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Criconematidae (Nematoda) in the Slovak Republic

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Summary

The occurrence of criconematid nematodes was investigated in various types of vegetation throughout the territory of the Slovak Republic. These nematodes were observed in 25 % of all soil samples with different frequency in individual types of vegetation. A total of seventeen species was recorded, from which nine species are for the first time observed in this territory. Most of the species are associated with natural types of vegetation, two species only, *Mesocriconema antipolitanum* and *M. xenoplax,* were observed in arable soil as well as in natural ecosystems. These two species together with *Criconema annuliferum* are the most widespread species. *Criconemoides annulatus, C. parvus, Criconema longulum, Ogma cobbi, Ogma menzeli,* unidentified *Ogma* sp., and *Xenocriconemella macrodora* were observed exclusively in soils with various forest types. More ecological and systematical informations on individual species observed are presented here.

Key words: Criconematidae; *Mesocriconema*; *Criconemoides*; *Criconema*; *Ogma*; *Xenocriconemella*; various types of vegetation, Slovak Republic

Introduction

Research on nematodofauna of various cultivated and forest types of vegetation during the last 40 years revealed partial information about the occurrence of criconematid nematodes in the territory of the Slovak Republic (Sabová and Valocká, 1977; Lišková, 1977; Vargová, 1983; Šály, 1983). A list of 16 so far recognized species with their first record from the country is given in Table 1. At present, apart from quite an extensive investigation of numerous soil samples for the presence of longidorid nematodes, numerous populations of criconematids were observed and examined as well. Some of the species are recorded from the Slovak territory for the first time. The obtained results of the occurrence, geographical distribution, ecology, host plants and morphological characters of the nematode species recorded for the first time are presented here. This work does not claim to be a complete survey of these nematodes in the Slovak Republic. However, the assembled information can contribute to piecing together the local picture of plant parasitic nematodes from the Slovak territory as well as to shaping their larger European picture.

Material and Methods

From the rhizosphere of various plants of agroecosystems and natural vegetation throughout the territory of the Slovak Republic, 782 soil samples (from cereal 33, potato 51, grassland 113, vineyard 62, fruit orchard 44, nut orchard 89, forest 312, flooded forest 24 and from river bank vegetation 54 soil samples) were collected. Since a complete nematode fauna of different plants grown on arable soil was examined during previous decades, the collecting of soil samples was concentrated more on the natural ecosystems. The nematodes were extracted from 500 g of soil using decanting and sieving technique (Brown and Boag, 1988), fixed by hot TAF and mounted in anhydrous glycerin on slides for examination. For identification up-to-date systematic works of De Grisse and Loof (1965), Siddiqi (1985; 2000) and Brzeski *et al*. (2002a;b) were mostly used.

Results and Discussion

From a total of 782 examined soil samples, criconematid nematodes were observed in 197 soil samples with frequency of 25 %. There are differences in frequency of criconematids in various types of vegetation (Table 2). The highest frequency was recorded in the rhizosphere of walnut trees, grapevine and forest trees (37, 32, resp. 31 %), followed by flooded forest and fruit trees (with prevalence of 25, resp. 23 %), in river bank vegetation mostly with *Alnus glutinosa*, *Salix* sp. and *Rubus caesius* (17 %) and in different grasses with prevalence of 14 %. The lowest fre-

Table 1. List of criconematid nematodes already recorded from the Slovak Republic

Nematode species	Hosts	Authors*
Macroposthonia annulata	*Quercetum*	Šály, 1978
M. annulatiformis	Forest nurseries	Stollárová, 1997
M. crenata	Forest nurseries	Stollárová, 1997
M. kralli	Forest nurseries	Stollárová, 1997
M. macrolobata	Grapevine	Lišková, 1977
M. ornata	*Dactylus glomerata*	Vargová, 1983
M. rustica	*Querceto - Fraxinetum*	Šály, 1969
M. similis	Grapevine	Lišková, 1977
M. xenoplax	Forest nurseries	Lišková *et al*., 1996
Criconemoides amorphus	Wheat, barley, rye, clover	Sabová and Valocká, 1977
C. informis	Wet meadow	Šály, 1976
C. morgenis	Forest nurseries	Lišková *et al.*, 1996
Nothocriconema annuliferum	*Quercetum*	Šály, 1970
N. demani	Grassland	Šály, 1974
Crossonema menzeli	*Petasites* sp.	Šály, 1978
Ogma cobbi	*Quercetum*	Šály, 1983

* Author of the first record from the teritory of the Slovak Republic

Table 2. The frequency of criconematid nematodes in various types of vegetation in the Slovak Republic

Vegetation type	Number of collected soil samples	Number of positive soil samples	Frequency of Criconematids in %
Cereals	33	3	9.1
Potatoes	51	5	9.8
Grassland	113	16	14.2
Vineyards	62	20	32.2
Fruit orchards	44	10	22.7
Nut orchards	89	33	37.1
Forest	312	98	31.4
Flooded forest	24	6	25.0
River banks	54	9	16.7
Total	782	197	25.2

quency was recorded in potato and cereal fields (10, respectively 9 %).

