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Preliminary studies on the periphytic algae in the branch-system of the Danube at Cikolasziget (Hungary)

By

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Abstract: Altogether 179 periphytic algal taxa were identified from the branch-system of the Danube at Cikolasziget, from different hosts (twig, reed, and other macrophytes). We found that water temperature, shadiness and water discharge affect the composition of the periphyton. According to the species composition of our samples, the number of taxa and the structure of the periphyton show a transitional character between the periphyton of standing and flowing waters.

INTRODUCTION

The Danube entering the Carpathian Basin divides into many smaller branches. This region is called Szigetköz and Csallóköz. Nowadays most of the small branches are separated from the main branch by dams. The branch-systems of the Danube in the area of Szigetköz and Csallóköz are not only among the most beautiful landscapes of Hungary but a unique natural heritage of Europe and even of the World. This wonderful part of the Danube is threatened by the hotly debated dam at Bős. It is a very urgent task of Hungarian science to possess better knowledge on the plants and animals living there. We have only few algological data on the phytoplankton of the Szigetköz (BARTALIS 1978, 1982, 1987a, KISS 1987) especially compared with the main branch of the river (e.g. BARTALIS 1987b, BOTHÁR and KISS 1990, HEGEDŰS 1987, HORTOBÁGYI 1979, KISS 1984, SCHMIDT 1976, SZEMES 1967, TAMÁS 1949) but we failed to find any publication on the attached algae of this region. The many branches, the sometimes slowly and sometimes quickly flowing or even standing water, the different kinds of submersed macrophyte associations presumable favour the development of very different periphytic communities. Therefore our purpose was to know more on the algological periphyton of this region.

The first and evident question of the periphytic studies is whether on the different submersed objects and plants (namely substrate) the periphyton is the same or not. However, we have no satisfying answer to this. Many papers report the uniformity of periphyton, i.e. there are no differences between the algae living on the different substrates (e.g. MILLIE and LOWE 1983, O'QUINN and SULLIVAN 1983, SULLIVAN 1982). Perhaps more publication deal simultaneously with the quantitative and qualitative differences of periphyton on different hosts (LAKATOS 1991, PROWSE 1959, STEVENSON and HASHIM 1989).

