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Species Content and Distribution of the Macrozoobenthos along Rilska River, South-West Bulgaria

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Summary: Rilska River is one of the left tributaries of Struma River and it is a substantial source of drinking water for the capital city of Sofia. In spite of that the hydrobiological data are quite poor, especially these concerning bottom invertebrate fauna. This study presents the results from research on the macrozoobenthos species composition carried out in 2007-2008 at six sites along the river. During the study period totally 192 benthic taxa were found. The relatively high taxa richness and the presence of species sensitive to pollution at all investigated sites are indicative of stable low-saprobic conditions in the river. It was determined that the species composition along the river continuum differed significantly in the upper and lower part of the river and a tendency of increasing species richness downstream the river was observed.

Keywords: Rilska River, Macroinvertebrate benthic fauna, Species composition, Dominant species

1. INTRODUCTION

Rilska River is one of the left tributary of Struma River and substantial source of drinking water for Sofia City. In spite of this, the hydrobiological data about it are quite poor, especially this concerning bottom invertebrate fauna.

The river springs from Ribni Ezera (Fish Lakes) in Rila Mts. at 2691 m a.s.l. and flows in west direction. The catchment area is 392 km^2 large and its natural annual outflow is 141.9 million km^3. The average slope of the river is quite high: 30‰. Its biggest tributary is Iliina River with total length of 16 км flowing out from the Sinyoto Ezero (Blue Lake) in Middle Rila Mts. In the upper course the river forms deep and steep valley in the mountain, passing through Kocherinovo plain and mouthing the Struma River. The

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deep snow, wet climate and lots of circus lakes are its main water sources. The main source of pollution of Rilska River is the urban watsewater from settlements alongside the river bed. The natural hydrological regime of the river is strongly influenced by several derivations, small hydropower plants and small accumulations for levelling. According to the West-Aegean Basin Directorate the rivers Rilska and Iliina are "probably at risk" not to achieve the environmental objectives of the Water Frame Directive 2000/60/EC.

This study presents the results of studies on the macrozoobenthos species composition as a basic biological quality element for ecological status classification of the riverine water bodies within the Rilska River watershed.

The former hydrobiological studies of Rilska River are quite poor. [4] investigated the macrozoobenthos at a site near the town of Kocherinovo, studying the pollution of Struma River. Later, in 1987, within the National Youth Action "Clean Rivers" funded by Ministry of Public Education (1989) two sites along the Rislka River (Pastra and Barakovo) have been studied (but results were not published). During that study the benthic fauna was established rather poor and on the last site, in the autumn, benthos was missing at all. Known data contain some information about bottom invertebrates as for 11 simuliid species (Diptera Simuliidae) reported by [3] and for 1 mayfly species (Ephemeroptera) reported, by [6].

2. MATERIAL AND METHODS

The study of macrozoobenthos in Rilska River was carried out on a monthly basis during the vegetation periods from June 2007 till November 2008 at six sites along the river (Table 1), selected as representative to reflect the ecological situation of the respective river stretch. Sixty-eight quantitative hydrobiological samples (macrozoobenthos material) were gathered following the ISO 7828: 1985 (F) standard.

After laboratory processing and species determination, dominant analysis was performed according to the method of [2] after [5]. The species similarity amongst the different sites along the river continuum was determined by the coefficient of Bray-Curtis (1957) and presented by Cluster Agglomerative Analyse [1].

Table 1. Description of the studied sites along the Rilska River

№	Name of the site	Altitude m a.s.l	Bottom substrate	Vegetation	Average t°
1	Manastirska R., upstream Kirirlova polyana site	1500	Stone, gravel	Coniferous forest vegetation	9.30
2	Iliina River, upstream Manastirska R.	1450	Stone, gravel	Deciduous forest vegetation	10.75
3	Rislka R., downstream Iliina R.	1395	Stone, gravel	Deciduous forest vegetation	11.90
4	Rilska R., downstream the village of Pastra	706	Stone, gravel	Deciduous forest vegetation	14.20
5	Rilska R., at the village of Stob	465	Gravel, sand	Riparian woods and shrubs	15.27
6	Rilska R., at the mouth into the Struma R.	370	Gravel, sand	Riparian woods and shrubs	17.30