A list of the observed species with numbers of records from individual types of vegetation is given in Table 3. A total of 17 species of criconematid nematodes was identified, from which 8 species - *Mesocriconema curvatum, M. dherdei, Criconemoides annulatus*, *C. parvus, Criconema longulum, C. mutabile, C. princeps and Xenocriconemella macrodora* and one unidentified *Ogma* species were for the first time recorded from the territory of Slovakia. Individual nematode species were identified using morphometrical characteristics of females. Males and larval stages were not observed. The most frequent species were *Mesocriconema xenoplax* (30 % of all records), *Criconema annuliferum* (18 %), *Mesocriconema antipolitanum* (12 %), *Criconema princeps* (9 %) and *Criconemoides amorphus* (7 %).

Ecological notes on the occurrence of criconematid species already known from the Slovak Republic

Genus *Mesocriconema*

M. antipolitanum (de Guiran, 1963) Loof *et* De Grisse, 1989 was identified in 24 soil samples, mostly from fruit orchards, vineyards and oak forests. It is the only species occurring in arable soil with potatoes and together with *M. xenoplax* in soil with barley and wheat. In Slovakia it was for the first time recorded as syn. *Macroposthonia macrolobata* (Jairajpuri *et* Siddiqi, 1963) De Grisse *et* Loof, 1965 from a vineyard (Lišková, 1977). Its occurrence is more concentrated in sandy soils with regosol soil type derived from dune sand in southern Slovakia or in fluvisol soil type derived from fluvial sediments throughout the territory. Next to *M. xenoplax, M. antipolitanum* is the second most frequent *Mesocriconema* species.

M. rusticum (Micoletzky, 1915) Loof *et* De Grisse, 1989, was observed in Slovakia in forest with *Quercus* sp., *Carpinus betulus*, *Pinus* sp. (Šály, 1969, 1971) and in natural grassland (Šály, 1976) as syn. *Macroposthonia rustica*. At present it is recorded from three locations, twice from river bank with *Saliceto-Alnetum* vegetation and once from fruit orchard with grass underground, overall from positive locations with light gravelled fluvisol soil type derived from river sediments. This species is frequent throughout the world in soils with various types of vegetation (meadow, forest, vineyard (Ivanova, 1976), in Czech Republic it was observed in grassland (Lelláková - Dušková, 1964).

M. xenoplax (Raski, 1952) Loof *et* De Grisse, 1989 – according to the latest results, it is the most widespread species, observed in 60 sampling sites of various types of vegetation, occurring mostly in nut orchard, vineyard, forest with accacia, pinus and oak, growing in area of light regosol soil type derived from dune sand in southern Slovakia. Some years ago, Lišková *et al*. (1996) and Stollárová (1999) recorded this species in the soil of forest nurseries with cedar-pine resp. poplar. *M. xenoplax* is a cosmopolitan species occurring in Europe, Asia, Africa, North

Table 3. The criconematid nematodes associated with different types of vegetation in the Slovak Republic

Nematode species	Arable				Orchard		Forest								Flooded forest	River bank	Total number of records and %	
	cereals	potatoes	grassland	vineyard	fruit	nut	1	2	3	4	5	6	7	8				
Mesocriconema spp.																		
M. antipolitanum	2	2	2	3	2	5	-	-	-	-	2	4	1	-	-	1	24	12.2
M. curvatum	-	-	3	-	-	-	-	-	1	-	-	1	-	-	1	2	8	4.1
M. dherdei	-	-	1	-	1	-	-	-	-	-	-	1	-	-	-	-	3	1.5
M. rusticum	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	2	3	1.5
M. xenoplax	1	-	1	14	3	22	-	-	-	-	4	3	9	-	3	-	60	30.5
Criconemoides spp.																		
C. amorphus	-	-	2	1	2	4	-	1	-	-	2	-	-	-	-	1	13	6.6
C. annulatus	-	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-	3	1.5
C. informis	-	-	4	1	-	-	-	-	-	1	1	-	1	-	2	-	10	5.1
C. parvus	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	0.5
Criconema spp.																		
C. annuliferum	-	-	3	1	-	1	1	4	3	3	7	6	4	1	-	2	36	18.3
C. longulum	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	0.5
C. mutabile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.5
C. princeps	-	-	-	-	1	1	-	1	4	2	2	4	3	-	-	-	18	9.1
Ogma spp.																		
O. cobbi	-	-	-	-	-	-	1	1	3	-	-	2	1	-	-	-	8	4.1
O. menzeli	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-	3	1.5
O. sp. unidentified	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	0.5
Xenocriconemella sp.																		
X. macrodora	-	-	-	-	-	-	-	2	1	-	-	1	-	-	-	-	4	2.0
Total	3	2	16	20	10	33	3	9	13	9	19	23	21	1	6	9	197	100.0