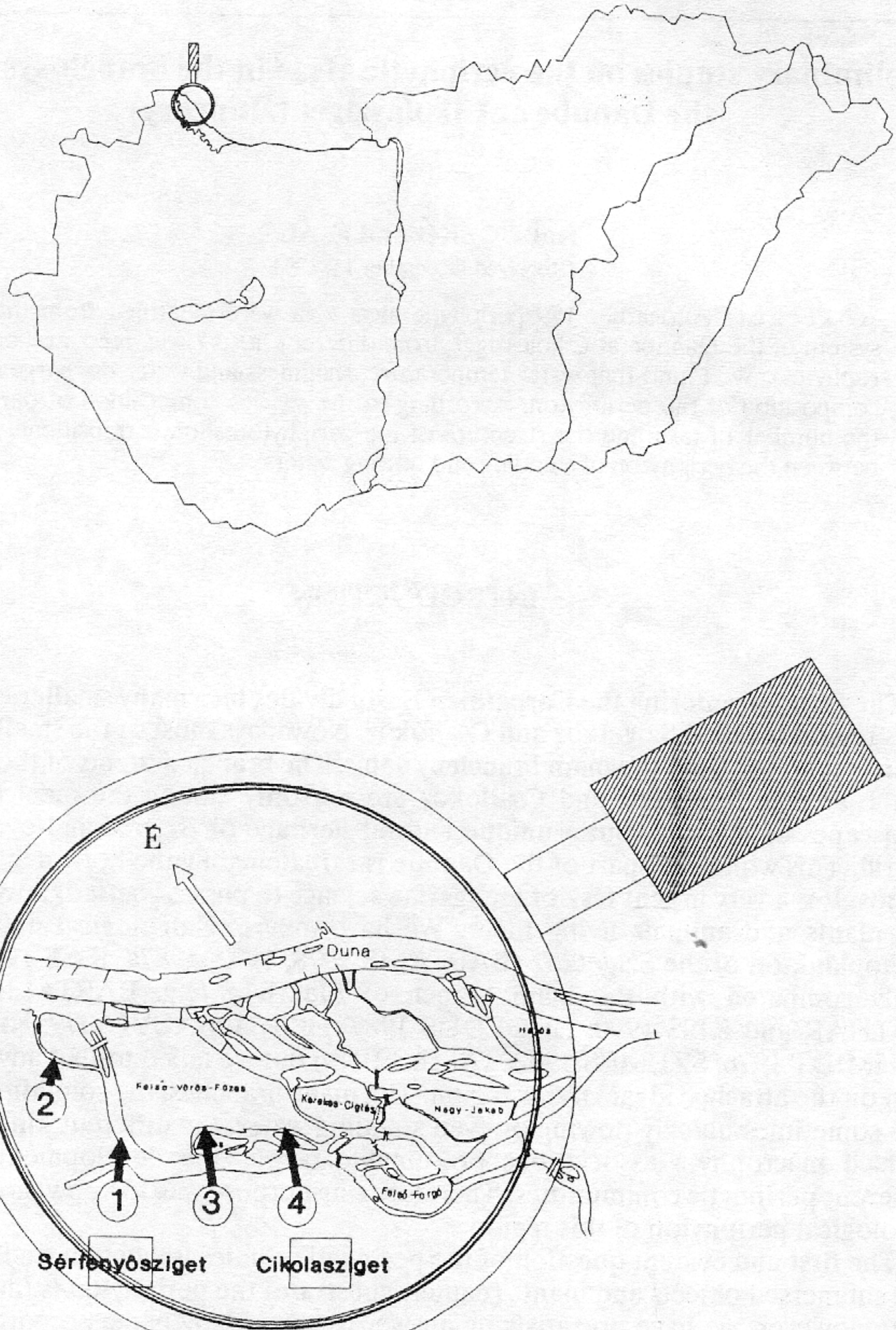

Fig. 1. Location of the sampling points

According to many papers the quality of the host in flowing waters (esp. quick rivers) is not as important as in standing waters (lakes, ponds), where the substrate seems to be the determinant factor. This hypothesis needs to be tested.

More or less regularly the branches in the Szigetköz section of the Danube are flooded from time to time by the rising Danube. During the flood the water flows for days or weeks in the branches. In this sense, the Szigetköz is a flowing water. On the other hand the dams close the branches when the level of water is low. In this case the water cannot flow through the small branches often for months. It is a very long period compared to the generation time of the algae, so in this sense we can regard the Szigetköz as many neighbouring ponds, separated by dams. So the Szigetköz section of the Danube is especially suitable for a study of the connection of the substrate and its coating (to test host specificity), and to compare the periphyton community of running and standing water periods.

According to WETZEL (1983), there are more significant differences between the biotic (macrophyte, leaves, twigs) and abiotic (stones, sand, mud) hosts then among the biotic ones. At first we tried to find differences among coats of macrophyte hosts.

MATERIALS AND METHODS

The samples were collected on 13 and 15 July, 1991, in the second branch system of Szigetköz (Fig. 1). Sampling points 1, 3 and 4 were in flowing water, No. 2 was in standing water. On 13 July, 14 samples were collected from these points on substrates as follows,

1. sampling point: old reed (o) in 5 repetitions
   green reed (g)
   Rorippa amphibia L. (Bess.) stem (R)
   Polygonum amphibium L. stem (P)
2. sampling point: *Carex acutiformis* Ehrh. leaf (Ca)
   green reed (g)
   twig (B1)
   Myriophyllum verticillatum L. stem (M)
3. sampling point: green reed (g)
4. sampling point: green reed (g)

July the 15th was the first day of a remarkable flood of the Danube, so our sampling points were flooded by water. This way we could collect only 1 sample from the 2nd sampling point, namely a twig (B2).

