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Faunistic and ecological investigations of the free-living freshwater nematode fauna of the Ogosta Reservoir (North-West Bulgaria)

STEFAN STOICHEV[1], HRISTINA KALCHEVA[2], ELENA NENOVA[3]

[1]*Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2, Str. "Major Yuri Gagarin", 1113 Sofia, Bulgaria, stefanstoichev@yahoo.com*
[2]*Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2, Str. "Major Yuri Gagarin", 1113 Sofia, Bulgaria, hristinakalcheva@yahoo.com*
[3]*Sofia University, Faculty of Biology, Department of Zoology and Anthropology, 8, Dragan Tzankov blvd., Sofia 1164, Bulgaria, elena_pnenova@abv.bg*

Abstract. The study gives for the first time a short hydrofaunistic investigation of the Ogosta Reservoir, recently infested by the invasive species from complex *Dreissena bugensis -polymorpha.* A total of 22 nematode species belonging to 12 genera and 9 families were found for the period April 2010 and August 2012. Nematode fauna and environmental factors were tested by statistical analyses. The species *Monhystera stagnalis*, *M. filiformis* and *Dorylaimus stagnalis* were found in all five stations of the reservoir. One species, *Rhabditis brevispina*, is new to the Bulgarian hydrofauna.

Key words: Nematoda, Ogosta Reservoir, Bulgaria

Introduction

First information about free-living nematode fauna in Bulgaria was given by Valkanov (1934) who reported 13 species and 6 genera. Further data about freshwater nematodes were given by Russev (1979) who reported two more species from the Bulgarian stretch of the Danube River. The latest studies (Stoichev 1996, 1998) report 61 free-living nematode species. The number of species that we found is closer to the data given by Traunspurger (2002), who reported that the species richness in general ranges between 30 and 70 in lakes and rivers. Abiotic parameters of habitat (sediment type, water depth, water temperature, concentration of dissolved oxygen, quantity of food available) have a significant influence on nematode distribution and abundance (Pehoffer 1989, Traunspurger 1996).The present study gives the first information about the free-living freshwater nematode fauna of the Ogosta Reservoir (Fig.1A) and its relation to the environmental factors.

Material and Methods

The material was collected with Ekman-Birge grab in April, July and September 2010, July and August 2011 and April and August 2012. A total of 35 samples were collected. The results were adjusted for 1 m^2. The nematode samples were rinsed on sieves, with mesh, and fixed in 4% formalin. Nematodes were identified according to Gagarin (1981) and measured on the basis of the formula of De Man (1886). The monograph of LOOF (1999) was also used to determine the nematodes.

The samples were collected from 5 sites in the reservoir (Fig. 1A): 1. Wall; 2. Kalimanishki, Borovski and Blagovo; 3. Middle; 4. Tserovski 5. Tail at Tserovski.

Environmental factors (temperature, COD (chemical oxygen demand), NO_3-N, NO_2-N, NH_4-N and oxygen saturation), measured by standard methods, and also bacterioplankton

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number and detritus particles, determined by a method of a direct microscopic count (Kalcheva et al. 2008), were taken from the same stations at the water layer 1m above the bottom. Species from complex *D. bugensis – polymorpha* assessment (by five categories: absent, only shells, small, middle and high quantities) in the five stations was done. Statistical analyses as the redundancy analysis (RDA, Canoco for Windows 4.5, ter Braak, Smilauer 2002) and rank order correlations (STATISTICA 7, StatSoft) were applied. Data of the environmental factors are not presented, but are used only in the statistical analyses.