* 1 – *Acer* sp.; 2 – *Carpinus betulus*; 3 – *Fagus sylvatica;* 4 – *Picea abies*; 5 – *Pinus* sp.; 6 – *Quercus* sp.; 7 – *Robinia pseudoacacia*; 8 – *Tilia cordata* + *Sambucus racemosa*

and South Amerika and Australia (Peneva *et al.*, 2000), mostly associated with woodlands and orchards. The species is considered to be a parasite of peach (Thomas, 1959), clover, carnation, and tomato (Hussey *et al.*, 1991), and with *M. curvatum* it is labelled as the most serious pest to nut trees. From the phytopathological point of view, fruit trees attacked by these nematodes are predisposed to other diseases, e.g. bacterial diseases (Nyczepir and Halbrendt, 1993), as indicated by research in forest nurseries from Bulgaria (Peneva and Choleva, 1987).

Genus *Criconemoides*

C. amorphus De Grisse, 1967 (= *Macroposthonia amorphus, nom. nud.* in De Grisse & Loof, 1965) was previously observed in Slovakia in arable soil with barley, wheat, rye, clover (Sabová and Valocká, 1977), in grass soil with *Festuca arundinaceae* and *Lolium perenne* (Vargová, 1983) and in forest nurseries with spruce and cedar-pine (Lišková *et al.*, 1996). During present investigation, it was recorded from 13 locations in nut and fruit orchards, grasslands, vineyards, *Carpinetum* and *Pinetum* forests, in river bank vegetation in different types of soils, e.g. loamy cambisol soil type derived from Carpathian flysh, clay luvisol derived from neogene sediments, as well as in fluvisol derived from light sandy, loamy sandy gravelled river sediments.

C. informis (Micoletzky, 1922) Taylor, 1936, was previously observed throughout the Slovak territory in soil of wet meadow by Šály (1976), in arable soil with barley, wheat and sugar beet as syn. *Macroposthonia anura* by Sabová and Valocká (1977), as syn. *Macroposthonia complexa* in vineyards by Lišková, (1977) and in forest nurseries by Lišková *et al.* (1996) and Stollárová (1999). During the present investigation, it was observed mostly in grass vegetation or flooded forest with *Salix* and *Alnus* sp. in river valleys with Fluvisol soil type derived from different river sediments. Sporadically it was recorded in *Picetum*, *Robinietum* and *Pinetum* forests and vineyards. It occurs in different ecosystems in Bulgaria (Peneva and Choleva, 1987) as well as in Romania (Popovici and Ciobanu, 2000 b).

Genus *Criconema*

C. annuliferum (de Man, 1921) Micoletzky, 1925 - after *M. xenoplax,* it is the most frequent criconematid species in Slovakia, preferring various natural forest biotopes (36 sampling sites), less frequently recorded from grassland, vineyard, nut orchard and river bank vegetation (3, 1, 1, resp. 2 sampling sites). For the first time Šály (1970) identified this species from *Quercetum* forest type as syn. *Nothocriconema annuliferum*. In comparison with the other criconematids, which prefer light sandy soils, this species is occurring aqually in light sandy soil, e.g. fluvisol derived from different sandy, often gravelled river sediments, or in rendzina soil type, stony soil derived from calcareous stones, as well as in heavy clay luvisol derived from neogene sediments.

Genus *Ogma*

O. cobbi (Micoletzky, 1925) Siddiqi, 1985 - a species already recorded in the territory of Slovakia in *Quercetum* forest by Šály (1983) and in orchard nurseries (Stollárová, 1999). Recently it was observed in various forests with *Fagus silvatica, Acer* sp., *Carpinus*, *Quercus* and *Robinia pseudoacacia* in different types of soils, e.g. Rendzina, Regosol and Luvisol soil type, more frequently in sandy soil.