Collection methods: the reeds were cut off at water level, and 8-10 cm below this level, then the stems were carefully taken off and put into the collecting jar. The other submersed plants were also carefully taken off, the leaves were cut off, and only the stems were placed into the jars. Water temperature, conductivity and the total hardness were measured at every sampling point.

In the laboratory the coats were washed off with a fine brush into known amounts of water. The surface of the substrate was measured. Afterwards the samples were handled as if they were planktonic samples. Algae were identified under light and scanning electron microscope, counted by UTERMÖHL's (1958) method taking the statistical results of LUND *et al.* (1958) into consideration. Diatoms were identified under light microscope after digestion with H_2O_2. For the necessary SEM identification we followed KISS' method (KISS 1986).

Complexometric titration with Titriplex^R III against mixed indicator tablets (Aquamerk^R 8011, E. Merck, Darmstadt, Germany) was used for determination of total hardness. Determinations were made directly in the field immediately after taking the water samples. The values of water hardness in Table 1 are given in German degrees (°d). (1 °d = 10 mg of CaO/l = 0.18 mmol/l of alkaline earth ions.)

The constancy of a species was calculated as $C_i = 100N_i/S$, where N_i was the number of the samples in which the species was present and S was the total number of samples. A species was given constancy value 5 if C = 80-100%, 4 if C = 60-80% etc.

The dominance value of a species was calculated as $D_i = 100A_i/M$, where A_i was the number of the individuals of the given species and M was the total number of individuals in the sample.

For cluster analysis the SYN-TAX III program was used (PODANI 1988) with WPGMA fusion algorithm.

RESULTS AND DISCUSSION

Altogether 179 taxa were identified (Cyanophyta 12, Euglenophyta 6, Chromophyta 88 - incl. Bacillariophyceae 83, Cryptophyta 10, Chlorophyta 63 - Fig. 2). The detailed list of the taxa is presented in Table 2.

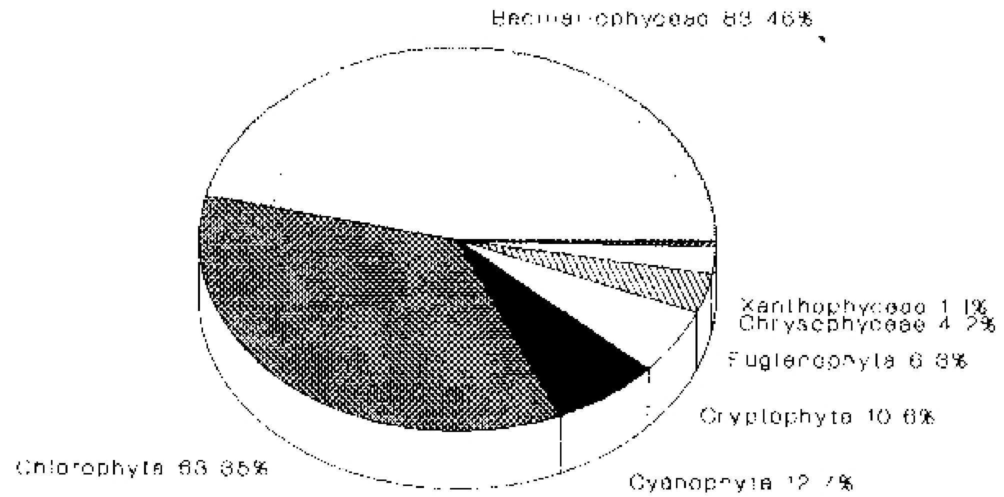

Fig. 2. Percentile proportion and number of taxa in different phyla (Chromophyta divided into 3 groups Bacillariophyceae, Xanthophyceae and Chrysophyceae)

Constancy was 4 and 5 in the following species (11%): 5: *Lyngbya limnetica, Achnanthes minutissima, Cyclotella meneghiniana, Cymbella minuta, Fragilaria ulna, Gomphonema parvulum, Navicula cryptocephala, Thalassiosira pseudonana, Stigeoclonium tenue,* 4: *Pseudanabaena catenata, Cocconeis pediculus, Cymbella affinis, Fragilaria ulna* var. *acus, Gomphonema truncatum, Navicula rhynchocephala, Nitzschia linearis, N. palea, Stephanodiscus hantzschii* f. *tenuis, S. invisitatus, Characium ensiforme.* These species were constant, subconstant (JAKUCS 1981). The majority (76%) of the species was accidental (C=1 or 2).

