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SAPROBIOLOGICAL ANALYSIS OF LLAP WATER (KOSOVO)

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ABSTRACT

In spring 2004, we investigated diatom taxa (Bacillariophyta) at 4 sampling stations on the Llap River in Kosova. The saprobic index was calculated on the basis of microscopic analysis of diatom communities to evaluate water quality in the Llap. 52 species of diatom algae were determined. According to the presence of indicator species, Llap water could be classified into category II class (beta mesosaprobic level).

Key words: Llap River, diatoms, saprobity

ANALISI SAPROBIOLOGICA DEL FIUME LLAP (KOSOVO)

SINTESI

Nella primavera del 2004 gli autori hanno studiato i taxa di diatomee (Bacillariophyta) in 4 stazioni di campionamento sul fiume Llap in Kosovo. L'indice saprobico è stato calcolato in base all'analisi microscopica delle comunità di diatomee al fine di valutare la qualità dell'acqua del fiume Llap. Sono state determinate 52 specie di diatomee. In base alla presenza di specie indicatrici, l'acqua del fiume Llap può venire classificata come categoria di qualità II (livello beta mesosaprobico).

Parole chiave: fiume Llap, diatomee, saprobia

INTRODUCTION

Periphyton is the mixture of algae, bacteria and fungi that grows on rocks, snags, macrophytes and man-made structures in streams (Rutherford & Cuddy, 2005). Aquatic organisms can serve as indicators of the properties of the surrounding environment. They are applied mainly in the field of water quality and in its central part saprobity (Sladeckova & Sladecek, 1993). Saprobity describes the effects of the content of putrescible organic matter undergoing microbial decomposition. The common processes of eutrophication, pollution, degradation and selfpurification can be damaged or destroyed by toxic, radiochemical and some physical factors interfering with saprobity. Biological indicators enable us to distinguish individual saprobic levels by microscopical analysis (Sladeckova & Sladecek, 1993). Diatoms, a predominant component of the periphyton, have long been used as biological indicators for monitoring surface water quality (Whitton & Rott, 1996).

The aim of the study was to investigate the diatom community composition in the upstream of the river Llap to the town of Besiana (ex Podujeva), as well as to demonstrate the influence of pollution on the variation of diatom community. Composition of diatom communities was assessed by studying their density and taxonomic composition.

Periphyton diatom communities are important primary producers in rivers, streams and lakes, where their characteristics are influenced by several environmental factors.

MATERIAL AND METHODS

Study site

The Llap River is 79.4 km long, with its source located near the village of Bellasic. The Llap joins the Sitnica River in the central part of Kosovo. Temperature regime of the investigated river water depends upon meteorological conditions and season. Its maximum temperature of 21.7 ºC was reached during the summer, while its lowest temperature (2.4 ºC) was registered in January. The highest rainfall was recorded between October and March (data supplied by the Meteorological and Hydrological Service of Kosova), the lowest between June and August. The water level of the Llap varies from 40–86 cm.

