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Contribution to the study of the free-living freshwater nematode fauna of the Bedechka River, Southern Bulgaria

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Abstract. Hydrobiological studies of the Bedechka River were performed in 2019. The present study provides information on free-living freshwater nematodes from the Bedechka River. In our study, we identified 9 species of freshwater free-living nematodes belonging to 8 genera. This is the first detailed study on free-living freshwater nematodes from the Bedechka River.

Key words: Free-living freshwater nematodes, Bedechka River, Southern Bulgaria.

Introduction

Nematodes are one of the most numerous groups in the animal world; their exact number is not known. Compared with other groups of worms, nematodes have adapted to different living conditions due to their solid cuticle, which makes them less sensitive to the oxygen content and to the impact of other ecological factors. Free-living freshwater nematodes form an important part of the biomass of the meiobenthos, but they are mostly neglected in hydrobiological studies.

The Bedechka River is located in Southern Bulgaria – Stara Zagora Region, Stara Zagora and Radnevo municipalities, a left tributary of the Sazliyka River, from the Maritsa basin. Its length is 34 km. The Bedechka River rises under the name Chakmadere at 649 m above sea level in Sarnena Sredna Gora, 1,5 km northwest of the village of Borilovo, Stara Zagora Municipality. The Stara Zagora – Kazanlak road it flows east in a relatively shallow valley with steep right slopes. Then it turns south and, in a deep gorge valley, it reaches Stara Zagora. After the city, it turns southeast, enters the Upper Thracian Lowland, where its bed is completely corrected with water protection dikes. It flows from the left into the Sazliyka River from the Maritza basin at 135 m above sea level, 700 m north of the village of Bozduganovo, Radnevo Municipality.

The aim of our study is to determine the species composition of the free-living freshwater nematode fauna of the Bedechka River.

Material and Methods

A total of 15 samples were collected in the area of the city of Stara Zagora. (Fig.1 A and B). Samples were fixed in 4% formalin, then heated in a water bath to stretch and measure. The determination and the presentation of the species were made according to Gagarin (1981). The formula of De Man (1886) was used to determine the species qualitative composition.

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Fig. 1. A (left) - Bedechka River in the city of Stara Zagora (Southern Bulgaria), B (right) - Lake Zagorka in the city of Stara Zagora (Southern Bulgaria). Photo: Evgeniya Tosheva.

Results and Discussion

The present study provides detailed information on free-living freshwater nematodes from the Bedechka River. The enormous quantity of nematodes, which, according to some authors (Rees 1940), amounts to several millions of specimens/m^2, determines their significance for the balance of the organic substances in the water basins. Nematoda are an example of such a state in the evolution of a given taxonomic unit, which is defined by Severtsov (according to Paramonov 1970) with the term biological progress. Free-living nematodes are a major component of freshwater meiofaunal communities, where they often attain very high densities (>1 million individuals per m^2; Traunspurger, 2000; Traunspurger *et al.*, 2012). The distribution of free-living freshwater nematodes found by us is presented in Table 1. The species density of the longitudinal distribution of the species is uneven. The higher number of nematodes in the upper mountainous part of the river is due to: lower pollution from human activity; colder and oxygen-rich water, which is favorable for nematodes that prefer cooler conditions; the presence of rocks, sand and fine sediments where nematodes can hide and feed; fewer fish and other predators that feed on nematodes, weaker competition from other organisms, as well as more abundant food due to differences in the decomposition of organic matter. Less than one-third of the species were found in the lower part of the river below Stara Zagora. No doubt, the human activity below Stara Zagora is an explanation for the poorer species composition in this stretch of the river nematodes are highest in soft habitats. Another large part of nematodes inhabits many habitats of different types, which proves the eurytopic characteristics of nematodes. For most nematodes inhabiting different types of habitats (hard and soft), the substrate is not a limiting factor.

Nematoda have achieved their current biological progress. They occupy all biotopes and habitats known to science, with their high ecological flexibility and adaptability. An analysis of the nematodes gives information that the very frequent species also dominate qualitatively in the nematode complex in various parts of the Bedechka River.

Conclusions

The nematode species found in the lower part of the Bedechka River are fewer due to anthropogenic pollution after passing the new neighbourhood built along the river. This coincides with the decrease in species diversity found by other authors (Heininger *et al.*, 2007; Haegerbaeumer *et al.* 2018) due to water and sediment pollution.

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Table1. Species composition and distribution of free-living freshwater nematodes in the Bedechka River.

	Nematoda	Distribution
1	*Dorylaimus stagnalis* (Dujardin, 1848)	Cosmopolitan in the European part of Russia, Ukraine, Moldova, Georgia, Romania, and Bulgaria. It is found in Serbia, Greece, Bosnia and Herzegovina. It is possible to find it all over Europe. In Bulgaria, it is widespread in rivers and lakes. It is found above and below Stara Zagora.
2	*Dorylaimus* sp.	It is found above and below Stara Zagora.
3	*Eudorylaimus carteri* (Bastian, 1865)	Cosmopolitan in the European part of Russia, Ukraine, Romania, and Bulgaria. It is found in Serbia, Greece, Bosnia and Herzegovina. It is possible to find it all over Europe. In Bulgaria, it is widespread in rivers and lakes. It is found above and below Stara Zagora.
4	*Eudorylaimus* sp.	It is found above Stara Zagora.
5	*Paractinolaimus macrolaimus (De Man,1880)*	It is found above Stara Zagora.
6	*Monhystera stagnalis* (Bastian, 1865)	Cosmopolitan in the European part of Russia, Ukraine, Moldova, Georgia, Romania, and Bulgaria. It is found in Serbia, Greece, Bosnia and Herzegovina. It is possible to find it all over Europe. In Bulgaria, it is widespread in rivers and lakes. It is found above Stara Zagora.
7	*Monhystera filiformis* Bastian, 1865	Cosmopolitan in the European part of Russia, Ukraine, Moldova, Georgia, Romania, and Bulgaria. It is found in Serbia, Greece, Bosnia and Herzegovina. It is possible to find it all over Europe. In Bulgaria, it is widespread in rivers and lakes. It is found above Stara Zagora.
8	*Monhystera* sp.	It is found above Stara Zagora.
9	*Prodesmodora circulata* (Micoletzky, 1913)	Cosmopolitan in the European part of Russia, Ukraine, Moldova, Georgia, Romania, and Bulgaria.It is possible to find it all over Europe. It is found above Stara Zagora.

10	*Tripyla glomerans* (Bastian, 1865)	Cosmopolitan in the European part of Russia, Ukraine, Moldova, Georgia, Romania, and Bulgaria. It is found in Serbia, Greece, Bosnia and Herzegovina. It is possible to find it all over Europe. In Bulgaria, it is widespread in rivers and lakes. It is found above and below Stara Zagora.
11	*Tripyla* sp.	It is found above Stara Zagora.
12	*Tobrilus gracilis* (Bastian, 1865) Andrassy, 1959	Cosmopolitan in the European part of Russia, Ukraine, Moldova, Georgia, Romania, and Bulgaria. It is found in Serbia, Greece, Bosnia and Herzegovina. It is possible to find it all over Europe. In Bulgaria, it is widespread in rivers and lakes. It is found above and below Stara Zagora.
13	*Tobrilus* sp.	It is found above Stara Zagora.
14	*Plectus cirratus* Bastian, 1865	It is found in sandy and clayey bottoms. Found in the European part of Russia, Bulgaria, Bosnia and Herzegovina. It is found below Stara Zagora.
15	*Plectus* sp.	It is found below Stara Zagora.

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