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On the free-living nematode fauna from Bulgarian inland waters

[Freilebende Nematoda in bulgarischen Binnengewässern]

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With 2 Tables

Schlagwörter: Nematoda, Bulgarien, Donau, Fluß, See, Baggersee, Stausee, Dominanz, Ähnlichkeit, Faunistik

From a total of 61 nematode species in various Bulgarian water bodies, 35 (18 genera) are new for Bulgaria and 6 species are new for the Danube. The species found are relatively estimated by the dominant analysis on the base of 767 samples. Various types of water bodies are compared by a faunal similarity coefficient.

Von 61 Nematoda-Arten aus verschiedenen bulgarischen Gewässern sind 35 (18 Gattungen) neu für Bulgarien und 6 neu für die Donau. Auf Grund von 767 Proben wird die relative Abundanz durch eine Dominanzanalyse sowie die faunistische Ähnlichkeit zwischen den verschiedenen Fundgewässern berechnet.

1 Introduction

At the present time the representation of the nematode fauna have passed the entire biosphere and inhabit all of the known habitats, including the underground waters (TSVETKOV & al. 1980; PANDOURSKI 1993, 1994). The enormous quantity of the nematodes, which, according to some authors (REES 1940), amount to several millions of specimens/m², determines their significance for the balance of the organic substances in the water basins.

First information about the free-living nematodes in Bulgaria was given by VALKANOV (1934, 1935), who reported 13 species of 6 genera. RUSSEV (1979) added two species from the Bulgarian stretch of the Danube River. Recent information on the Bulgarian free-living nematodes is reported in more details by STOICHEV (in press, a), KOVACHEV & STOICHEV (in press) and STOICHEV (in press, b).

The present paper gives new information on the free-living nematode fauna from various types of water basins according to the quantitative presence, frequency of occurrence and the distribution in the various habitats. A dominance analysis and an estimation of the degree of faunal similarity has also been made.

2 Materials and methods

The basic part of the investigated material from Bulgaria is a collection of Prof. Valkanov and Prof. Russev, gathered 1947-1993. The collection has been added by the samples of the author at the rivers Ogosta, Iskar, Vit, Rositsa, Negovanka, Mesta, Maritsa, Struma, Bedechka, Cherni Iskar, Beli Iskar, Iskretski izvor, Kamchija, Ropotamo, Veleka, Rezovska and the lakes Shabla, Stara Zagora spa, sand-pit lakes at the villages Dolni Bogrov, Chelopechene, Chepintsi, and the reservoirs Koprinka and Stambolijski and the high mountain lakes Detelinata, Bubreka, Okoto, Rila mountain.

Altogether 767 samples have been investigated, distributed as follows: 1. Danube - 103; 2. Lom - 15; 3. Tsibritsa - 10; 4. Ogosta - 14; 5. Iskar - 65; 6. Vit - 28; 7. Rositsa - 7; 8. Negovanka - 5; 9. Mesta - 21; 10 Maritsa - 43; 11. Prava Maritsa; 12; 13. Struma - 14; 13. Bedechka - 13; 14. Trigradska- 15; 18. Shirokolashka - 21; 16. Vedena - 16; 17. Palakarija - 5; 18. Proboijnitsa - 6; 19. Cherni Iskar - 7; 20. Beli Iskar - 7; 21. Iskretski izvor - 5; 22. Kamchija - 15; 23. Ropotamo - 18; 24. Veleka 7; 25. Rezovska - 8; 26. Valsko ezero, Rila mountain - 21; 27. Lopushno ezero, Rila mountain 14; 28. Bubreka, Rila mountain - 17; 29. Ezero Okoto, Rila mountain - 9; 30. Ezero Detelinata, Rila mountain 7; 31. Ribno ezero, Pirin mountain 11; 32. Argirovo ezero, Pirin mountain - 13; 33. Georgijsko ezero, Pirin mountain - 9; 34. Stara Zagora spa - 11; 35. Shabla lake - 28; 36. Dolni Bogrov lake - 28; 37. Chelopechene lake - 28; 38. Chepintsi lake - 28; 39. Srebarna lake - 35; 40. Koprinka reservoir - 16; and Stambolijski reservoir - 8.