Mainly diatoms were found abundantly in the samples (except on *Carex acutiformis*, where green algae were predominant). The high number of green algal taxa, and their low rate of abundance were characteristic. The blue-green algae and others were not important.

Achnanthes minutissima was the predominant taxon on each host in the 1st, 3rd, and 4th sampling point. *Cymbella minuta* had more than 5% relative abundance on the 1st, 3rd and 4th sampling point, *Stigeoclonium tenue* on 1st and 4th point, *Nitzschia fonticola* and *Fragilaria ulna* on the 1st sampling point. The species composition of the predominant taxa was very variable in the 2nd sampling point:

substrates	taxon	D%
green reed	*Achnanthes minutissima*	34.01
	Fragilaria brevistriata	33.75
Carex acutiformis	*Characium ensiforme*	67.42
	Achnanthes minutissima	20.05
	Fragilaria brevistriata	8.02
Myriophyllum vert.	*Fragilaria brevistriata*	24.63
	Achnanthes minutissima	15.67
	Fragilaria ulna	13.18
	Characium ensiforme	5.0
twig before the rise	*Achnanthes minutissima*	26.5
	Fragilaria pinnata	13.75
	Characium ensiforme	9.5
	Fragilaria ulna var. *acus*	6.75
	Epithemia sorex	6.25
twig after the rise	*Nitzschia fruticosa*	40.25
	Achnanthes lanceolata	10.25

The constant and dominant species were (constancy 5, dominancy 5% at least in one sample): *Achnanthes minutissima, Cymbella minuta, Fragilaria ulna, Stigeoclonium tenue.*

It is interesting that *Achnanthes minutissima*, the characteristic taxon of the periphyton of the investigated branch-system, was found only in negligible numbers on the twig which was collected after the rise.

The samples collected by us from the branch-system of the Danube at Cikolasziget seem to originate from an intermediate community of periphytic algae. This periphyton resembles at the periphyton of the flowing waters as well as that of the standing waters.

As far as the richness of the taxa concerned these samples are reminiscent of lake periphyton. The great number of green algae also refer to the periphyton collected in lakes (ÁCS *et al.* 1992). The structure of the coats also shows differences between samples collected from standing and flowing waters. On the basis of our previous studies in lakes, we suppose that the typical lake periphyton consists of many tube dwelling diatoms (*Cymbella* species) and the *Rhoicosphaenia*, *Gomphonema* and *Achnanthes* species become fixed to the substrate with long stalks. These look like as a bucket. *Achnanthes minutissima* very often was the predominant taxon in the lake periphyton, and it was fixed with long stalk. On the contrary, in the summer period *Achnanthes minutissima* usually is not dominant in another part of the Danube (Göd section), where it occurs usually directly fixed onto the hosts without a stalk. In our samples from the Szigetköz *Achnanthes*

