude 400-1900 m, sites no. 1, 2, 4-6, 10, 11 (Table I).

Remarks. Several previous reports of *T. davainei* from various natural areas, mainly grasslands (Popovici, 1993, 1998; Popovici and Ciobanu, 1997), as well as from agroecosystems (Popovici, 1974) indicate that it is a common species in Romania.

### *TYLENCHUS ELEGANS* De Man, 1876

(Table III; Fig. 2)

Female body ventrally curved, C-shaped, cuticular annulation distinct. Lateral field with outer margin crenated, central band wider than the marginal ones. Head continuous with four annules. Stylet 14  $\mu$ m in length. Excretory duct refractive. Spermatheca rounded, filled with sperm 2  $\mu$ m in diameter. Tail shorter than vulva-anus distance, terminus finely rounded.

Male not found.

Distribution. Mine spoil dump under bioremediation at Rodna Veche, site no. 7 (Eastern Carpathians) (Table I).

Remarks. A slightly more anterior located vulva can be noted in the Romanian population as compared to the measurements given by Brzeski (1998) ( $V\% = 55-55.7$  in the Romanian specimens *vs*  $V\% = 58-70$  in the Polish specimens). This species has been reported from several European countries as well as from the U.S.A. (Andrássy, 1979). Brzeski (1998) characterized *T. elegans* as the

most common among *Tylenchus* species found in Poland, occurring either in cultivated or uncultivated soils.

The habitat, from where the Romanian specimens were collected, was characterized by low nutrient resources and by high content of Pb and Zn impurities. These data suggest that *T. elegans* is not affected by polluted habitats.

### *TYLENCHUS MAIUS* Andrásy, 1979

(Table III; Fig. 3)

Female body ventrally curved, C-shaped, cuticular annulation distinct. Lateral field crenated. Head continuous with four annules. Stylet 11-12  $\mu$ m in length. Excretory duct refractive. Spermatheca ovoid, empty. Tail shorter than vulva-anus distance, curved, terminus more or less pointed.

Male not found.

Distribution. Grassland located in the Suatu scientific botanical reserve, site no. 9 (Table I).

Remarks. *T. maius* was originally reported from pasture soil collected from Roubaix, South Dakota, U.S.A. The Romanian population is characterized by longer and slightly more slender body and by a greater  $c'$  value ( $L = 0.8-0.9$  mm,  $a = 37.8-42.7$ ,  $c' = 6.1-9.3$  in the Romanian specimens *vs*  $L = 0.5$  mm,  $a = 29-33$ ,  $c' = 6-6.5$  in the American specimens). It is closely related to *T. butteus* from which it differs in having shorter tail and longer vulva-anus distance ( $c = 7.0-8.2$ , vulva-anus distance 1.4-1.7 times longer than tail in *T. maius* *vs*  $c =$