The analysis of the dominant quantitative presence (frequency of occurrence pF, frequency of dominance DF and range of dominance Dt, in %) has been made by the method of De Vries (1937). The determination and the presentation of the species was made according to Gagarin (1981). The formula of De Man (1886) was used to determine the species qualitative composition. The faunal similarity was calculated by Jaccard (1901).

3 Species composition

There have been found 61 species of 29 genera, 22 families and 6 orders (Tab. 1). Compared to the European part of the late Soviet Union (Gagarin 1981) and the Austrian Danube stretch (Humpesch 1994), the Bulgarian free-living nema tode fauna has been recently well investigated. New findings for the Bulgarian fauna are 35 species (marked by +), 18 genera (marked by o), and 6 of the species (marked by *) are new for the Danube aquatic fauna.

4 Dominance analysis

Tab. 1 shows that *Dorylaimus stagnalis* could be found in all of the Bulgarian reservoirs. *Paradorylaimus filiformis, Tobrilus gracilis, Monchystera dispar, M. filiformis, M. paludicola, M. vulgaris* could be found nearly everywhere.

The results from the dominance analysis of the species are expressed on Tab. 1. According to the obtained frequency of presence data the following classification could be applied. This classification was proposed for the first time by Stoichev (in press, b), where the species fall to someone of the groups:

1. Very frequently found species (pF >50 %): *Mononchus truncatus, Dorylaimus stagnalis, Monchystera stagnalis*. Total: 3 species.
2. Frequently found species (pF 10-50 %): *Dorylaimus montanus, Paradorylaimus filiformis, Paractinolaimus macrolaimus, Monchystera paludicola, M. dispar, Prodesmodora circulata, Paraphanolaimus behnigi, Aphanolaimus aquaticus, Cylindrolaimus melancholicus*. Total: 12 species.
3. Rarely found species (pF 1-10 %): *Eudorylaimus stagnalis, Monchystera filiformis, M. similis, Cylindrolaimus communis, Chronogaster typicus, Prismatolaimus intermedius, Trypyla glomerans, T. selifera, Mononchoides striatus*. Total: 9 species.
4. Very rare species (pF <1 %): *Mononchus* sp., *Mylonchulus brachyurus, Aquatides aquaticus*, *Dorylaimus* sp., *Laimydorus flavomaculatus, Paractinolaimus* sp., *Thornia steatopyga, Monchystera macraphis, M. viridis, M. simplex*. Total: 37 species.

A comparison of the index pF and the order of the dominance Dt shows that the very frequent species dominate also qualitatively in the zoobenthic complex in various water bodies in Bulgaria (Tab. 1).

Beside with the species of high values of pF and D (*Mononchus truncatus, Dorylaimus stagnalis*), species of high values of the range of dominance low presence and dominance, frequency, can be found (*Monchystera paludicola, M. filiformis, Trypyla glomerans, T. selifera*).

The present data establish stenobiontic character of some species as well. The abundant development of these species is possible only in narrow limits of the environmental conditions. Out of this limits they can not be found or they are quantitatively scanty. It is most probable that the more polluted stretches of the rivers and influenced lakes cause instability of the environment. At the places with great selfpurificational capacity, a well composed and usually constant qualitative composition can be found. The distribution of the species (Tab. 2) shows that the gravel and sand habitats have the greatest number of species (34), followed by sludge (32); sludge and sand (24); coarse sand (18); sand (13); gravel (11); clay and sand (2) and clay (1).Tab. 2 also shows that many species are able to inhabit various habitats, which could probably explained by the tendency of nematode species to enlarge their range, and by their eurybiontic character, as an expression of the biological progress of the group.

5 Faunal similarity

The values of faunal similarity between some rivers, lakes and reservoirs vary from 27 to 75 %. Faunal similarity between the Danube River and some smaller rivers (Beli Iskar, Cherni Iskar, Palakaria, Bedechka, etc.) is lower. The presence of some species in the Danube River only (*M. macraphis, M. vulgaris, Ch. viridis, P. bioculata, T. filicaudata, Rhabditis* sp., *Mononchus* sp., *Dorylaimus* sp., etc.) and their absence in the inner rivers could be explained by the differ-

ence of the hydrological regime between the Danube and these tributaries. The peculiar nematode fauna of the Danube is probably due to the greater water discharge, the considerably slower velocity, the presence of sand deposits, the slight slope of the bottom, and probably other environment-forming conditions.