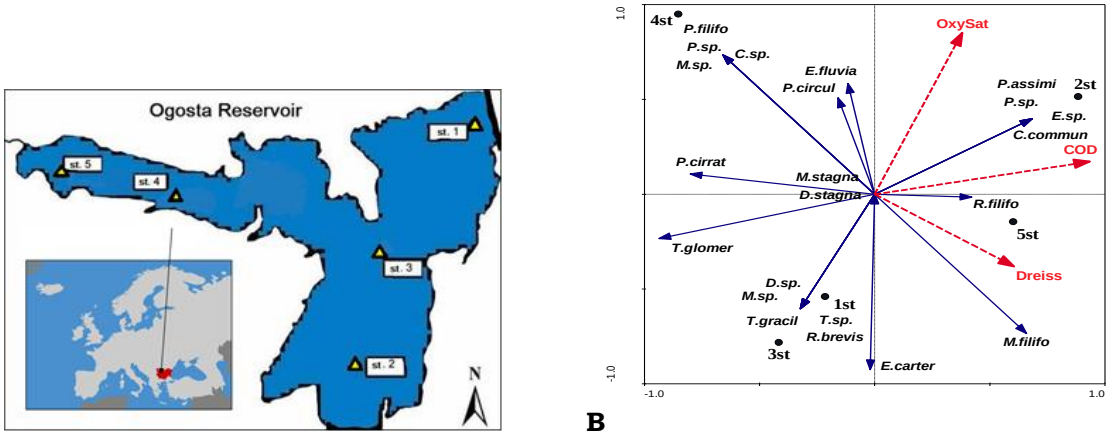

Fig. 1. A: Map of Ogosta Reservoir with the location of the sites (stations); B: RDA triplot of correlations between Nematoda species and environmental factors in the five stations of the Ogosta Reservoir. Statistical results (AllEV=1.000, CanEV=0.859, F-ratio=2.039, P-value=0.0720; without species from complex *D. bugensis - polymorpha* - P-value=0.0260).

Results and Discussion

A total of 22 species from 12 genera, 9 families and 5 orders are included in the present study (Tab.1). The species *Monhystera stagnalis*, *M. filiformis* and *Dorylaimus stagnalis*, were found on all sites. One species (*Rhabditis brevispina*) is new to the Bulgarian hydrofauna. The Nematoda diversity in Zhrebchevo Reservoir (Stoichev, Danova, 2012), 26 species, was close to the species number in Ogosta Reservoir, both infested by species from complex *D. bugensis - polymorpha*. While in not infested Koprinka Reservoir and Stambolijski Reservoir the species number is lower, 15 and 11 respectively (Stoichev 1996). The results from the dominance analysis of the species (pF, DF and Dt in %) are shown in Tab.1. According to the obtained frequency of presence data, a classification was applied for the first time by Stoichev (1996) where found species fall into three of the four groups: 1. Very frequently found species (pF >50 %) *M. stagnalis, D. stagnalis, Eudorylaimus carteri, Tripyla glomerans.* 2. Frequently found species (pF 10–50 %) *E. carteri, Plectus cirratus, Rhabditis filiformis, Tobrilus gracilis ,Enoploides fluviatilis.* 3. Rarely found species (pF 1–10 %) *Paradorylaimus filiformis, Paradorylaimus sp., Cylindrolaimus communis, Plectus assimilis, Prodesmodora circulata.* 4. Very rarely found species (pF <1 %).

Beside species with high values of frequency of occurrence and range of dominance (*M. stagnalis, M. filiformis, D. stagnalis*), also species with high values of range of dominance and low frequency of occurrence and frequency of dominance can be found (*C. communis, Rh. filiformis, P. circulata*).

Tab.1. Nematoda species by stations and dominant analysis (pF%, DF% and Dt%).

