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Algae of specific environments in Slovenia

Alge posebnih okolij v Sloveniji

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Abstract. Algae studies were carried out in some specific biotopes of Slovenia: eutrophic lakes (Koseški bajer, Sotelsko jezero), peat bogs (Lovrenška jezera, Šijec), waterfalls (Savica, Krka falls, small waterfall on Pohorje), springs (springs at Medvedje Brdo and Pohorje, hot spring at Terme Čatež, mineral spring at Rimski vrelec), brackish waters (Fiesa lake, Dragonja estuary), hypereutrophic biotopes (manure water, constructed wetlands), aerial biotopes (concrete wall, stony wall, lime tree trunk (*Tilia platyphyllos*), limestone rock, Krška jama cave) and the Dragonja River.

Samples were taken seasonally at 26 sampling sites in 1998, 1999, 2000 and 2001. Similarity in species structure and abundance of algae were determined with the Bray-Curtis coefficient of similarity.

Altogether, 537 species and subspecies of algae (of nine classes) were determined and most of them belonged to Bacillariophyceae. 146 species and subspecies were identified for the first time in Slovenia; of these 107 belonged to Bacillariophyceae, 28 to Cyanophyceae, six to Chlorophyceae, four to Zygnematophyceae and one to Xanthophyceae.

The appearance of almost half of all species and subspecies was limited to a single sampling site. Eight species (*Achnanthes minutissima, Cymbella affinis, Cymbella silesiaca, Gomphonema angustum, Navicula veneta, Navicula* sp., *Phormidium* sp. and *Trentepohlia aurea*) were present in more than half of all specific biotopes.

Key words: algae, eutrophic lakes, waterfalls, springs, peat bogs, aerial biotopes, constructed wetlands, caves, brackish waters, manure waters

Izvleček. V prispevku je predstavljena raziskava alg v nekaterih posebnih biotopih v Sloveniji: eutrofnih jezerih (Koseški bajer, Sotelsko jezero), visokih bar-

jih (Lovrenška jezera, Šijec), slapovih (Savica, slapovi na Krki, slapič na Pohorju), izvirih (izvir na Medvedjem Brdu in Pohorju, termalni izvir v Termah Čatež, mineralni izvir Rimski vrelec), brakičnih vodah (jezero v Fiesi, izliv Dragonje), hiperevtrofnih biotopih (gnojevka, rastlinskih čistilnih napravah), kopenskih biotopih (betonski zid, kamniti zid, deblo lipe (*Tilia platyphyllos*), apnenčasta skala, Krška jama) in reki Dragonji.

Vzorci so bili odvzeti na 26 vzorčnih mestih v letih 1998, 1999, 2000 in 2001. Z Bray – Curtisovim koeficientom podobnosti je bila ugotovljena podobnost v vrstni strukturi in abundanci alg.

Skupno je bilo določenih 537 vrst in podvrst alg iz devetih razredov, po številu določenih vrst so prevladovale Bacillariophyceae. 146 vrst in podvrst je bilo v Sloveniji prvič zabeleženih, od tega jih 107 pripada razredu Bacillariophyceae, 28 razredu Cyanophyceae, šest razredu Chlorophyceae, štiri razredu Zygnematophyceae in ena razredu Xanthophyceae.

Pojavljanje skoraj polovice vseh določenih vrst in podvrst je bilo omejeno na posamezna vzorčna mesta. Osem vrst (*Achnanthes minutissima, Cymbella affinis, Cymbella silesiaca, Gomphonema angustum, Navicula veneta, Navicula* sp., *Phormidium* sp. in *Trentepohlia aurea*) je bilo prisotnih v več kot polovici vseh posebnih biotopov.

Ključne besede: alge, eutrofna jezera, slapovi, izviri, visoka barja, kopenski biotopi, rastlinske čistilne naprave, jame, brakične vode, gnojevka

Introduction

Algae are present in sea water, brackish water, freshwater and in aerial biotopes. Same of them exist also in specific environments like snow, hot springs, caves, peat bogs, etc. In Slovenia, the number of specific environments is very large because of its geographic diversity and a relatively low degree of pollution. Algae in such environments have been investigated only partly, despite the exceptional species diversity.