O. menzeli (Stefanski, 1924) Schuurmans Stekhoven & Teunissen, 1938 is already known in Slovakia from the rhizosphere of *Petasites* sp. (Šály, 1978), generally grown along rivers in mountains throughout the country. During the present investigation, *C. menzeli* was recorded in *Quercetum* and *Picetum* forests grown on typical luvisol soil type derived from calcareous loess in southern Slovakia, resp. cambisol derived from granite in the High Tatra Mountains. The species was originally described from moss in Poland. It is associated with various types of vegetation preferring natural ecosystems throughout the world (survey given by Peneva *et al.*, 2000), e.g. in Romania (Popovici and Ciobanu, 2000b), where it occurs exclusively in natural ecosystems of Carpathian Mountains.

Criconematid species observed in the territory of Slovakia for the first time, their morphometric characteristics and short description and occurrence in the Slovak Republic (Fig. 1 – 4).

Mesocriconema curvatum (Raski, 1952) Loof *et* De Grisse, 1989 (Table 4., Fig. 1)

Description: Morphometrics is similar to the one given by De Grisse and Loof (1965). Body small, with numerous smooth annules directed posteriorly, submedial lobes thin, reached second body annule. Head not set off, tapering anteriorly, the first annule shorter than the second one. Stylet short and gentle, with a short metenchium and gentle knobs. Vulvae open clear, spermatheca visible. Tail short, truncate, the end with two, or three lobs.

Distribution: Species is observed mostly in the valleys with meadows. Seldom it occurs in flooded forest, or in river bank vegetation with light sandy, or loamy-sandy often gravelled fluvisol soil type derived from river sediments, e.g. in flooded forests along the Danube River, as well as in soils along smaller rivers and brooks. Moreover, it was sporadically observed in *Fageto - Quercetum* forest type. The species is known from various ecosystems throughout the world (Ivanova, 1976), including fresh-water and brackish biotopes (Loof, 2001) and it is considered to be an important pest to fruit crops (Nyczepir and Halbrendt, 1993). At present it was recorded from natural ecosystems in Romania (Popovici and Ciobanu, 2000a,b), common species in Poland (Brzeski, 1998).

Mesocriconema dherdei (De Grisse, 1967) Loof *et* De Grisse, 1989 (Table 4., Fig. 3)

Description: Morphometrics similar to original description, our population with longer stylet (60 – 65 vs. 52 – 62 µm) and tail (c=14.2 – 15.2 vs. c=19 – 30). Head not set off, submedian lobes not expressive. Annules of body thick (8 µm in the midd of body), smooth, rounded. Vulva open. Tail short, conical, it can be immediately tapered after vulva.

Distribution: Nematode species was observed in three localities - grassland, plum orchard in river plains with loa-

Table 4. Morphometrics (all measurements in micrometres) of *Mesocriconema curvatum*, *M. dherdei*, *Criconemoides annulatus*, *C. parvus*, *Criconema longulum*, *C. mutabile*, *C. princeps* and *Xenocriconemella macrodora*

Locality n	*M. curvatum* Kráľova Lehota 2 ♀♀	*M. dherdei* Trebejov 3 ♀♀	*C. annulatus* Červený Kláštor 4 ♀♀	*C. parvus* Jablonica 1 ♀	*C.longulum* Rabča 1 ♀	*C. mutabile* Detva 1 ♀	*C. princeps* Baba 4 ♀♀	*C. princeps* Dobšiná 3 ♀♀	*X. macrodora* Dobšiná 4 ♀♀
L	378 (364 – 392)	435 (422 – 456)	445 (352 – 544)	280	432	328	537 (440 – 604)	399 (340 – 464)	331 (312 – 354)
a	10.5 (10.1 – 11.0)	11.1 (10.1 – 11.7)	12.5 (11.0 – 14.3)	11.6	12	12.2	10.6 (9.0 – 10.8)	9.0 (8.4 – 9.7)	11.8 (10.8 – 12.6)
b	3.9 (3.9 – 4.0)	3.8 (3.7 – 3.8)	3.1 (2.8 – 3.4)	3.3	4.2	3.3	3.8 (3.4 – 4.2)	2.8 (2.6 – 3.0)	2.3 (2.0 – 2.5)
c	21.1 (19.6 – 22.6)	14.8 (14.2 – 15.2)	24.9 (22.0 – 30.5)	23.3	7.2	20.5	8.4 (8.4)	13.7 (11.2 – 16.3)	1 6.1 (12.9 – 19.7)
V	93.7 (92.9 – 94.5)	91 (90 – 91)	93.8 (92.0 – 94.8)	94.3	84.3	91.5	86.8 (84.1 – 90.0)	87.9 (86.7 – 90.1)	89.1 (88.5 – 89.8)
St	45 (44 – 47)	63 (60 – 65)	87 (81 – 92)	41	66	64	110 (104 – 112)	90 (88 – 92)	110 (109 – 112)
R	95 (95 – 96)	58 (56 – 59)	144 (133 – 151)	178	82	104	54 (53 – 55)	58 (57 – 59)	118 (113 – 122)
RSt	13 (12 – 15)	10 (9 – 10)	30 (24 – 34)		12	18	11 (11 – 12)	13 (12 – 13)	39 (36 – 42)
ROes	26 (26 – 27)	15 (15 – 16)	47 (41 – 51)	52	19	30	15 (14 – 16)	19 (18 – 20)	
Rex	25 (24 – 26)	16 (14 – 17)	46 (42 – 49)		15			18 (18)	35 (35)
RV	6 (6 – 7)	6 (6 – 7)	9 (7 – 9)	16	15	10	10 (10 – 11)	9 (8 – 9)	17 (15 – 18)
RVan	1 (1 – 2)	1 (1 – 2)	3 (3 – 4)	6	2	3	4	3 (2 – 4)	5 (4 – 7)
Ran	5 (5 – 5)	5 (5)	5 (4 – 6)	10	13	4	7 (7)	6 (5 – 7)	12 (11 – 13)
VL/VB	1.0 (1.0 – 1.1)	1.4 (1.3 – 1.6)	0.9 (0.6 – 1.0)	0.7	2	1	2.0 (1.9 – 2.3)	1.6 (1.5 – 1.8)	1.4 (1.4 – 1.6)
St%L	12.0 (11.9 – 12.1)	14.5 (13.2 – 15.4)	20 (17 – 23)	14.6	15.3	19.5	19.3 (18.5 – 20.0)	22.9 (19.3 – 27.1)	33.3 (31.6 – 35.3)