	STATIONS					Dominant analysis		
TAXA	**1**	**2**	**3**	**4**	**5**	**pF%**	**DF%**	**Dt%**
Monhysterida								
Monhysteridae								
Monhystera stagnalis BASTIAN, 1865	X	X	X	X	X	74,28	54,28	73,07
Monhystera filiformis BASTIAN, 1865	X	X	X		X	62,85	51,42	81,81
Monhystera sp.				X		2,85		
Dorylaimida								
Dorylaimidae								
Dorylaimus stagnalis DUJARDIN, 1845	X	X	X	X	X	88,57	62,85	70,96
Dorylaimus sp.			X			2,85		
Paradorylaimus filiformis (BASTAN, 1896) ANDRASSY, 1969				X		5,71		
Paradorylaimus sp.		X				2,85		
Mesodorylaimus sp.			X			2,85		
Qudsianematidae								
Eudorylaimus carteri (BASTIAN, 1865) ANDRASSY, 1969	X		X		X	31,42	14,28	45,44
Cylindrolaimidae								
Cylindrolaimus communis DE MAN, 1880		X				8,57	2,85	33,25
Cylindrolaimus sp.				X		2,85		
Plectidae								
Plectus cirratus BASTIAN, 1865			X	X		22,85	17,14	75,01
Plectus assimilis BÜTSCHLII, 1873		X				5,71		
Rhabditida								
Rhabditidae								
Rhabditis filiformis BÜTSCHLII, 1873	X	X				17,14	11,42	66,62
Rhabditis brevispina (CLAUS, 1862) BÜTSCHLII, 1873 +			X			2,83		
Enoplida								
Tripylidae								
Tripyla glomerans BASTIAN, 1865	X		X	X		51,42	45,71	88,89
Tobrilus gracilis BASTIAN, 1865			X			11,42		
Tobrilus sp.			X			2,85		
Enoplidae								
Enoploides fluviatilis MICOLETZKY (1923)	X	X		X		14,28	5,71	39,98
Enoploides sp.		X				2,85		
Chromadorida								
Microlaimidae								
Prodesmodora circulata (MICOLETZKY,1913) MICOLETZKY,1915				X	X	8,57	2,85	33,25
Prodesmodora sp.				X		2,85		

Nbac and COD (Fig. 1B) were with higher values in the stations 2 and 5. These stations are ecotone zones, because of the inflow of the rivers Zlatitsa and Barzeya and respectively Ogosta, where the quantity of dead organic matter, coming from the rivers to the reservoir, is higher and the processes of its degradation are more intensive. Negative correlations were found between bacteria and *Tripyla glomerans* (r = -0.98, P = 0.002, T.glomerans = 36,0076-0,0001*x) and between detritus and *Enoploides fluviatilis* (r = - 0.88, P<0.05). *Tobrilus* genus was found in the sampling station 3 and correlated negatively with the oxygen saturation. The individuals of *Tobrilus* genus are represented at a high density in the sediments of lenthic ecosystems, especially in eutrophic lakes and are considered as tolerant of low oxygen conditions (Vidakovic, Bogut 2004).

Only two environmental factors, COD and oxygen saturation, explained significantly 71 % of the distribution of Nematoda species by stations (Fig. 1B, RDA, AllEV=1.000, CanEV=0.708, F=2.424, P-value=0.0260). Including the factor - species from complex *D. bugensis - polymorpha* as the third independent variable, canonical eigenvalues increased to 0.859 (86 %), P-value was higher (0.0720), but still close to level of significance. A negative correlation was found between species from complex *D. bugensis - polymorpha* and *Prodesmodora circulata,* but positive correlations with *Monhystera filiformis* and *Rhabditis filiformis*.

Conclusions

The present study reveals the stenobiontic character of some of the species. The abundant development of these species is only possible in narrow limits of the environmental conditions. Outside these limits they cannot be found or they are in low quantity. The Nematoda community in the ecosystem of Ogosta Reservoir is composed of species with high ecological valence, as well as species with different level of specialization and adaptation to the environmental conditions and also to the infestation of the invasive species from complex *D. bugensis - polymorpha*. Free-living Nematoda play an important ecological role mainly as primary consumers, displaying saprophagous or bacterivorous feeding habits, and take part in controlling the nutrient cycling of the reservoir.

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