Because most algal species are spread worldwide, they are not considered to be an endangered group of organisms. It is also difficult to consider a single algal species to be endangered. Changing or even disappearing of some ecosystems (desiccation of swamps, regulation of rivers, building of artificial lakes, polluted rivers, etc.) causes quality and quantity changes in algal associations. In most cases, the species diversity lowers and consequently, the numerousness of species, which are tolerant to changes in ecosystems, increases. In the case of a permanent change of ecosystems (desiccated swamps and peat bogs, etc.), the algal species in such areas could be lost forever (Kosi & Vrhovšek 1996).

We investigated algae in some specific biotopes of Slovenia, i.e. the biotopes with low pH, high temperature, high or low conductivity, low light, high velocity of water flow, low humidity, the environments rich in food, etc. Our purpose was to establish the species structure and the abundance of species and subspecies in those biotopes. With regard to special ecological conditions, particular attention was given to the species and subspecies present only in specific biotopes and to those existing in various biotopes. The study was carried out in biotopes of Slovenia that have been investigated only partly or never before: eutrophic lakes (Koseški bajer, Sotelsko jezero), peat bogs (Šijec, Lovrenška jezera), springs (spring at Medvedje Brdo, spring on Pohorje, hot spring at Terme Čatež, mineral spring at Rimski vrelec), waterfalls (Savica, Krka falls, small waterfall on Pohorje), aerial biotopes (concrete wall, stony wall, lime tree trunk (*Tilia platyphyllos*), limestone rock, Krška jama cave), the Dragonja River, brackish lake at Fiesa, manure water and two constructed wetlands (Barje,

Dragonja). Altogether, 26 sampling sites were investigated. For description of sampling sites, see KRIVOGRAD KLEMENČIČ (2001).

Materials and Methods

Samples were taken seasonally in 1998, 1999, 2000 and 2001. For the dates of sampling, see KRIVOGRAD KLEMENČIČ (2001). In lakes, peat bogs, springs, waterfalls and in the Dragonja River, the samples of periphyton for qualitative analysis were brushed from the surface of stones, rocks, wood, macrophytes and other sunk objects like bottles, plastic and iron objects, etc. In peat bogs, the Krka falls, the spring at Medvedje Brdo and the small waterfall on Pohorje, the samples of periphyton for qualitative analysis were also squeezed out of water mosses. In the mineral spring at Rimski vrelec and the hot spring at Terme Čatež, the samples of periphyton were brushed from the bottom and the walls of the fountains.

Terrestrial algae were brushed from a limestone rock, a concrete wall, a stony wall and a lime tree trunk. In the Krška jama cave, algae were brushed from the rock bellow the light, which was most distant from the cave entrance. The samples of manure water were taken on the grassland above the manure pit. The samples of the Barje constructed wetland were taken from the collecting pool. The samples of phytoplankton were taken also in lakes (Koseški Bajer, Sotelsko jezero, Fiesa lake), peat bogs (Lovrenška jezera, Šijec) and in the Dragonja estuary.

The samples were immediately bottled and preserved in a four per cent solution of formaldehyde, except the samples of manure water and the samples from both constructed wetlands, which were first examined and then preserved. All samples were treated by concentrated HNO_3 to determine the species from the Bacillariophyceae class.

We determined the species and subspecies of algae using a light microscope and according to the following determination keys: LAZAR (1960), BOURRELLY (1966, 1968, 1970), STARMACH (1966, 1968, 1972, 1974, 1977, 1980, 1983), GOLUBIĆ (1967), KRAMMER & LANGE-BERTALOT (1986, 1988, 1991a, 1991b), POPOVSKY & PFIESTER (1990), HINDAK (1978, 1996), CVIJAN & BLAŽENČIĆ (1996), LENZENWEGER (1996, 1997). Abundance was estimated by numbers from 1 to 5 (1-single, 2-rare, 3-customary, 4-frequent, 5-dominant). Similarity in species structure and the abundance of algae were determined by the Bray-Curtis coefficient of similarity.

Results and Discussion

Altogether, 537 species and subspecies of algae (of nine classes) were determined. Most of them (295) belonged to Bacillariophyceae, 116 belonged to Cyanophyceae, 58 to Chlorophyceae, 44 to Zygnematophyceae, eight to Xanthophyceae, six to Dinophyceae, five to Euglenophyceae, three to Chrysophyceae and two to Florideophyceae. For algal species lists with the estimation of abundance for individual sampling sites, see KRIVOGRAD KLEMENČIČ (2001).