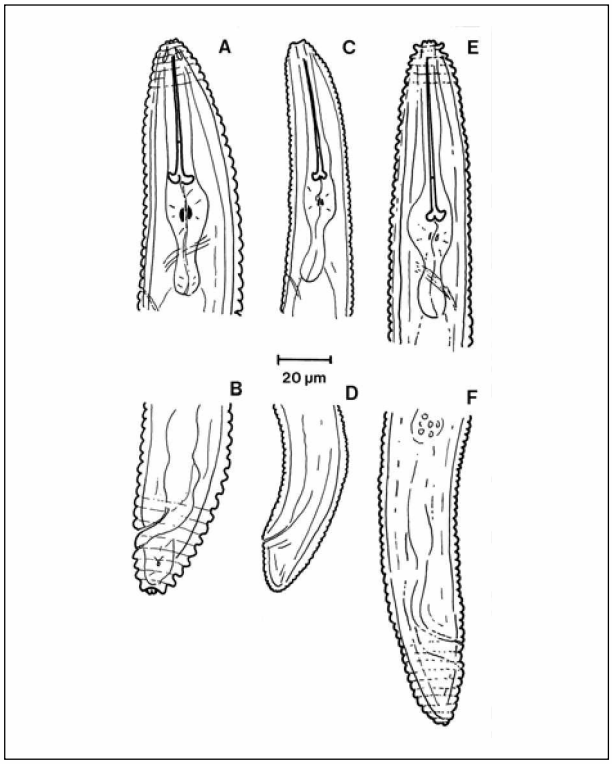

Fig. 1. *Mesocriconema curvatum* - female: A – anterior region; B – posterior region; *Criconemoides parvus* - female: C – anterior region, D – posterior region; *Criconema mutabile* - female: E – anterior region; F – posterior region

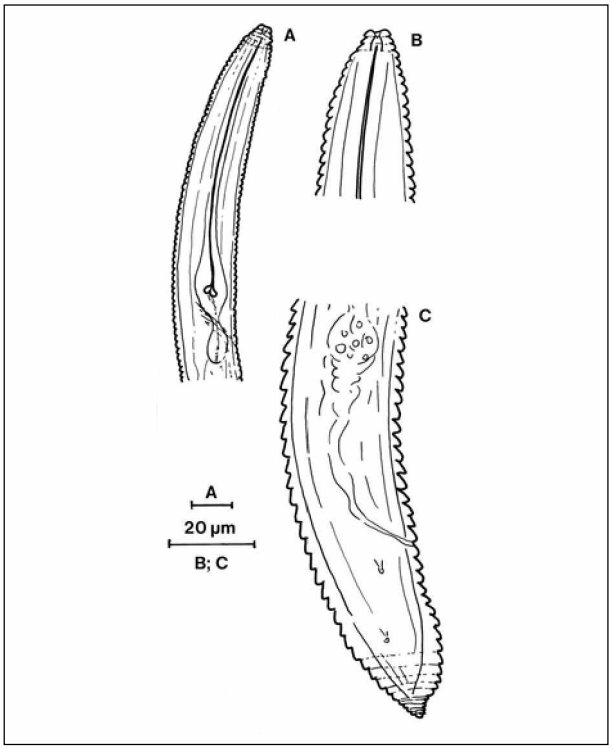

Fig. 2. *Xenocriconemella macrodora* - female: A – anterior region; B – head; C – posterior region

my-sandy fluvisol and in *Quercetum* forest grown in rendzina soil type derived from calcareous parental rock. Originally it was recorded from grassland in Belgium.