**Table III.** Measurements of *T. elegans*, *T. maius* and *T. naranensis*.

Species:	<i>T. elegans</i>	<i>T. maius</i>	<i>T. naranensis</i>
Site location:	Rodnei Mts.	Transylvanian Plain	Someşan Plateau
n	3 ♀♀	4 ♀♀	10 ♀♀
L	641.0(605-673)	958.8(897-996)	843.8(766.0-1000.0)
a	27.8(24.2-32.2)	40.5(37.8-42.7)	41.6(38.5-45.5)
b	5.6(5.3-5.8)	6.4(5.9-7.5)	6.3(5.5-7.0)
c	5.5(5.2-6.0)	7.6(6.9-8.6)	6.6(6.0-7.9)
c'	8.2(7.1-9.0)	7.6(6.1-9.3)	9.4(8.0-10.5)
V%	55.3(55.0-55.7)	67.9(66.9-68.8)	65.3(62.7-67.5)
Oesophagus	114.7(111.0-119.0)	151.5(133.0-167.0)	135.0(123.0-144.0)
Procorpus	59.3(58.0-60.0)	69.3(62.0-77.0)	59.7(55.0-67.0)
Isthmus+bulbus	55.3(51.0-61.0)	82.3(71.0-90.0)	75.3(68.0-80.0)
Proc./Ist.+bulb.%	51.8(48.7-54.1)	45.7(43.9-46.6)	44.2(42.4-46.5)
MB	45.8(42.9-48.3)	45.7(42.9-48.3)	41.0(38.6-47.6)
Excretory pore	100.0(98.0-102.0)	122.3(109.0-134.0)	107.3(100.0-116.0)
Head - vulva	355.0(335.0-375.0)	650.8(602.0-685.0)	550.9(486.0-665.0)
Tail	115.3(100.0-128.0)	127.0(116.0-141.0)	128.9(112.0-148.0)
Vulva-anus	170.7(170.0-172.0)	181.0(165.0-195.0)	164.0(142.0-187.0)
V-an/tail	1.5(1.3-1.7)	1.4(1.3-1.7)	1.3(1.1-1.6)
Body width	23.3(20.0-25.0)	23.8(21.0-26.0)	20.3(18.0-22.0)
Anal body width	14.0(13.0-15.0)	17.0(14.0-19.0)	13.8(12.0-17.0)
Head width	6.5(6.5-6.5)	6.8(6.0-7.0)	6.1(6.0-7.0)
Post-uter. sac	14.0(13.0-16.0)	14.8(13.0-17.0)	12.7(12.0-14.0)