Figure 1 shows the algal structure by classes at all 26 sampling sites. In the eutrophic lakes of Koseški bajer and Sotelsko jezero, the Savica waterfall, the Krka falls, the small waterfall on Pohorje, the spring at Medvedje Brdo, the mineral spring at Rimski vrelec, the peat bog at Lovrenška jezera, the Krška jama cave, the Fiesa brackish lake and the Dragonja River, most species and subspecies belonged to Bacillariophyceae, while in the Šijec peat bog those belonging to

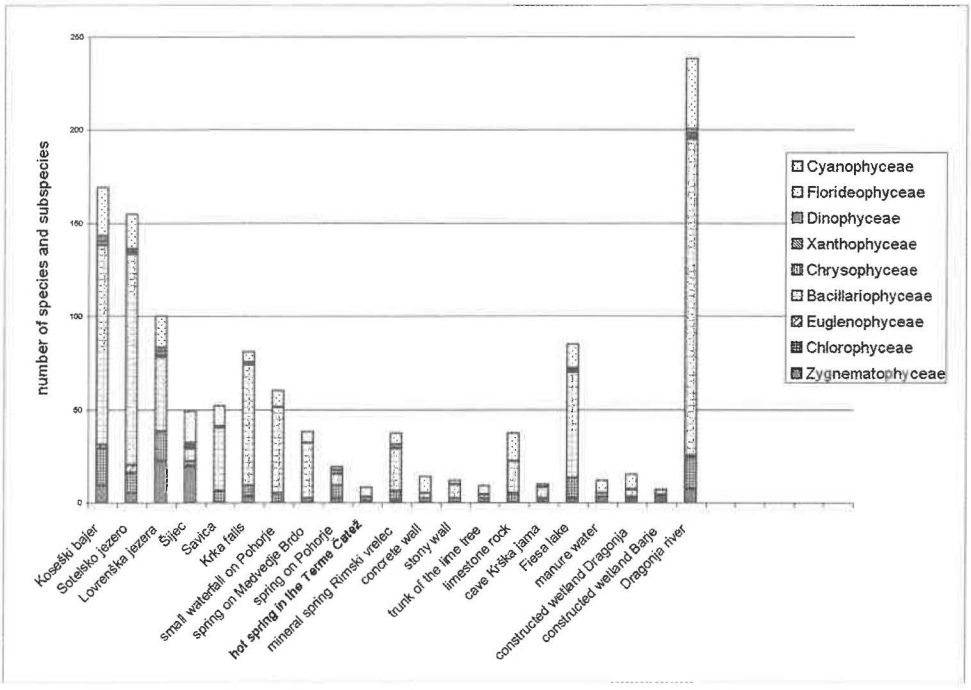

Figure 1: Algal structure by classis at all sampling sites
Slika 1: Sestava alg po razredih na vseh vzorčnih mestih

Zygnematophyceae were predominant. In the spring on Pohorje, most species and subspecies belonged to Chlorophyceae and in the hot spring to Cyanophyceae. Cyanophyceae was predominant also in manure water, the Dragonja constructed wetland and in aerial biotopes (concrete wall, trunk of the lime tree). In the other two aerial biotopes (stony wall, limestone rock), most species and subspecies belonged to Bacillariophyceae.

146 new species and subspecies in Slovenia were determined, of these 107 belonged to Bacillariophyceae, 28 to Cyanophyceae, six to Chlorophyceae, four to Zygnematophyceae and one to Xanthophyceae (Table 1).

Table 1: List of species and subspecies new to Slovenia
Tabela 1: Seznam vrst in podvrst novih za Slovenijo

taxon

CYANOPHYTA

CYANOPHYCEAE

Anabaena affinis Lemm.
Borzia trilocularis Cohn
Calothrix thermalis (Schwabe) Hansg.
Gloeocapsa bituminosa (Bory) Kuetz.
Lyngbya cryptovaginata Schkorbatoff
Lyngbya hieronymusii Lemm.
Lyngbya perelegans Lemm.
Microcystis hansgirgiana (Hansgirg) Elenkin
Microcystis viridis (Braun) Lemm.
Nostoc spongiaeforme Agardh
Oscillatoria laetevirens (Crouan) Gomont
Phormidium angustissimum W. & G.S. West
Phormidium dimorphum Lemm.
Phormidium henningsii Lemm.
Phormidium lignicola Fremy
Phormidium rotheanum Itzig.
Phormidium setchelianum Gomont
Phormidium valderiae (Delp.) Geitler
Plectonema terebrans Bornet & Flahault
Pseudanabaena papillaterminata (Kisselev) Kukk
Pseudospirulina amoena Pankow & Jahnke
Schizothrix friesii (Agardh) Gomont
Spirulina flavovirens Wislouch
Spirulina gomontiana (Setchell) Geitler
Spirulina meneghiniana Zanar.
Spirulina tenuissima Kuetz.
Synechocystis septentrionalis Skuja
Tolypothrix cucullata Jaag