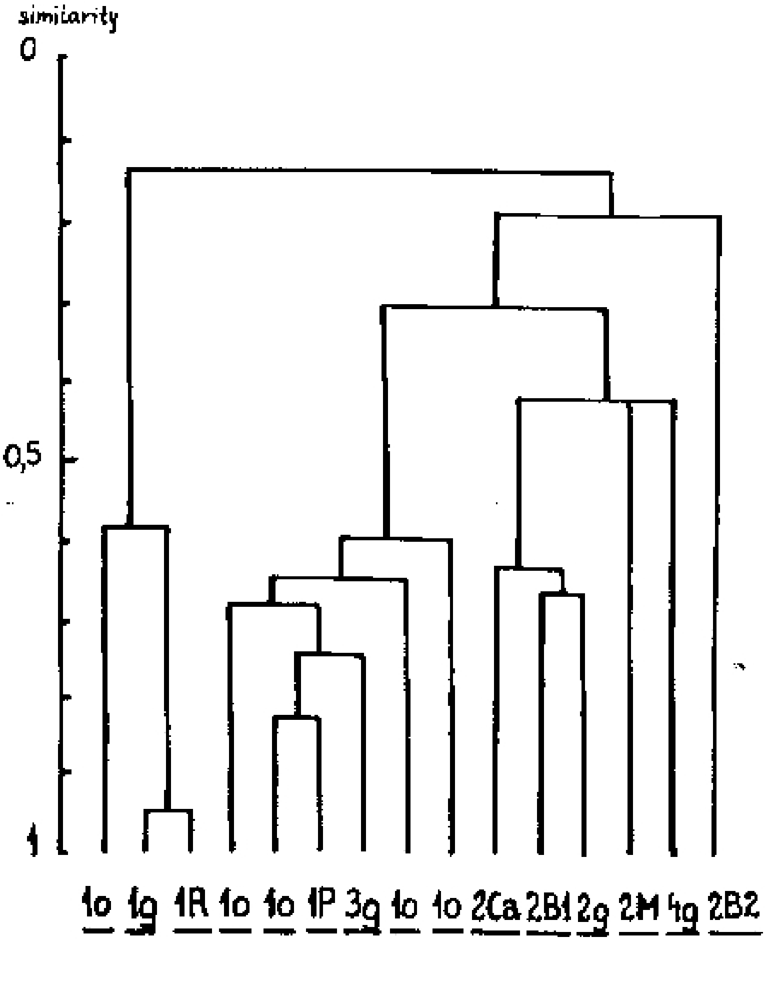

Fig. 3. Dendrogram of the cluster analysis of 15 samples from, the branch-system of the Danube at Cikolasziget. Abbreviations: o=periphyton from old reed, g=periphyton from green reed, R=periphyton from *Rorippa amphibia* stem, P=periphyton from *Polygonum amphibium* stem Ca=periphyton from *Carex acutiformis* leaf, B1=periphyton from twig before the flood, M=periphyton from *Myriophyllum verticillatum* stem, B2=periphyton from twig after the flood

minutissima was found in "flowing water form" (without stalk) but in "standing water amount" (it was predominant).

Another phenomenon confirming the "flowing water" character of the site is the dominancy of *Achnanthes lanceolata. Achnanthes lanceolata* is a typical, dominant and constant taxon of flowing water periphyton in the Danube (ÁCS and KISS 1991). It was completely absent from the samples before the flood but it became predominant after it.

The result of the cluster analysis (using CZEKANOWSKI's resemblance measure - Fig. 3) show that the sample collected from twig after the flood is separated from the others. However, its species composition is also significantly different from that of the other samples. (Relative abundance of *Achnanthes minutissima* was found to be only 1.5 % - similar to the summer samples in the main branch at Göd (ÁCS and KISS 1991). Perhaps the flood brought this twig from the main branch.

The sampling points are quite well separated from each other (Fig. 3). Within this, the samples collected from *Carex acutiformis* differ from the other samples collected from the 2nd sampling point. This is caused by *Characium ensiforme* whose dominance was as high as 67.42, while on other hosts it was only 9.5 and 5.0