The similarity between Danube River and quarry lakes at Dolni Bogrov, Chelopechene and Chepintsi are exclusively low (Tab. 1). The continuous taking off of the bottom substrate in these lakes causes unstable environment. Their species composition is poor (KOVACHEV, STOICHEV, in press).

The faunal similarity between the Black Sea tributaries Kamchija, Ropotamo, Veleka and Rezovska is considerably greater (40-70 %). The slight slope, low velocity, sea influence by increased salinity and other factors make their species composition rather similar. This rivers have somewhat specific fauna, especially at their mouths.

The faunal similarity of the high mountain lakes varies very much (0-67 %). The full absence of similarity between some of them could be explained first of all by the many endemic species there, and probably by the different altitude, pH, age of the lakes and other factors. The extreme environmental conditions of the high mountain lakes mean concurrent relationships. These lakes have small dimension and are isolated, which is an obstacle against their colonization, and the concurrence between species is enforced. The role of the base-making species probably important.

Tab. 1: Qualitative composition frequency of occurrence and a dominant analysis of the nematode species found

Taxa	Stations	pF %	DF %	Dt %
Dorylaimida Pearse, 1942				
Mononchidae Filipjev, 1934				
Mononchus truncatus Bastian, 1865	1-3, 5-10, 12-23, 31, 33-35, 39	94.52	41.72	44.13
Mononchus sp.	1	0.13		
Mylonchulidae Jairajpuri, 1969				
Mylonchulus brachyurus (Buetschli, 1873) + o	8, 12,	0.65		
Nygolaimidae Thorne, 1935				
Aquatides aquaticus (Thorne, 1930) + o	33	0.13		
Dorylaimidae de Man, 1876				
Dorylaimus stagnalis Dujardin, 1848	1-32, 35-41	97.78	54.10	55.32
Dorylaimus montanus Stefanski, 1924 +	2, 5, 9, 10, 12, 13, 16, 29-32	20.73	1.95	9.40
Dorylaimus sp.	1	0.13		
Paradorylaimus filiformis (Bastian, 1865) + *	1-3,5-10,12-16,18-20,23,25,39	46.93	2.86	6.09
Laimydorus flavomaculatus (Linstow, 1876)	33,35, 39, 41	0.91		
Oudsianematidae Jairgipuri, 1965				
Eudorylaimus carteri (Bastian, 1865)	1, 2, 5, 8-10, 12-14, 35	4.95		
Actinolaimidae Thorne, 1939				
Paractinolaimus macrolaimus (de Man, 1880) + o	5, 7, 8, 10, 12-23, 31-33, 39	27.50		
Paractinolaimus sp.	34	0.13		
Thornidae de Coninck, 1965				
Thornia steatopyga (Thorne et Schwanger,1936) + o	33, 34	0.52		