HETEROKONTOPHYTA

XANTHOPHYCEAE

Characiopsis minima Pasch.

BACILLARIOPHYCEAE

Achnanthes amoena Hust.
Achnanthes catenata Bily in Marvan
Achnanthes lanceolata ssp. *dubia* (Grun.) Lan.-Bert.
Achnanthes lanceolata ssp. *frequentissima* Lan.-Bert.
Achnanthes oblongella Oestrup
Achnanthes septata A. Cleve
Amphora angusta (Greg.) Cleve
Bacillaria paradoxa Gnalin
Caloneis molaris (Grun.) Kramm.
Cymatopleura solea var. *apiculata* (W.Smith) Ralfs
Cymbella caespitosa (Kuetz.) Brun
Cymbella cuspidata Kuetz.
Cymbella descripta (Hust.) Kramm. & Lan.-B.
Cymbella gaeumannii Meister
Cymbella pusilla Grun.
Cymbella tumidula var. *lancettula* Kramm.

Denticula kuetzingii Grun.
Denticula subtilis Grun.
Diatoma ehrenbergii Kuetz.
Diatoma moniliformis Kuetz.
Epithemia turgida var. *granulata* (Ehr.) Brun
Eunotia circumborealis Noerpel in Lan.-Bert.
Eunotia denticulata (Breb.) Raben.
Eunotia microcephala Krass.
Eunotia paludosa Grun.
Fragilaria biceps (Kuetz.) Lan.-Bert.
Fragilaria capucina var.*mesolepta* (Rab.) Rab
Fragilaria montana (Krass.) Lan.-Bert.
Fragilaria parasitica var. subconstricta Grun.
Frustulia spicula Amosse
Gomphonema amoenum Lan.-Bert.
Gomphonema clevei Hust.
Gyrosigma nodiferum (Grun.) Reimer
Gyrosigma tenuissimum (W.Smith) Cleve
Gyrosigma wansbeckii (Dankin) Cleve
Melosira moniliformis (Muell.) Agardh
Melosira nummuloides (Dillwyn) Agardh
Navicula accomoda Hust.
Navicula aerophila Krass.
Navicula angusta Grun.
Navicula bryophila Pet.
Navicula capitata var. *capitata* Ehren.
Navicula cincta (Ehren.) Ralfs & Prit.
Navicula duerrenbergiana Hust.
Navicula erifuga Lan.-Bert.
Navicula goeppertiana (Bleisch) H.L. Smith
Navicula gregaria Donkin
Navicula harderii Hustedt
Navicula heufleriana (Grun.) Cleve
Navicula incertata Lan.-Bert.
Navicula integra (W.Smith) Ralfs
Navicula libonensis Schoeman
Navicula margalithii Lan.-Bert.
Navicula menisculus var. *upsaliensis* Grun.
Navicula mutica var. *ventricosa* Cleve & Grun.
Navicula nivalis Ehren.
Navicula oppugnata Hust.
Navicula pseudokotschyi Lan.-Bert.
Navicula recens Lan.-Bert.
Navicula salinarum Grun.
Navicula schroeterii Meister
Navicula subhamulata Grun. & Van Heurck
Navicula suecorum var. *dismutica* (Hust.) Lan.-Bert
Navicula viridula var. *linearis* Hust.
Navicula viridula var. *rostellata* (Kuetz.) Cleve
Navicula vitiosa Schiman.
Neidium bisulcatum (Lager.) Cleve
Neidium ladogensis (Cleve) Foged
Nitzschia angustatula Lan.-Bert.
Nitzschia calida Grun.