3. RESULTS AND DISCUSSION

During the whole period of the study, totally 192 benthic species from 55 invertebrate families have been found. For Iliina River 90 taxa from 42 families were found; of them *Dendrobaena alpina* (Rosa, 1884) (Lumbricidae), *Iron yougoslavicus* (Samal, 1935) (Heptageniidae), *Drusus sp*. (Limnephilidae), dipterian larvae *of Liponeura sp.* (Blephariceridae) and *Hexatoma sp.* (Limoniidae) were not found in the Rilska River. The value of taxa richness was the highest at site 4 where totally 101 taxa have been registered for the studied period. Three groups were found most rich of representatives: Oligochaeta (21 species), Ephemeroptera (20 species) and Diptera (20 species). Close to this was the species content of bottom invertebrates at site 6 with 93 registered species, where again Oligochaeta and Ephemeroptera were presented with 23 taxa each. After that comes site 2 where dipterian larvae (21 taxa) and representatives of Trichoptera (18 taxa) prevail. The macrozoobenthos of the other sites have had similar number of species established between 82 (with highest number of 21 dipterian species) for site 1, 85 for the site 5, and 88 for the site 3.

Cluster analysis and the coefficient of Bray-Curtis distinguished two groups of examined sites according to the similarity of their species composition (Fig. 1.)

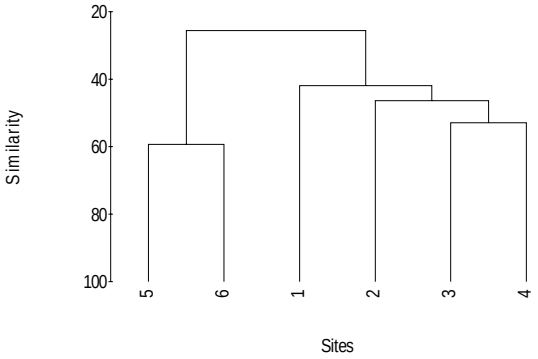

Fig. 1 Dendogram: Classification of the examined river sites based on the macrozoobenthos species content

One of the groups (further marked as foothill part of the river course, just before mouthing) includes sites 5 and 6, with high similarity among them – 60%. The other group (further marked as mountain part of the river course) consists of sites 1-4 (headwater+gorge) with average degree of similarity 41.24%. Low faunistic similarity – 22.57%, was established among the both groups.

Larvae of order Diptera prevail in the riverine macrozoobenthos. The total number of identified dipterian species was 43 which is 22.4% of all species found during this study. Most of them belong to the family Chironomidae (16 species). The representatives of family *Ceratopogonidae g. sp*. and the chironomid species *Chironomus gr. riparius, Cryptochironomus gr. defectus*, and other dipterians like *Dicranota sp., Tipula sp*. were found in all six sites along the river course. Another benthic group with high richness of species was class Oligochaeta with 39 species found (20.3% of the total number of species), most of them (16 species) from Naididae. All over the species *Stylodrilus heringianus* Claparede, 1862*, N. pseudoobtusa* and *Enchytraeidae g. sp*. were found. Order Ephemeroptera was presented with 32 species (16.7%), with predominant presence of species from Heptageniidae (14 species). Nine mayfly species were found in all studied sites - *B. alpinus, B. muticus* (Linnaeus, 1758), *B. rhodani, Ecdyonurus sp. gr. helveticus, Ecdyonurus sp., Epeorus*

sylvicola, Rhithrogena. sp. gr. hybrida, Rhitrogena sp., Habroleptoides confusa Sartori & Jacob 1986. Caddisflies (order Trichoptera) were presented with 27 species (14.1%), three of them distributed all over the river – *Hydropsyche sp., O. hellenicum, Rhyacophilla sp.* Close to them was order Plecoptera with 25 species (13%), as only *L. pseudosignifera* was found at all sites along the river course. The other macroinvertebrate groups were presented with lower number of species.

According to the values of frequency of occurrence, 4 species could be defined as mass occurring in the river (pF >50%): *B. alpinus* (75%), *B. rhodani* (74%), *Ecdyonurus sp*. (59%), *Hydropsyche sp.* (59%). The commonly occurring species with frequency of occurrence within 20-50% were 29, and 66 species had values of pF 5-20%. Most of the species - 95, were defined as rarely occurring species with pF < 5% and 54 of them (27.8% from the total number) were found once only for the whole studied period.