Taxa	Stations	pF %	DF %	Dt %
Monhysterida da Coninck et Sch. Stekhoven, 1933				
Monhystaridae de Man, 1876				
Monchystera stagnalis Bastian, 1865	1, 12, 14-22, 24-26, 33, 39, 41	81.22	4.56	5.61
Monchystera paludicola de Man, 1880	1-3,5-7,9,15,16,19-21,33,36	12.77	1.17	9.16
Monchystera dispar Bastian, 1865	1, 3-7, 10-13, 15-19	26.20	1.13	4.31
Monchystera filiformis Bastian, 1865	1,3,5,8,9,14-16,18,20,29,33	2.86	0.26	9.09
Monchystera macraphis Filipjev, 1930	1	0.13		
Monchystera vulgaris de Man, 1880 *	1	0.13		
Monchystera similis Buetschll, 1873	7, 8, 14, 15	1.95		
Monchystera simplex de Man, 1880	33	0.13		
Monchystera sp.	33	0.13		
Chromadorida Chitwood, 1933				
Microlaimidae Micoletzky, 1922				
Prodesmodora circulata (Micoletzky, 1913) + o *	1-3, 5, 7, 9, 16-18, 35, 39	25.42	0.65	2.55
Chromadoridae Filipjev, 1917				
Chromadorina viridis (Linstow, 1876)	1	0.13		
Punctodora ratzemburgensis (Linstow, 1876) + o	39	0.13		
Punctodora bioculata (Schultze in Carus, 1857) +*	1	0.13		
Araeolaimida de Coninck et Sch. Stekhoven, 1933				
Halaphanolaimidae de Coninck & Sch. Stekhoven,1933				
Paraphanolaimus behniigi Micoletzky, 1923 + o	2-4, 7, 10, 12, 15-17, 22, 23, 25	38.72	0.13	0.33
Aphanolaimus viviparus Plotnikoff, 1899 + o	31-33	0.26		
Aphanolaimus aquaticus Daday, 1897 +	4, 7, 9, 10, 13-18, 22, 24, 40,41	43,15	7.17	16.61
Cylindrolaimidae Micoletzky, 1922				
Cylindrolaimus communis de Man, 1880 + o	29-31	1.56		
Cylindrolaimus melancholicus de Man, 1880 +	2-5, 7, 9, 10, 13-17	17.99	2.08	11.56
Axonolaimidae Filipjev, 1918				
Axonolaimus spinosus (Buetschli, 1874) + o	32	0.13		
Axonolaimus sera Tchesunov, 1976 +	33	0.13		
Chronogasteridae Gagarin, 1975				
Chronogaster typicus (de Man, 1921) + o	30-33	1.04		
Chronogaster boettgeri Kischke, 1956 +	37	0.13		
Plectidae Oerley, 1880				
Plectus assimilis Bueschli, 1873 + o	33	0.13		
Plectus inquirendus Andrassy, 1958 +	30-32	0.91		
Plectus cirratus Bastian, 1865	36	0.26		
Plectus tenuis Bastian, 1865 + o	2-4, 6-16, 33	0.39		
Enoplida Chitwood, 1933				
Enoplidae Dujardin, 1845				
Enoploides fluviatilis Micoletzky, 1923 + *	1-6, 8-10, 14, 15, 22-25, 33, 35	28.94	3.77	13.02
Enoploides sp.	33	0.13		
Prismatolaimidae Micoletzky, 1923				
Prismatolaimus intermedius (Buetschli, 1873) + o	22-24	1.82		
Prismatolaimus dolichurus de Man, 1880 +	34	0.13		
Tripylydae de Man, 1876				
Tripyla glomerans Bastian, 1865	1-10, 34, 39	2.21	0.26	11.76
Tripyla filicaudata de Man, 1880	1	0.26		
Tripyla sellfera Buetschli, 1873	27-29, 31	1.43	0.52	36.36
Tripyla sp.	1	0.13		

Taxa	Stations	pF %	DF %	Dt %
Trischistoma monohystera (de Man, 1880) + o	32	0.26		
Trischistoma arenicola (de Man, 1880) +	32	0.13		
Tobrilinae Andrassy, 1976				
Tobrilus gracilis (Bastian, 1865)	1-6, 8-17, 22-25, 27, 40, 41	41.59	0.65	1.56
Tobrilus stefanskii (Micoletzky, 1925) +	32	0.26		
Tobrilus abberans (W. Schneider, 1925) +	32	0.39		
Tobrilus ap.	32	0.13		
Rhabditida Chitwood, 1933				
Rabditidae Orley, 1880				
Rabditis filiformis Buetschli, 1873 + o *	1, 2, 4, 5, 7-9, 11, 13-15, 30-33	25.03	0.13	0.51
Rabditis sp.	1	0.13		
Diplogasteridae Micoletzky, 1922				
Diplogaster rivalis (Leydig, 1854) + o	33	0.13		
Mononchoides striatus (Buetschli, 1876) + o	31-33	2.21		
Mononchoides striatulus (Fuchs, 1933) +	32, 33	0.65		
Diplogaster aquaticus Gagarin, 1977 +	41	0.13		
Paraigolaimella anomala Gagarin, 1977 +	5, 40, 41	0.26		
Panagrolaimidae Thorne, 1937				
Panagrolaimis hygrophilus Bassen, 1940 +	32	0.39		