Nitzschia capitellata Hust.
Nitzschia commutatoides Lan.-Bert.
Nitzschia compressa var. *compressa* (Bailey) Boyer
Nitzschia constricta (Kuetz.) Ralfs
Nitzschia dissipata var. *media* (Hant.) Grun.
Nitzschia filiformis var. *conferta* (Rich.) Lan.-Bert.
Nitzschia flexa Schum.
Nitzschia granulata Grun.
Nitzschia levidensis var. *salinarum* Grun.
Nitzschia linearis var. *subtilis* (Grun.) Hust.
Nitzschia linearis var. *tenuis* (W.Smith) Grun.
Nitzschia littoralis Grun.
Nitzschia longissima var. *genuina* A.Cleve
Nitzschia lorenziana Grun.
Nitzschia navicularis (Breb.) Grun.
Nitzschia perspicua Choln.
Nitzschia recta var. *robusta* Hust.
Nitzschia scalpelliformis Grun.
Nitzschia sigma (Kuetz.) W.Smith
Nitzschia sinuata var. *delognei* (Grun.) Lan.-Bert.
Nitzschia sinuata var. *tabellaria* (Grun.) Grun.
Nitzschia sociabilis Hust.
Nitzschia vermicularis (Kuetz.) Hant.
Nitzschia wuellerstorffii Lan.-Bert.
Pinnularia divergens W. Smith
Pinnularia microstauron var. *brebissonii* (Kuetz.) May.
Pinnularia rupestris Hant.
Pinnularia subcapitata var. *hilseana* (Jan.) Muell.
Pinnularia sudetica (Hilse) Peragallo
Pleurosigma salinarum Grun.
Pleurosigma strigosum W.Smith
Rhizosolenia eriensis H.L.Smith
Rhopalodia brebissonii Krammer
Rhopalodia constricta (W.Smith) Kramm.
Surirella brebissonii Kramm. & Lan.-Bert.
Surirella constricta W.Smith
Surirella striatula Turpin

CHLOROPHYTA
CHLOROPHYCEAE
Elakatothrix biplex (Nyg.) Hindak
Elakatothrix spirochroma (Rev.) Hindak
Gloeobotrys monochloron Ettl.
Koliella crassa Hindak
Koliella variabilis (Nyg.) Hindak
Scenedesmus velitaris Kom.
ZYGNEMATOPHYCEAE
Cosmarium pseudamoenum Wille
Spondylosium pulchellum Arch.
Spondylosium tetragonum W. West
Staurastrum chaetoceras (Schr.) Smith

The appearance of almost half of all determined species and subspecies (248) was limited to a single sampling point. Eight species were determined in more than a half of all specific biotopes (Table 2). The *Phormidium* sp. species was most frequent, present in eutrophic lakes, waterfalls, springs, brackish waters, the Dragonja River, aerial biotopes and hypereutrophic biotopes. The *Achnanthes minutissima* species was present in eutrophic lakes, peat bogs, waterfalls, springs, hot spring, brackish waters, the Dragonja River and in aerial biotopes. The *Navicula veneta* species was present in eutrophic lakes, waterfalls, springs, brackish waters, the Dragonja River, aerial biotopes and hypereutrophic biotopes. The *Trentepohlia aurea* species was present in peat bogs, waterfalls, springs, a hot spring, the Dragonja River, aerial biotopes, Krška jama cave and hypereutrophic biotopes. The *Cymbella silesiaca* species was present in eutrophic lakes, peat bogs, waterfalls, springs, brackish waters, the Dragonja River and hypereutrophic biotopes. The *Gomphonema angustum* species was present in eutrophic lakes, peat bogs, waterfalls, springs, brackish waters, the Dragonja River and aerial biotopes. The *Navicula* sp. species was present in eutrophic lakes, waterfalls, springs, brackish waters, the Dragonja River, aerial biotopes and hipereutrophic biotopes. The *Cymbella affinis* species was present in eutrophic lakes, peat bogs, falls, springs, brackish waters, the Dragonja River and aerial biotopes.