The number of species that dominated in the river macrozoobenthos was 15 (Table 2). The highest degree of dominance – 59.26%, was determined for *G. balcanicus*. This species was found only in the foothill part of the river and it was abundant during the whole vegetation period. Two dipterian larvae – *T. gr. gregarius* (DT=36.36%) and *Ch. gr. riparius* (DT=29.41%) also had a relatively high degree of dominance in the river. The first one dominated at the sites in the upper course of the river, as the second one prevailed in the middle part and once in the mouthing site.

The species *B. alpinus* and *Rhitrogena sp.*, distributed all over the river had values of DT=15%. The same degree of dominance was also exhibited by the dipterian *Tonnoiriella sp.* which was abundant only at the site of Iliina River. The other species had low degrees of dominance and 6 of them were registered as dominants only once.

During the year changes of the dominant species were observed due to the specific natural life cycles of the bottom invertebrates and the various conditions in the river through the seasons (Table 2).

Species	Spring			Summer			Autumn		
	pF %	DF %	DT %	pF %	DF %	DT %	pF %	DF %	DT %
Nais pseudoobtusa (Piguet, 1906)	27.78			50.00	4.17	8.33	30.77		
Gammarus balcanicus (Schäferna, 1922)	33.33	16.67	50.00	33.33	25.00	75.00	50.00	30.77	61.54
Baetis alpinus (Pictet, 1843)	77.78	27.78	35.71	91.67	4.17	4.54	57.69	3.85	6.67
Baetis rhodani (Pictet, 1843)	77.78	11.11	14.29	79.17	8.33	10.52	80.77	7.70	9.53
Epeorus sylvicola (Pictet, 1865)	11.11			16.67			84.61	3.85	4.55
Rhithrogena semicolorata (Curtis, 1834)	11.11			8.33	4.17	50.00	3.85		
Rhitrogena sp.	22.22			25.00	4.17	16.67	65.38	15.38	23.52
Leuctra fusca (Linnaeus, 1758)	5.55			25.00	4.17	16.67	3.85		
Leuctra pseudosignifera (Aubert, 1954)	16.67			37.50			34.61	3.85	11.12
Hydropsyche sp.	50.00			50.00			84.61	7.70	9.1
Odontocerum hellenicum (Malicky, 1972)	27.78	5.55	20.00	16.67					
Chironomus gr. Riparius (Meigen, 1804)	44.44	16.67	37.50	62.50	25.00	40.00	38.46	3.85	10.01
Cryptochironomus gr. Defectus (Kieffer, 1913)	38.89	11.11	28.57	37.50	4.17	11.1	34.61		
Tanytarsus gr. Gregarius (Kieffer, 1909)	22.22	11.11	50.00	41.67	20.83	50.00	34.61	3.85	11.12
Tonnoiriella sp.	22.22			25.00			61.54	15.38	25.00

Table 2. Distribution of the dominant bottom invertebrate species during the vegetation period (May-November)

During the spring, the species *B. alpinus, G. balcanicus* and *Ch. gr. riparius* were found with highest frequency of dominance (DF). In the same period highest degree of dominance (DT) have had again *G. balcanicus* and the species *T. gr. gregarius* despite its low frequency of occurrence during the season. On the contrary, the very commonly occurring spring caddisfly *Hydropsyche sp*. did not dominate at all.

During the summer, the species with high frequency of occurrence as *B. alpinus, B. rhodani, N. pseudoobtusa* had relatively low degree of dominance. Dominant role in the community was exhibited by species *G. balcanicus, R. semicolorata* and *T. gr. gregarious* (despite their local character of occurrence), and the mass occurring for the season species - *Ch. gr. riparius*.

During the autumn, *G. balcanicus* was absolutely dominant, followed by the mass occurring for that season species *Tonnoiriella sp*., with considerably lower degree of dominance. The other dominant species during the autumn had low DT-values, despite their mass and commonly occurrence.

4. CONCLUSION

The present study of bottom invertebrate fauna of Rilska River established relatively high species richness. 190 species out of 192 found in the river during the studied period were found and reported here for first time. The presence of taxa being sensitive to pollution during the whole period of investigation, at all sites along the river, was indicative for stable low-saprobic condition in the river and its high self-purification capacity. Along the river continuum there was observed a significant difference in the faunistic similarity between the upper and lower part of the river. This result confirms the necessity of including the altitude as an obligatory element in determination of the typology of riverine water bodies.

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