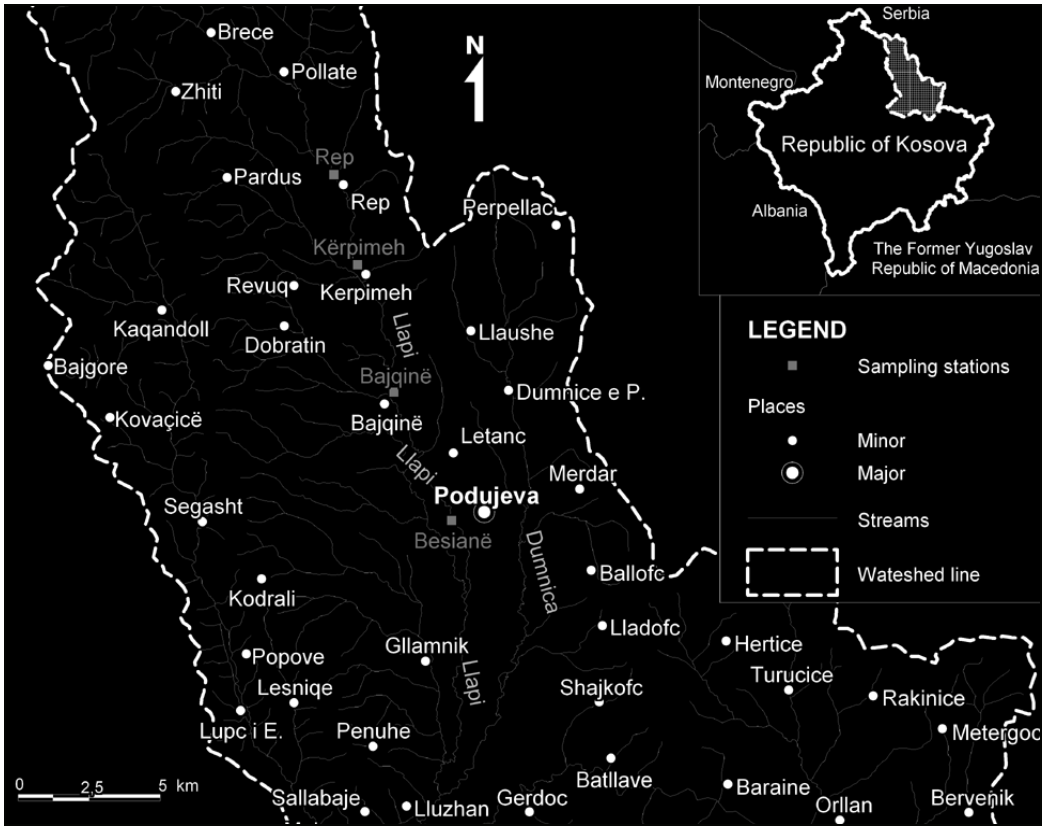

Fig.1: The map of the Llap River with sampling stations.
Sl. 1: Zemljevid reke Llap z vzorčišči.

Sampling localities:

1 – Right bank of the Llap River downstream of Repa village;

2 – Left bank of the Llap River in the centre of Kerpimeh village, after the inflow of the effluent waters from the sewage system;

3 – Right left bank of the Llap River near the bridge leading to Bajqinë village;

4 – Right bank of the Llap River after the inflow of waste waters from the Besiana town sewage system.

Material of phytobenthos was obtained by collecting sediments and stones taken from the river bottom (10–30 cm deepness) at four (4) stations between Repa and Besiana (Fig. 1).

The collected material was fixed with 4% formaldehyde and analysed in the laboratory of the Department of Biology, Faculty of Natural Science. Phytomicrobenthos was examined under "Leica" microscope. Determination of algae was described according to Geitler (1932), Gollerbah *et al.* (1953), Zabelina *et al.* (1951) and Lazar (1960). The levels of saprobity were estimated by Sladecek (1973), while the evaluation of saprobity was carried out on the basis of indicator species and standard procedure of Pantle & Buck (1955), Knopp (1954–1955) and Krammer & Lange Bertalot (1986–1991).

The relative abundance of the phytoplankton has been determined according to the modified sixth degree scale (Kawecka 1980).

Cleaning of diatoms and slide preparation

Cleaning of diatom frustules, preparation of permanent slides and determinations follow Krammer & Lange-Bertalot (1986–2001). The analysed water was put into a 600 ml glass beaker with 20 ml of concentrated HNO_3. The beaker was placed on a hotplate and heated until the volume of liquid was reduced to about 20 ml. From time to time, particles of $K_2Cr_2O_7$ were added. Eventually, the samples were rinsed with tap water until reaching 7 pH.

For slide preparation, a drop of water solution was put in the centre of a slide and left to dry. Than a drop of Hyrax mounting medium was added in the centre of coverslip and pressed gently with finger to spread the hyrax.