Table 2: List of algal species determined in more than half of all specific biotopes
Tabela 2: Seznam vrst prisotnih v več kot polovici vseh posebnih biotopov

taxon	sampling sites
Phormidium sp.	Koseški bajer, Sotelsko jezero, waterfall Savica, Krka falls, small waterfall on Pohorje, spring on Medvedje Brdo, spring on Pohorje, mineral spring Rimski vrelec, brackish lake Fiesa, river Dragonja, limestone rock, manure water, constructed wetland Dragonja
Achnanthes minutissima	Koseški bajer, Sotelsko jezero, peat bog Lovrenška jezera, waterfall Savica, Krka falls, small waterfall on Pohorje, spring on Medvedje Brdo, hot spring, mineral spring Rimski vrelec, brackish lake Fiesa, river Dragonja, limestone rock
Navicula veneta	Koseški bajer, Sotelsko jezero, waterfall Savica, Krka falls, small waterfall on Pohorje, spring on Medvedje Brdo, mineral spring Rimski vrelec, brackish lake Fiesa, river Dragonja, limestone rock, constructed wetland Dragonja
Trentepohlia aurea	peat bog Lovrenška jezera, waterfall Savica, small waterfall on Pohorje, spring on Medvedje Brdo, spring on Pohorje, hot spring, mineral spring Rimski vrelec, river Dragonja, stony wall, limestone rock, cave Krška jama, manure water, constructed wetland Dragonja
Cymbella silesiaca	Koseški bajer, Sotelsko jezero, peat bog Lovrenška jezera, waterfall Savica, Krka falls, small waterfall on Pohorje, spring on Medvedje Brdo, brackish lake Fiesa, river Dragonja, constructed wetland Barje
Gomphonema angustum	Koseški bajer, Sotelsko jezero, peat bog Lovrenška jezera, waterfall Savica, Krka falls, small waterfall on Pohorje, spring on Medvedje Brdo, brackish lake Fiesa, river Dragonja, limestone rock
Navicula sp.	Koseški bajer, Sotelsko jezero, waterfall Savica, Krka falls, small waterfall on Pohorje, spring on Medvedje Brdo, brackish lake Fiesa, river Dragonja, concrete wall, stony wall, manure water, constructed wetland Barje
Cymbella affinis	Koseški bajer, Lovrenška jezera, waterfall Savica, small waterfall on Pohorje, mineral spring Rimski vrelec, brackish lake Fiesa, river Dragonja, stony wall

Bray-Curtis Coefficient of Similarity

The Bray-Curtis coefficient showed no significant similarity in sampling sites with high water velocity (Fig. 2). The Krka falls were more similar to the Sotelsko jezero and to the Koseški bajer than to the Savica waterfall. In the Dragonja River the differences depended more on the season than on the water velocity. Therefore, the velocity does not significantly influence the species structure and the numerousness of algal association. Regarding the eutrophic waters, there is a similarity between the Sotelsko jezero, the Koseški bajer and the Krka River, while there is a very low similarity between them and the extreme eutrophic sampling sites (manure water and constructed wetlands), as only two common species were found there, i.e. *Cymbella silesiaca* and *Navicula veneta.* Similarity was determined between the brackish sampling points: the Fiesa lake and the Dragonja estuary. High influence of geological structure was also determined. All Dragonja River sampling sites (except the Dragonja estuary) were similar. Because of the limestone ground there was also a similarity between the Medvedje Brdo spring and the Savica waterfall. A higher similarity was expected between the spring and the small waterfall on Pohorje, but in the spring samples some terrestrial species (*Navicula contenta, Klebsormidium flaccidum, Trentepholia aurea*) were found. Thus, the results showed that the spring on Pohorje was more similar to the terrestrial sampling sites, like the limestone rock and the Krška jama cave. There was a high similarity between the terrestrial sampling sites: the lime tree trunk, concrete wall and stony wall where limitation factors were the absence of food and humidity. High water temperature was the major limiting factor for species structure and the numerousness of algal association in the Terme Čatež hot spring.