Criconemoides annulatus Cobb in Taylor, 1936 = *C. hemisphaericaudatus* Wu, 1965 (syn. by Raski and Golden, 1965) (Table 4., Fig. 3)

Description: Morphology of the Slovak population is identical with original descriptions. Some small differences are in longer stylet and higher number of body annules. In the Slovak population stylet length is 81 – 92 µm vs. 68 – 79 in the original description; body annules 133 – 151 vs. 114 – 137. Characteristic of the species are numerous smooth body annules (2.5 – 4.0 µm bright in the middle of body), head not offset, more rounded with not expressive submedial lobes, long stylet, tail of body short, hemisphaerical, at the end with tiny lobs.

Distribution: Species was recorded from three forest sampling sites with *Acer*, *Fagus* and *Picea* sp., in gravelled and stony rendzina soil type derived from calcareous stone in protected area of National Park Pieniny on the border with Poland.

Criconemoides parvus Raski, 1952 (Table 4., Fig. 1)

Description: Morphometrics corresponds with original description and is also similar to morphometrics of female from Danube Delta in Romania (Popovici and Ciobanu, 2000b). Characteristic feature is an extremely small body size with numerous very tiny annules. Head not offset, fine submedian lobes present. Tail short, bluntly conoid, gently annulated.

Distribution: Species was observed in the rhizosphere of *Robinia pseudoacacia* in mid heavy loamy luvisol soil type derived from loess at one locality in western Slovakia only. It is relatively rare species, howewer, worldwide distributed (Loof, 2001). In Europe recently recorded by Popovici and Ciobanu (2000b) from wet soil with *Populus* sp. in Romania, by Brzeski (1998) from sandy unploughed soils and by Háněl (1998) from meadows and forest soils in the Czech Republic near border of the Slovak Republic.

Criconema longulum Gunhold, 1953 (Table 4., Fig. 3)

Description: Body relatively slim with smooth annules. Head offset, consisting of two in diameter equal annules, both narrower than the third annule. Stylet and knobs gentle. Tail elongate, tapering to the pointed end.

Distribution: Nematode species was observed at one locality of Oravská vrchovina, highland only, in the rhizospere of *Picea abies* in midd heavy loamy cambisol soil type derived from Carpathian flysh. According to Loof (2001) the species is known from Europe, North America, Aleutian, Hawaii, and Japan.

Criconema mutabile (Taylor, 1936) Raski *et* Luc, 1985 (Table 4., Fig. 1)

Description: The species is characterized by small body with numerous smooth annules tapering posteriorly. Head offset with two labial annules, the first one is directed forward, the second one is broader than the first one, and it is narrowly joined with following body annules. Stylet short, gentle, but in comparison with the body length quite long (19.5 %). The body is slightly tapering posteriorly, but