RESULTS AND DISCUSSION

The highest species number of diatoms was recorded at locality 1 (Repa), where 48 algal species were determined (Tab. 1). Localities 2 and 3 also had a relatively high number of species (31 taxa). In comparison with locality 1, the lower algal richness at localities 2 and 3 is probably due to the pollution caused by sewage waters falling into the Llap River at localities 2 (Kërpimeh village) and 3 (Bajqinë). At station 4, 21 diatom species were determined. The lower diatom richness could be ascribed to the pollution caused by sewage waters from the town of Besiana (former Podujeva), as well as to higher velocity of the river current at the other three stations (Medley & Clements, 1998; Fuertet - Mazel *et al.* 2003; Megharaj *et al.*, 2004; Zamaro, 2005). The development and seasonal variation of diatoms depend on various factors: velocity of the current, which influences their metabolism in terms of breathing, the pH of water, temperature (diatoms prefer fresh spring and autumn waters) and the oxygen present in the water (Zamaro, 2005). Density of algae depends on the substrate nature to which the diatoms adhere (Zamaro, 2005). Our study investigated whether algae-based water quality assessment is affected by differences between algal assemblages on hard substrates (rock, wood) and soft substrates (fine–grained sediments).

Tab. 1: Results of algological analyses of phytomicrobenthos in the upstream of the Llap River between Repa village and Besiana town in spring 2004.
Legend: o – oligosaprobic level; β – betamesosaprobic level; α – alphamesosaprobic level.
Tab. 1: Rezultati algoloških analiz fitomikrobentosa v toku reke Llap med vasjo Repa in mestom Besiana spomladi leta 2004.
Legenda: o – oligosaprobna stopnja; β – betamezosaprobna stopnja; α – alfamezosaprobna stopnja.

Taxa	Saprobic level	Locality			
		1	2	3	4
No. species per locality		48	31	31	21
Bacillariophyta					
Achnantes hungarica (Grunow)	o	1	1	-	-
Amphora lybica (Ehr)	β	-	1	-	1
A. normani (Rab)	o	2	-	1	-
Cocconeis placentula (Ehr)	β	1	1	-	-
C. pedicilus (Ehr)	o-β	1	-	-	-
Caloneis amphisbaena (Cl.)	β-α	1	-	-	-
Cymbela austriaca (Grun)	b	3	2	2	-

Taxa	Saprobic level	Locality			
		1	2	3	4
C. affinis (Kütz)	o-β	5	5	3	-
C. ventricosa (Kütz)	β	1	-	1	-
C. minuta (Hilse et Rab)		1	-	-	-
Craticula cuspidate (Kütz)Man		3	3	-	1
Cymatoplura solea (W.Smith)	β-α	-	3	1	-
Diatoma vulgare (Bory)	β	3	1	1	-
D. elongatum var. *tenuis*	α	1	-	1	-
D. monoliforme (Kütz)		1	1	-	-
Epthemia addnata (Kütz) Breb		1	-	-	-
Fragilaria ulna (Nitzsch) Lange-Bertalot		3	1	1	-
Gyrosigma acuminatum (Raben.)	β	-	-	-	1
G. scalproides (Cleve)		2	-	1	-
Gomphonema olivaceum (Kutz)	β	5	-	3	-
Hantzschia amphioxis (Grun)	α	1	-	-	-
Luticola geoppertiana (Bleish) Mann		3	3	2	-
Luticola mutica (Kütz)		3	1	-	1
Melosira varians (Ag)	β	1	3	-	3
Navicula gracilis (Ehr)	β-α	-	1	-	-
N. cryptocephala (Kütz)	α	3	1	5	1
N. exigua (Muller)	β	3		5	-
N. lanceolata (Agardh) Ehr.		1	1	-	1
N. radiosa (Kütz)	o-β	2	-	-	3
N. rhynchocephala (Kütz)	α	1	1	-	-
N. viridula (Kütz)	α	7	-	7	1
Nitzschia acicularis (W.Sm)	α	3	-	2	-
N. acula (Hantzch)	α	1	1	-	3
N. constricta (Kütz)		2	1	1	1
N. capitellata (Hust)		3	3	1	1
N. fonticola (Grun)	o-β	1	1	3	5
N. gracilis (Hatzsch)		-	3	1	-
N. hungarica (Grun)	α	5	-	3	5
N. palea (W.Sm)	α	1	-	2	-
N. paleacea (Grun)	-	3	1	2	-
N. recta (Hatzsch)	β-α	2	1	-	-
N. stagnorum (Raben)	β	1	1	-	3
N. sigmoidea (W.Sm)	β	-	-	1	1
N. termalis var. *minor* (Hisle)	-	1	-	-	2
N. vermicularis (Grun)	β	2	2	3	3
Pinnularia microstauron var. *brebissoni* (Kütz)	β	1	-	1	-
P. viridiformis (Nitzsch) Ehren		1	-	1	-
Roichosphaenia curvata (Gr)	β	2	1	1	-
Stauroneis anceps (Ehr.)	β	3	3	1	5
Synedra ulna (Her)	β	5	1	5	-
Surirella ovata (Kütz)	o-β	5	-	-	-
S. linearis (W.Smith)	β	1	1	3	1
S. robusta (Ehr.)		3	-	-	-
S. angusta (Ehr.)	β	1	1	3	5