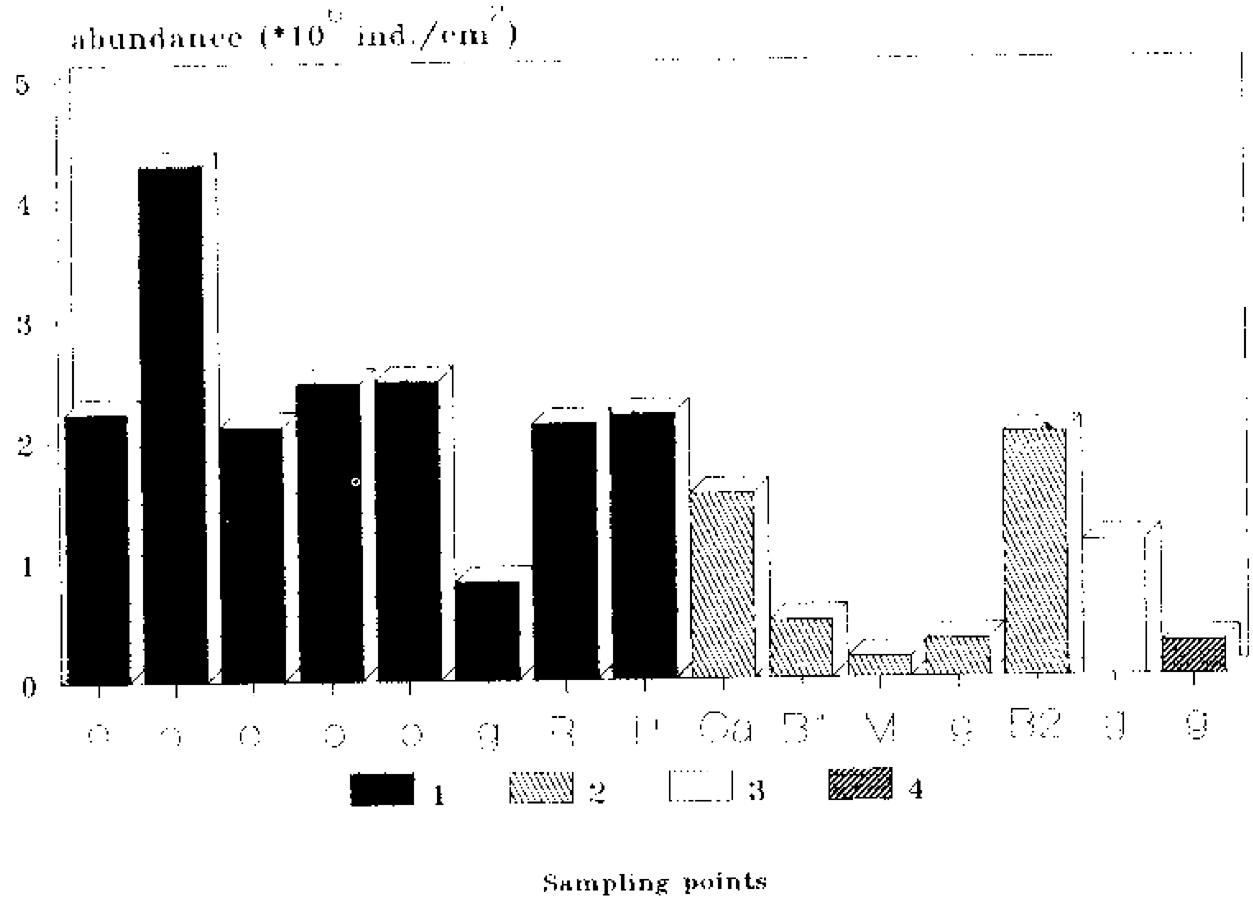

Fig. 4. Abundance of periphyton in the 4 sampling points. For abbreviations see Fig. 3.

respectively. A more detailed study is necessary to clarify the reasons (perhaps *Carex* releases chemicals which inhibit diatoms?).

Abundance (Fig. 4) on the old reeds was much higher ($2.05 * 10^6$ ind/cm^2) than on the green reeds ($0.65 * 10^6$ ind/cm^2). It is not too surprising, because there is more time to develop periphyton on old reed. Before the flood, the average abundance was lower in the 2nd sampling point than on the 1st and the 3rd point. It may have been caused by the lower water temperature and shadiness (Table 1). Abundance in the 4th point was low, as this sampling point was shaded by high trees.

Table 1. Water temperature, total hardness and conductivity in the 4 sampling point in Cikolasziget, on 13 July, 1991

sampling points	1	2	3	4
water temperature (°C)	23.50	20	25	24.50
total hardness (°d)	11	13	11	12
conductivity (μS)	63	63	63	64

SUMMARY

Species composition, number of taxa and structure of the periphyton samples collected from the Danube's side branch-system at Cikolasziget show transitional characters between the periphyton of standing and flowing waters. Samples draw from the same sampling point resemble each other more than samples collected from the same hosts. This result was also found by STEVENSON and HASHIM (1989) in the branches of Maple river. It seems that the most important factor in the development of periphyton is water discharge. Under similar flowing conditions similar coats develop on the same host. Nevertheless further investigations are necessary to test these hypotheses, with more samples from different locations under various circumstances (seasons, water discharge, etc.).