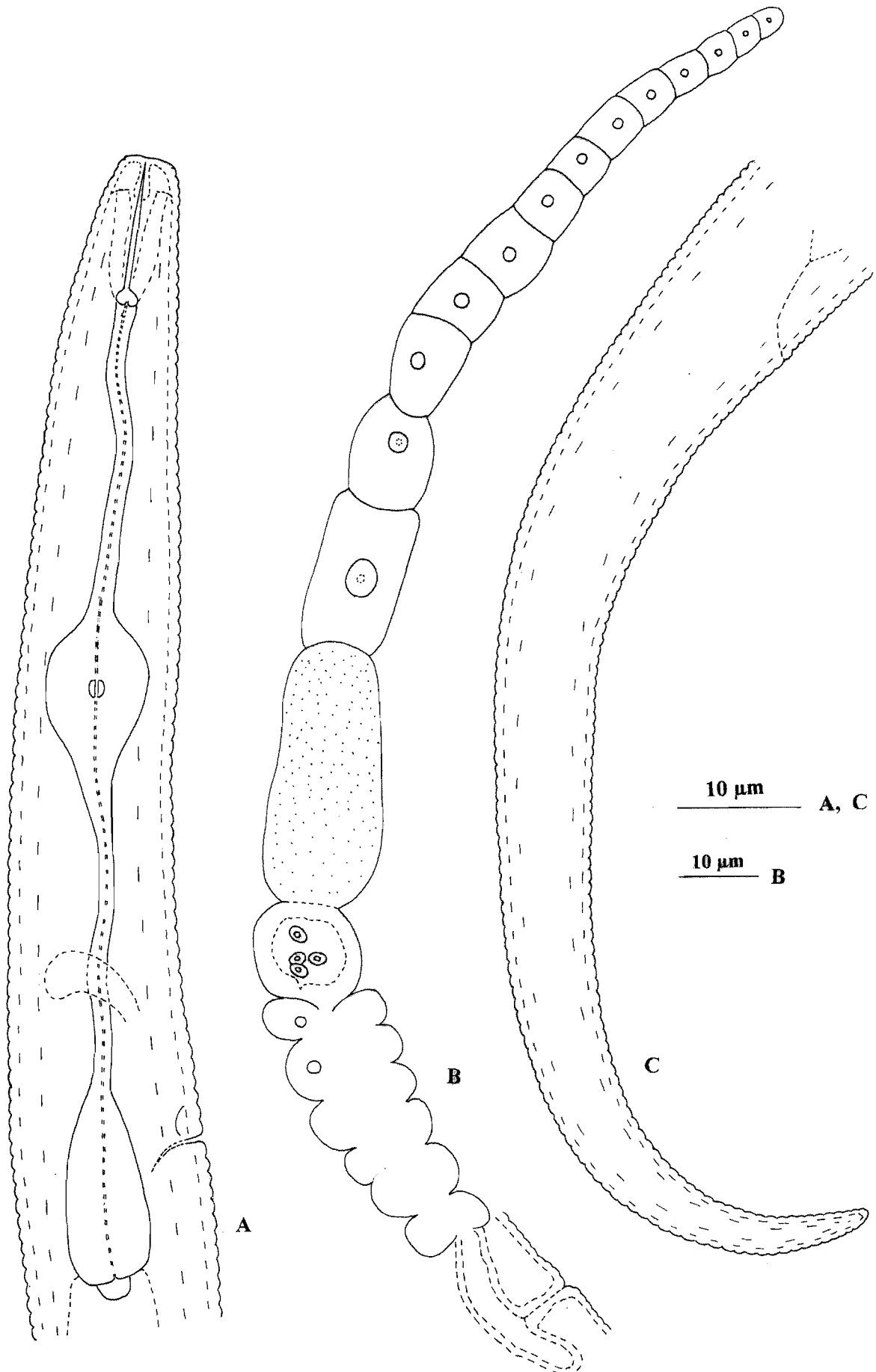


Fig. 2. *T. elegans*: A, anterior part of female; B, female reproductive system; C, posterior part of female.