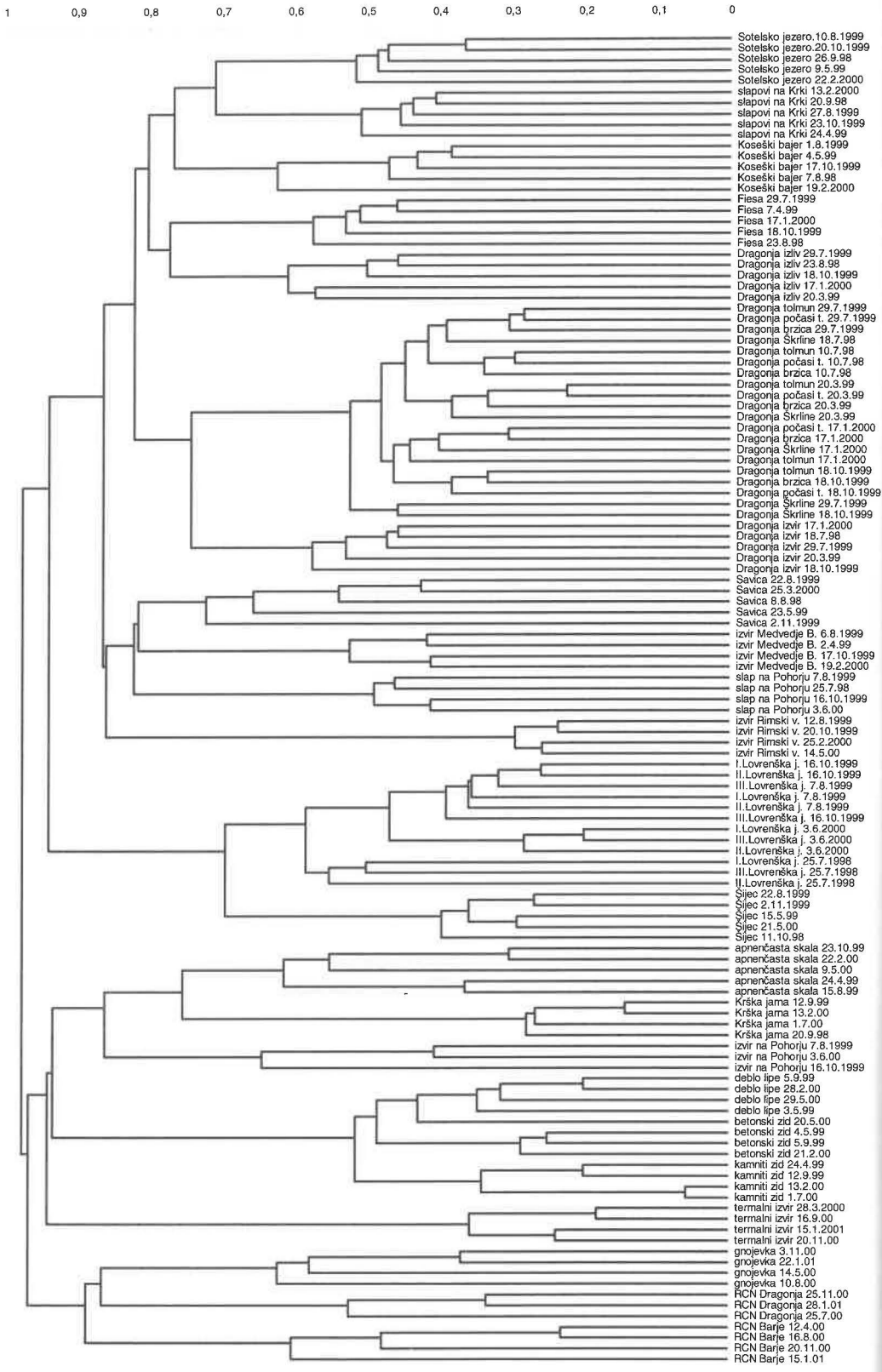

Figure 2: Dendrogram: Bray-Curtis coefficient of similarity for all sampling sites
Slika 2: Dendrogram: Bray-Curtisov koeficient podobnosti za vsa vzorčna mesta

Povzetek

V nalogi smo raziskovali alge nekaterih posebnih biotopov Slovenije v različnih letnih časih od leta 1998 do 2001 z namenom ugotoviti kvalitativno vrstno sestavo algnih združb in pogostost pojavljanja posameznih vrst in podvrst alg v določenih biotopih s posebnimi okoljskimi dejavniki (nizek pH, visoka temperatura, visoka ali nizka elektroprevodnost, pomanjkanje svetlobe, visoka hitrost vodnega toka, pomanjkanje vlage, visoka vsebnost hranil itd.). Zanimale so nas predvsem vrste, ki so prisotne samo v posameznih posebnih biotopih in vrste, ki glede na posebne ekološke pogoje lahko nastopajo v večih posebnih biotopih hkrati. Omejili smo se na sladkovodne, brakične in kopenske biotope, ki dosedaj še niso bili ali pa so bili le delno raziskani. Alge smo določevali v evtrofnih jezerih (Koseški bajer, Sotelsko jezero), visokih barjih (barje Šijec, Lovrenška jezera), izvirih (kraški izvir na Medvedjem Brdu, izvir na Pohorju, termalni izvir v Termah Čatež, mineralni izvir Rimski vrelec), slapovih (lehnjakovi slapovi na reki Krki, slapič na Pohorju, slap Savica), raziskovali smo kopenske alge na apnenčasti skali, betonskem zidu, deblu lipe (*Tilia platyphyllos*) in v Krški jami ter alge v flišni reki Dragonji, brakičnem jezeru v Fiesi in hiperevtrofnih biotopih (gnojevki in rastlinskih čistilnih napravah na deponijah Barje in Dragonja). Z Bray – Curtisovim koeficientom podobnosti smo ugotavljali podobnost v vrstni sestavi in pogostosti pojavljanja alg med posameznimi vzorčnimi mesti.