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Table 2. List of taxa with the constancy values. For abbreviations see Fig. 3.

	1o	1o	1o	1o	1o	1g	1R	1P	2Ca	2B1	2M	2G	2B2	3g	4g	C
CYANOPHYTA																
Anabaena spiroides Kleb											+					1
Anabaena viguieri Denis et Frémy											+					1
Chroococcus minutus (Kg.) Näg.		+					+		+				+			2
Gomphosphaeria lacustris Chodat.												+				1
Lyngbya hyeronymusii Lemm.									+	+						1
Lyngbya limnetica Lemm.	+	+	+	+	+		+	+		+	+	+	+	+	+	5
Merismopedia glauca (Ehrbg.) Näg.	+		+					+			+			+		2
Merismopedia tenuissima Lemm.											+	+				1
Microcystis aeruginosa Kg.												+				1
Oscillatoria articulata Gardn.													+	+		1
Oscillatoria mougeotii Kg.						+										1
Pseudanabaena catenata Lauterb	+		+		+		+	+	+		+	+	+	+	+	4
EUGLENOPHYTA																
Euglena sp.										+						1
Lepocynclis sp.											+					1
Phacus sp.											+					1
Strombomonas verrucosa (Daday) Defl. var. *conspersa* (Pasch.) Defl.			+													1
Trachelomonas planctonica Swir.	+			+							+			+	+	2
Trachelomonas volvocina E.					+		+				+	+			+	2
CHROMOPHYTA																
Chrysophyceae																
Chrysococcus rufescens Klebs	+				+	+	+				+	+		+	+	3
Dinobryon divergens Imhof	+															1
Dinobryon sertularia Ehr.					+		+	+						+	+	2
Ophiocytium lagerheimii Lemm.									+					+		1
Synura sp.	+															1
Xanthophyceae																
Goniochloris mutica (A.Braun.) Fott			+													1
Bacillariophyceae																
Achnanthes inflata Kütz.											+					1
Achnanthes lanceolata Bréb.													+			1
Achnanthes lanceolata var. *rostrata* Hust.													+	+	+	2
Achnanthes minutissima Kütz.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	5
Amphora ovalis (Kütz.) Kütz.	+											+			+	2
Amphora pediculus (Kütz.) Grun.					+	+	+	+		+	+				+	3
Caloneis amphisbaena (Bory) Cleve								+			+					1
Caloneis silicula (Ehr.) Cleve											+					1
Cocconeis pediculus Ehr.	+	+	+	·		+	+			+		+		+	+	4
Cocconeis placentula Ehr.												+				1
Cyclostephanos dubius (Fricke) Round						+		+					+			2
Cyclotella atomus Hust.															+	1
Cyclotella comta (Ehr.) Kütz.											+		+			1
Cyclotella meneghiniana Kütz.	+		+	+	+	+	+	+	+	+	+	+		+	+	5
Cyclotella pseudostelligera Hust.								+				+				1
Cymatopleura solea (Bréb.) W. Smith				+			+	+			+					2
Cymatopleura solea var. *apiculata* (W. Smith) Ralfs							+				+					1
Cymbella affinis Kütz.		+	+	+	·	+	+	+					+		+	4
Cymbella aspera (Ehr.) Cleve	+					+					+	+				2
Cymbella cymbiformis Agardh						+		+			+			+		2
Cymbella ehrenbergii Kütz.											+					1
Cymbella leptoceros (Ehr.) Kütz.	+			+		+	+							+	+	3
Cymbella microcephala Grun.	+	+			+	+		+				+		+	+	3
Cymbella minuta Hilse ex Rabenhorst	+	+	+	+	+	+	+	+	+	+	+	+		+	+	5
Diatoma elongatum Agardh	+					+		+			+				+	2