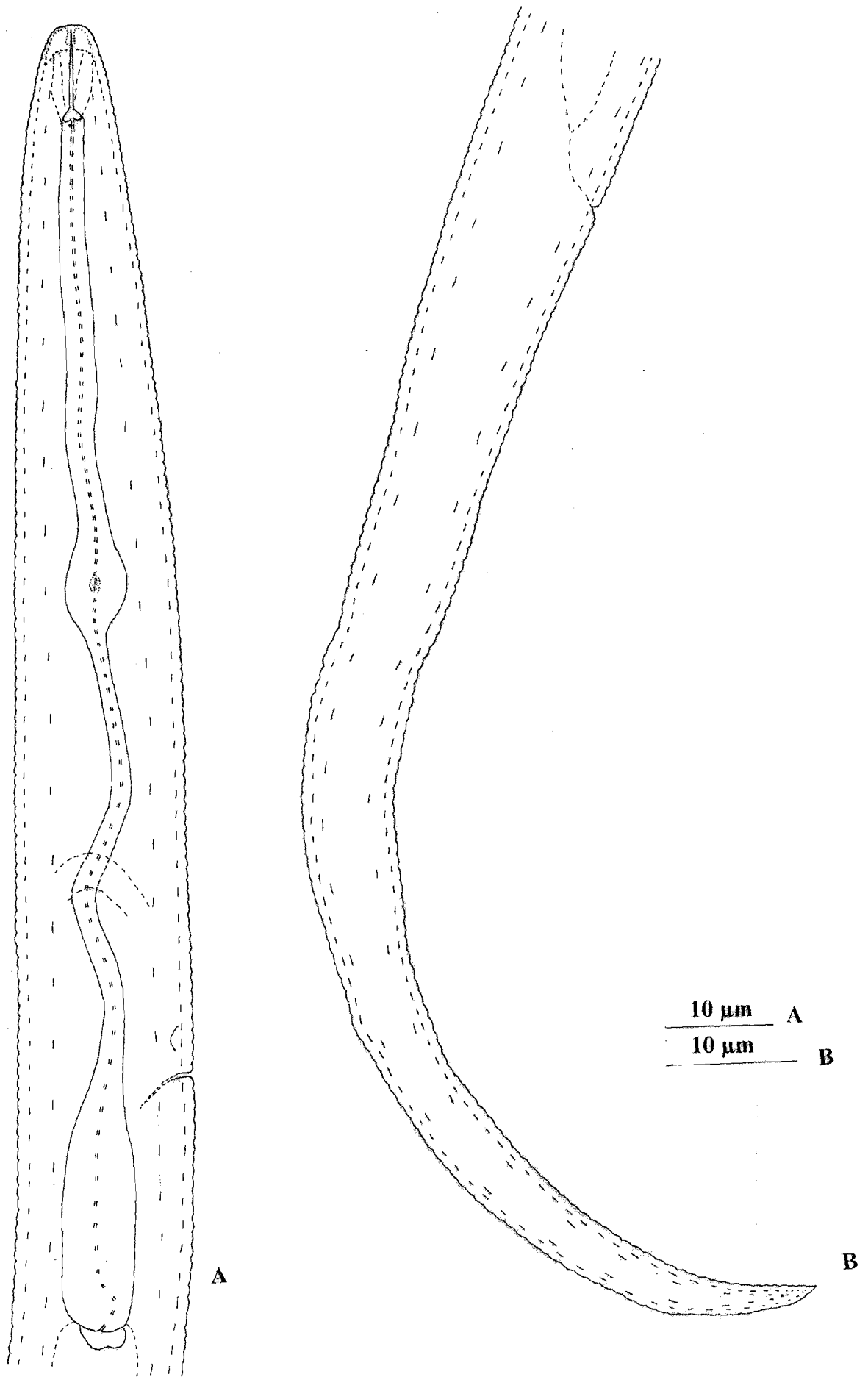


Fig. 3. *T. maius*: A, anterior part of female; B, posterior part of female.