Skupno smo na šestindvajsetih vzorčnih mestih določili 537 različnih vrst in podvrst alg iz devetih razredov. 295 vrst in podvrst pripada razredu Bacillariophyceae, 116 razredu Cyanophyceae, 58 razredu Chlorophyceae, 44 razredu Zygnematophyceae, 8 razredu Xanthophyceae, 6 razredu Dinophyceae, 5 razredu Euglenophyceae, 3 razredu Chrysophyceae in 2 razredu Florideophyceae.

146 določenih vrst in podvrst je novih za Slovenijo, od tega pripada 107 vrst in podvrst razredu kremenastih alg, 28 razredu Cyanophyceae, 6 razredu Chlorophyceae, 4 razredu Zygnematophyceae in 1 razredu Xanthophyceae.

Pojavljanje skoraj polovice vseh določenih vrst in podvrst (248) je bilo omejeno na posamezna vzorčna mesta. Vrste *Achnanthes minutissima, Cymbella affinis, Cymbella silesiaca, Gomphonema angustum, Navicula veneta, Navicula* sp., *Phormidium* sp. in *Trentepohlia aurea* so splošno razširjene vrste, prisotne so bile v večini posebnih biotopov.

Primerjava vrstnih sestavov algnih združb in pogostosti pojavljanja posameznih vrst in podvrst med vzorčnimi mesti z Bray – Curtisovim koeficientom podobnosti je pokazala, da si vzorčna mesta, kjer je bila hitrost vodnega toka velika, med seboj niso bila preveč podobna. Lehnjakovi slapovi na reki Krki so bili bolj podobni Sotelskemu jezeru in Koseškemu bajerju kot slapu Savici in slapiču na Pohorju. Bray – Curtisov koeficient je pokazal med vzorčnimi mesti na reki Dragonji, ki se v glavnem razlikujejo le v hitrosti vodnega toka, večjo sezonsko kot krajevno odvisnost. Iz zgoraj naštetega lahko sklepamo, da hitrost vodnega toka ni bistveno vplivala na vrstno sestavo in številčnost algnih združb. Evtrofne vode: Sotelsko jezero, Koseški bajer in reka Krka so si bile med seboj podobne, medtem ko je bila njihova podobnost z ekstremno evtrofnimi vodami (gnojevko in RČN) izredno majhna, saj med njimi razen dveh (*Cymbella silesiaca* in *Navicula veneta*) ni bilo skupnih vrst. Med seboj sta si bili podobni tudi obe brakični vodi: priobalno jezero v Fiesi in izliv reke Dragonje. Na vrstno sestavo in številčnost algnih združb ima velik vpliv geološka podlaga. Vsa vzorčna mesta na flišni reki Dragonji (razen izliva) so si bila med seboj podobna. Podobna sta si bila tudi izvir na Medvedjem Brdu in slap Savica, oba ležita na apnenčasti podlagi. Pričakovali bi večjo podobnost med izvirom in slapičem na Pohorju, vendar smo v izviru na Pohorju določili nekaj kopenskih vrst alg (*Navicula contenta, Klebsormidium flaccidum, Trentepohlia aurea*), zaradi česar

je bil izvir na Pohorju bolj podoben kopenskima vzorčnima mestoma: apnenčasti skali in Krški jami. Precejšnja podobnost je bila med kopenskimi vzorčnimi mesti – deblo lipe, kamniti in betonski zid, kjer sta verjetno glavna omejujoča dejavnika za uspevanje alg pomanjkanje vlage in hranilnih snovi. V termalnem izviru v Termah Čatež pa na vrstni sestav in številčnost alg v prvi vrsti vpliva zelo visoka temperatura izvirne vode.

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