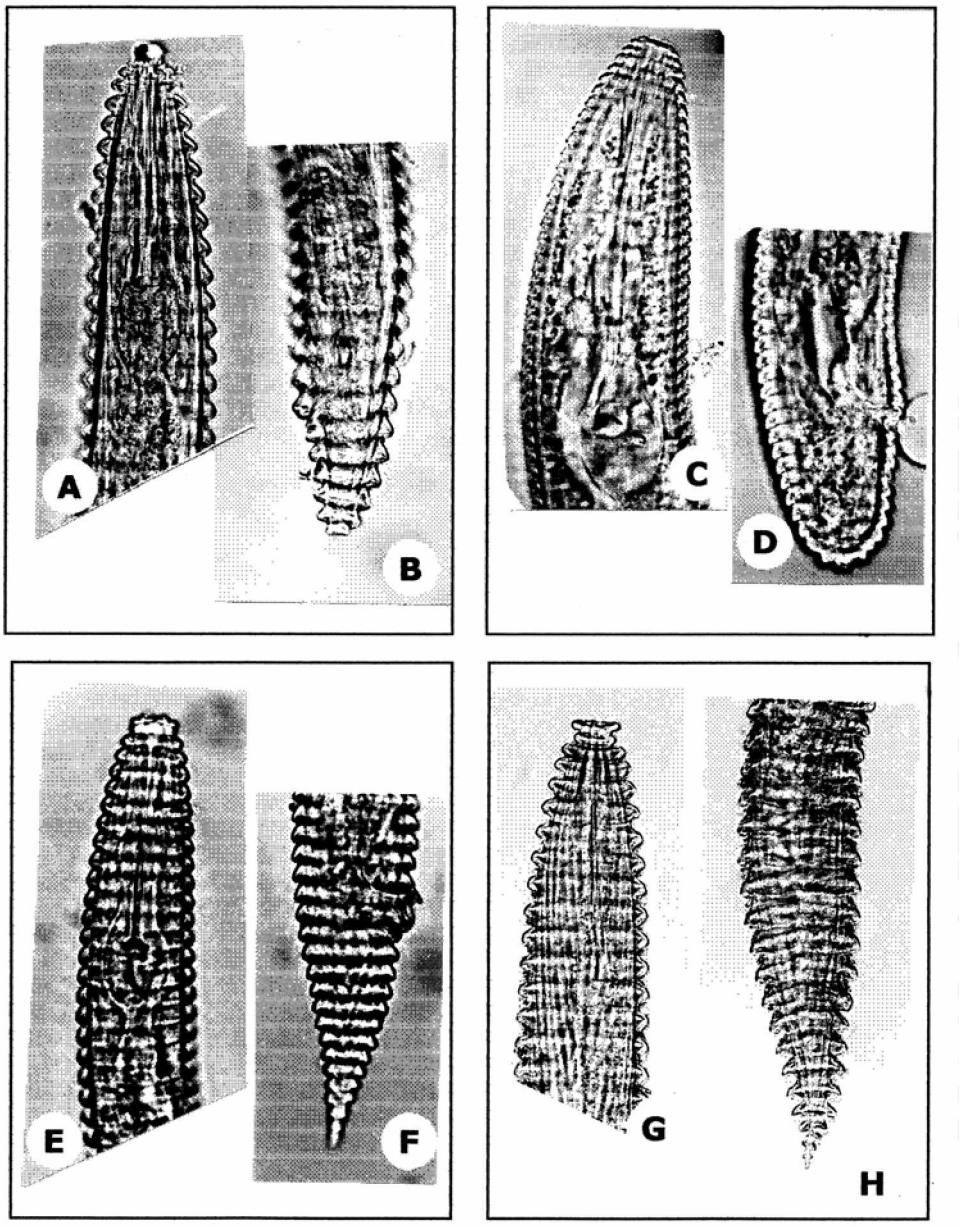

Fig. 3. *Mesocriconema dherdei* - female: A – anterior region; B – posterior region; *Criconemoides annulatus* - female: C – anterior region; D – posterior region; *Criconema longulum* - female: E – anterior region; F – posterior region; *Criconema princeps* - female: G – anterior region; H – posterior region

with a short conical rounded tail. Spermatheca visible, filled with spermatozoids.

Distribution: Nematode population was found in middle Slovakia at one sampling site only, in light sandy fluvisol soil type with river bank vegetation (*Salix* sp., *Urtica dioica, Agropyrum repens*). According to Ivanova (1976) and Bongers (1988), this species is extended throughout the world (North and South America, Africa, but also in England and former Soviet Union) in arable soil as well as in natural ecosystems.

Criconema princeps (Andrássy, 1962) Raski et Luc, 1985 (Table 4, Fig. 3)

Description: Morphometric characteristics are similar to original description, but much closer to the description of Bulgarian population (e.g. in length of stylet) given by Peneva and Nedelchev (2000). Among individual Slovak populations some variation was observed, mostly in body size and length of stylet (Table 4). It is a relatively slim criconematid species with an expressive body structure and annule ornamentation. The head is clearly offset, consisting

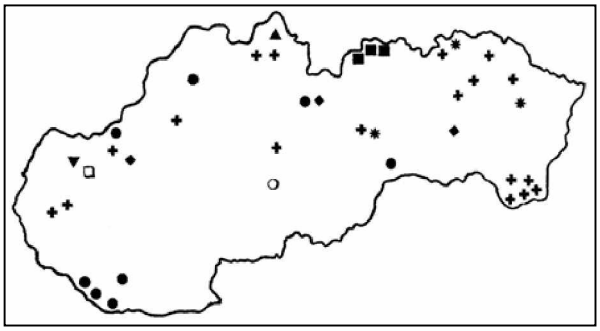

Fig. 4. The occurrence of for the first time observed criconematid species in the Slovak Republic

● – *Mesocriconema curvatum*; ♦ – *M. dherdei*; ■ – *Criconemoides annulatus*; □ – *C. parvus*; ▲ – *Criconema longulum*; ❍ – *C. mutabile*; ✚ – *C. princeps*; ✱ – *Xenocriconemella macrodora*

of two annules, the first one of 20 µm width, joined with the second annule of 18 µm width by a narrow 14 µm wide "neck". The first body annule is much wider - 28 µm. Sublabial lobes are narrow, not exceeding head annules. Stylet is long and expressive. Spermatheca with spermatozoids were observed with some specimens. Tail conically pointed, the last four annules expressively tapering.