Our results show that nearly in the entire part of the research area the algae of the genus *Nitzschia* with 14 species are prevalent. Other established taxa are the genus *Navicul*a with 7 species, *Surirella* and *Cymbella* with 4 species, *Diatoma* with 3 species, *Luticola, Gyrosigma, Pinularia, Cocconeis* and *Amphora* with 2 species, and other genus with 1 species. This species composition could be explained by the temperature of Llap water, which ranges in spring between 14–20 ºC, which is an optimum for the growing and development of the established groups of algae (Habdija, 1970; Grin, 1971; Oksijuk 1973; Maloseja, 1979; Hunter *et al.*, 2000). The abundance of diatoms also depends on light penetration (Hunter *et al.*, 2000; Zamaro, 2005).

Tab. 2: The saprobic index and saprobic level calculated for the Llap River according to the Pantle-Buck criteria (Pantle & Buck, 1955).
Tab. 2: Saprobni indeks in saprobna stopnja, izračunana za reko Llap glede na kriterije Pantle-Buck (Pantle & Buck, 1955).

Parameter	Localities			
	1	2	3	4
Saprobic index	1.67	1.62	1.72	1.71
Saprobic level	β	β	β	β
Quality class	II	II	II	II

Diatoms are ideal for biomonitoring purposes as they occur in very high numbers and are sensitive to changes in water chemistry (Fisher & Dunbar, 2007). They often have narrow tolerance range for pH, nutrients or salinity conditions (http://www.adelaide.edu.au/diatoma/stm.html).

Table 1 shows the list of 52 determined diatom species. For each of the 38 indicator species, saprobic level is denoted. We found 2 species characteristic of the oligosaprobic level, 5 oligo-beta-mesosaprob species, 18 beta-mesosaprobic species, 4 beta-alpha-mesosaprobic species and 9 species characteristic of the alpha-mesosaprobic level.

According to the bioindicator algal species determined in phytobenthos, the researched part of the Llap River belongs to quality class II (beta-mesopsaprobic level) (Tab. 2).

CONCLUSION

In the researched part of the Llap River, 52 species of diatoms were recorded. The highest number of taxa was found at locality 1 (Repa) with 48 species. 38 of them were bioindicator species. According to the presence of species as saprobiologic bioindicators and saprobic level, the researched part of the Llap River was classified into category II of the water quality.

SAPROBIOLOŠKA ANALIZA VODE REKE LLAP (KOSOVO)

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POVZETEK

Spomladi leta 2004 so avtorji članka preučevali taksone kremenastih alg (Bacillariophyta) na 4 vzorčiščih vzdolž reke Llap (Kosovo). Saprobni indeks je bil z namenom, da se oceni kakovost vode v reki, izračunan na osnovi mikroskopske analize združb kremenastih alg. Ugotovljenih je bilo 52 vrst kremenastih alg. Glede na pojavljanje bioindikatorskih vrst v reki Llap, lahko to reko vključimo v kakovostni razred II, kar pomeni, da pripada beta-mezosaprobni stopnji.

Ključne besede: reka Llap, kremenaste alge, saprobnost

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