Tab. 2: Distribution of the nematodes in different habitats

Taxa	gravel	gravel and sand	sludge	sludge and sand	sand	coarse sand	clay and sand	clay
Mononchus truncatus Bastian, 1865	X	X						
Mononchus sp.	X							
Mylonchulus brachyurus (Buetschli, 1873)		X						
Aquatides aquaticus (Thorne, 1930)		X	X	X	X		X	
Dorylaimus stagnalis Dujardin, 1848	X	X	X	X	X	X		
Dorylaimus montanus Stefanski, 1924			X					
Dorylaimus sp.		X						
Paradorylaimus filiformis (Bastian, 1865)	X	X			X	X		
Laimydorus flavomaculatus (Linstow, 1876)			X	X				
Eudorylaimus carteri (Bastian, 1865)			X					
Paractinolaimus macrolaimus (de Man, 1880)			X	X				
Paractinolaimus sp.		X						
Thornia steatopyga (Thorne & Schwanger, 1936)		X						
Monchystera stagnalis Bastian, 1865			X					
Monchystera paludicola de Man, 1880		X						
Monchystera dispar Bastian, 1865		X			X			
Monchystera filiformis Bastian, 1865		X		X	X	X		
Monchystera macraphis Filipjev, 1930	X				X			
Monchystera vulgaris de Man, 1880				X	X	X		
Monchystera similis Buetschli, 1873			X	X	X			
Monchystera simplex de Man, 1880			X					
Monchystera sp.		X						
Prodesmodora circulata (Micoletzky, 1913)	X	X				X		
Chromadorina viridis (Linstow, 1876)			X	X		X		
Punctodora ratzemburgensis (Linstow, 1876)			X	X	X	X		

Taxa	gravel	gravel and sand	sludge	sludge and sand	sand	coarse sand	clay and sand	clay
Punctodora bioculata (Schultze in Carus, 1857)		X	X					
Paraphanolaimus behniigi Micoletzky, 1923			X	X				
Aphanolaimus viviparus Plotnikoff, 1899		X						
Aphanolaimus aquaticus Daday, 1897	X	X						
Cylindrolaimus communis de Man, 1880	X	X		X				
Cylindrolaimus melancholicus de Man, 1880				X	X			
Axonolaimus spinosus (Buetschli, 1874)			X					
Axonolaimus sera Tchesunov, 1976		X	X	X				
Chronogaster typicus (de Man, 1921)				X				
Chronogaster boettgeri Kischke, 1956		X	X	X	X			
Plectus assimilis Bueschli, 1873					X			
Plectus inquirendus Andrassy, 1958			X	X	X			
Plectus cirratus Bastian, 1865		X	X					
Plectus tenuis Bastian, 1865		X	X	X				
Enoploides fluviatilis Micoletzky, 1923				X	X		X	X
Enoploides sp.	X	X	X					
Prismatolaimus intermedius (Buetschli, 1873)			X					
Prismatolaimus dolichurus de Man, 1880		X	X					
Tripyla glomerans Bastian, 1865		X				X		
Tripyla filicaudata de Man, 1880		X				X		
Tripyla selifera Buetschli, 1873		X						
Tripyla sp.		X						
Trischistoma monohystera (de Man, 1880)		X						
Trischistoma arenicola (de Man, 1880)		X	X					
Tobrilus gracilis (Bastian, 1865)	X		X		X	X		
Tobrilus stefanskii (Micoletzky, 1925)	X	X	X					
Tobrilus abberans (W. Schneider, 1925)				X				
Tobrilus sp.		X	X					
Rabditis filiformis Buetschli, 1873		X	X			X		
Rabditis sp.				X				
Diplogaster rivalis (Leydig, 1854)		X	X					
Mononchoides striatus (Buetschli, 1876)			X					
Mononchoides striatulus (Fuchs, 1933)			X	X	X	X		
Diplogaster aquaticus Gagarin, 1977				X	X			
Paraigolaimella anomala Gagarin, 1977			X	X	X			
Panagrolaimis hygrophilus Bassen, 1940		X	X	X				

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