Distribution: Species was observed at 18 sampling sites throughout the country, mostly in the rhizosphere of deciduous trees - *Robinia pseudoacacia*, and in *Quercus* forest with *Chelidonium majus* in sandy regosol soil type derived from dune sand in Východoslovenská rovina, plain, or in *Fagetum* forest grown in stony and gravelled rendzina soil type derived from calcareous stones, e.g. in Strážovské vrchy, mountains. It is uncommon in coniferous *Picetum* and *Pinetum* forest type with midd heavy loamy or heavy clay cambisol soil type derived from Carpathian flysh in, e.g. Oravská and Ondavská vrchovina, highlands. In the same soil type it was observed in plum and nut orchard as well. It is a known species in Europe (Brzeski, 1998; Loof, 2001). Originally it was described from the rhizosphere of *Alium* sp. in Hungary (Andrássy, 1962). The species occurs in various types of natural vegetation in Romania (Popovici and Ciobanu, 2000b), in oak forest in Bulgaria (Peneva and Nedelchev, 2000) and in Russia (Peneva *et al*., 2000).

Xenocriconemella macrodora (Taylor, 1936) De Grisse & Loof, 1965 (Table 4., Fig. 2)

Description: A short body tapering posteriorly and anteriorly, characterised by numerous narrower smooth annules (width of annules 2 – 3 µm) directed posteriorly. Stylet extremely long (more than 33 % of body length), slimm, gentle and typically flexible. The head consisted of two annules, the first one is a little wider than the second one. Sublabial lobes gentle. Spermatheca visible, filled with spermatozoids. Tail conically rounded, but the last five annules create an expressive short point, slightly directed dorsally. Sometimes tail in the middle of length from dorsal site "pressed".

Distribution: Nematode species distributed in various forests throughout the world (Ivanova, 1976; Brzeski, 1998). In the Czech Republic it was observed in spruce forest (Háněl, 1992) as well as in deciduous forests (Háněl, 1996). It is the most frequent criconematid species in various natural ecosystems in Romania (Popovici and Ciobanu, 2000b). In Slovakia it was observed at four sampling sites, twice in *Carpinetum* once in *Fagetum* and once in *Quercetum* forest, in loamy cambisol derived from Carpathian flysh of Ondavská vrchovina, highland and in rendzina, light gravelled soil type derived from calcareous stones of Volovské vrchy, mountains.

Ogma sp. - an unidentified *Ogma* species is morphologically different from previous nematode species. Its resemblance is closest to *Ogma palmatum* (Siddiqi *et* Southey, 1962) Siddiqi, 1986. The nematode was observed in one location of Malé Karpaty, mountains only in forest with *Robinia pseudoacia* in loamy luvisol soil type derived from loess. Insufficient material does not allow to specify the nematode species accurately.

From geographical point of view, the individual nematode species were associated with some geographical area or biotop through particular species of vegetation. Previously observed association of criconematids with various natural forest types, e.g. species *Criconemoides annulatus, C. parvus, Criconema longulum, Ogma cobbi, O. menzeli,* unidentified *Ogma* sp. and *Xenocriconemella macrodora* occurred only in forest soil and, e.g. *Mesocriconema xenoplax* nematode species was mostly linked with grapevine and nut trees. Two species only - *Mesocriconema antipolitanum* and *M. xenoplax* were observed besides in other types of vegetation, in a few locations with arable soils as well. A close association of most criconematid species with light sandy soil such as with regosol soils derived from dune sand, fluvisol derived from light, sandy, often gravelled and stony river sediments, with cambisol, or with rendzina soil types derived from different types of parental rock was recorded. The exceptions were species *Criconemoides amorphus, Criconema annuliferum* and *C. princeps* associated with light sandy as well as with heavy clay soils. Some species, e.g. *Mesocriconema curvatum* and *Criconemoides informis* occurred often in soil with meadow, wet flooded forest and *M. curvatum* was also detected in river bank vegetation.

Because some species of criconematid nematodes are considered as phytopathologically important pests, harmful to, e.g. fruit and nut orchard trees (Nyczepir and Halbrendt, 1993; Ciancio and Grasso, 1998) or to olive trees (Vovlas and Inserra, 1981), the results presented here could extend the knowledge about these nematodes and could become essential for further deeper nematological, ecological and phytopathological study.

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