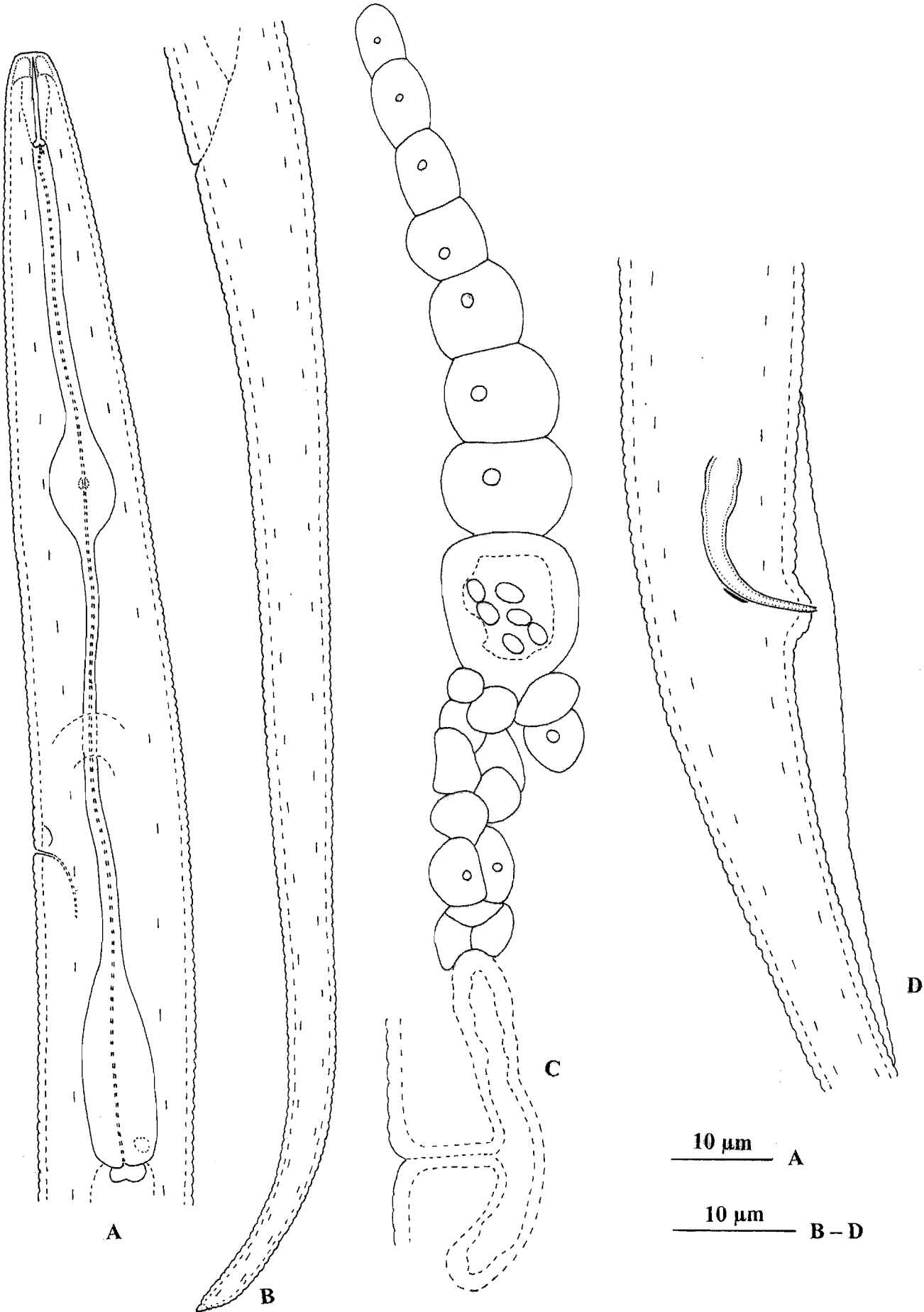


Fig. 4. *T. naranensis*: A, anterior part of female; B, posterior part of female; C, female reproductive system; D, male cloacal region.

4.5, vulva-anus distance shorter than tail in *T. butteus*).

By reporting *T. maius* from the Suatu scientific botanical reserve we broaden its geographical distribution in Romania.

**TYLENCHUS NARANENSIS Maqbool,  
Zarina et Ghazala, 1987**  
(Table III; Fig. 4)

Female body ventrally arcuate, cuticle finely annulated. Lateral field weakly crenated. Head continuous with 4-5 fine annules. Stylet 10-11  $\mu\text{m}$  in length. Excretory duct refractive. Spermatheca rounded, filled with sperm about 2  $\mu\text{m}$  in diameter. Tail shorter than vulva-anus distance, curved, gradually tapering to a rounded terminus. Male slightly shorter than female, with well-developed bursa, spicule 25-29  $\mu\text{m}$  in length.

Distribution. Grassland located in the scientific botanical reserve Fânațele Clujului, site no. 8 (Table I).

Remarks. *T. naranensis* was originally reported from soil around roots of *Silene conoidea* L. from Naran, Pakistan (Maqbool *et al.*, 1987). Short stylet and long body are distinctive characters for this species. According to Maqbool *et al.* (1987), *T. naranensis* is closely related to *T. hamatus* Thorne and Malek, 1968, *T. sandneri* Wasilewska, 1965 and *T. kirjanovae* Andrásy, 1954. It differs from *T. hamatus* in having longer body and stylet, shorter anterior portion of oesophagus and shorter vulva-anus distance ( $L = 0.7-0.8$  mm, stylet 9.6-10.4  $\mu\text{m}$ , anterior portion of oesophagus 45-46%, vulva-anus distance 1-1.2 in *T. naranensis* vs  $L = 0.6$  mm, stylet 8-9  $\mu\text{m}$ , both anterior portion of oesophagus equal in length, vulva-anus distance 1.5 in *T. hamatus*).

It can be differentiated from *T. sandneri* by its longer body and stylet, longer anterior portion of oesophagus, longer tail (110-117  $\mu\text{m}$ ) and more anterior located vulva ( $L = 0.3-0.4$  mm, stylet 7.7-8.2  $\mu\text{m}$ , anterior part of oesophagus 38-40%, tail 56  $\mu\text{m}$  and  $V\% = 76-78.8$  in *T. sandneri*).

It can also be differentiated by *T. kirjanovae* in having posteriorly located vulva and greater a and c values ( $a = 36-43.6$ ,  $c = 6.0-7.0$  in *T. naranensis* vs  $V\% = 48-50$ ,  $a = 28-31$ ,  $c = 4.8-5.2$  in *T. kirjanovae*).

Our measurements come close to those of the type population, but in the Romanian population vulva-anus/tail ratio is slightly wider (1.1-1.6) and tail is longer (112-148).

In the Romanian population males were present and spermatheca filled vs no males present and spermatheca without sperm in type population.

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