Table 2. (continued)

	1o	1o	1o	1o	1o	1g	1R	1P	2Ca	2B1	2M	2G	2B2	3g	4g	C
Diatoma vulgare Bory	+															1
Diatoma vulgare var. *grandis* (Smith) Grun.							+								+	1
Epithemia sorex Kütz.	+									+	+					2
Epithemia turgida (Ehr.) Kütz.										+	+	+				2
Eunotia lunaris (Ehr.) Grun.											+	+				1
Fragilaria brevistriata Grun.	+		+		+				+	+	+	+			+	3
Fragilaria capitata (Ehr.) Lange-Bert.											+			+		1
Fragilaria construens var. *binodis* (Ehr.) Grun.													+			1
Fragilaria pinnata Ehr.	+									+	+		+		+	2
Fragilaria ulna (Ehr.) Lange-Bert.	+		+	+	+	+	+	+	+	+	+	+	+	+	+	5
Fragilaria ulna var. *acus* (Kütz.) Lange-Bert.	+		+	+	+	+		+		+	+	+	+		+	4
Fragilaria ulna var. *danica* Grun.											+	+				1
Fragilaria ulna var. *oxyrhychus* (Kütz.) Lange-Bert.													+			1
Fragilaria vaucheriae (Kütz.) Lange-Bert.										+	+					1
Gomphonema acuminatum Ehr.	+		+			+					+	+	+		+	3
Gomphonema angustatum (Kütz.) Rabenhorst	+															1
Gomphonema olivaceum (Hornemann) Bréb.															+	1
Gomphonema olivaceum var. *calcareum* (Cleve) Cleve		+														1
Gomphonema parvulum (Kütz.) Kütz.			+	+	+	+	+	+		+	+	+	+	+	+	5
Gomphonema truncatum Ehr.	+	+	+					+			+	+	+	+	+	4
Gomphonema sp.										+	+					1
Hantzschia amphyoxis (Ehr.) Grun.?				+				+								1
Melosira distans (Ehr.) Kütz.													+			1
Melosira granulata var. *angustissima* Müll.										+			+			1
Melosira italica var. *tenuissima* (Grun.) O. Müll.						+				+	+		+			2
Melosira varians C.A. Ag.				+		+		+	+	+	+	+			+	3
Navicula capitata var. *hungarica* (Grun.) Ross												+	+			1
Navicula cryptocephala Kütz.	+	+	+	+	+	+	+	+		+		+	+	+	+	5
Navicula exigua (Gregory) Grun.															+	1
Navicula gastrum (Ehr.) Kütz.													+		+	1
Navicula lanceolata (Ag.) Ehr.					+					+					+	2
Navicula menisculus Schumann					+											1
Navicula minima Grun.	+				+					+			+		+	2
Navicula oblonga Kütz.		+			+	+					+		+			2
Navicula pupula Kütz.											+		+			1
Navicula pygmeae Kütz.						+	+	+		+	+				+	3
Navicula radiosa Kütz.	+		+			+					+			+	+	3
Navicula rhynchocephala Kütz.			+	+		+	+	+			+	+		+	+	4
Nitzschia acicularis (Kütz.) W. Smith			+	+								+				2
Nitzschia angustata Grun.						+	+									1
Nitzschia commutata Grun.													+			1
Nitzschia dissipata (Kütz.) Grun.															+	1
Nitzschia flexa Schumann	+															1
Nitzschia fonticola Grun.	+	+	+	+	+					+			+		+	3
Nitzschia fruticosa Hust.	+						+	+				+	+	+	+	3
Nitzschia linearis (Agardh) W. Smith		+	+			+			+		+	+	+	+	+	4
Nitzschia palea (Kütz.) W. Smith	+	+	+		+		+	+			+	+	+		+	4
Nitzschia sigmoidea (Nitzsch) W. Smith			+					+					+	+		2
Nitzschia tryblionella Hantzsch				+							+					1
Pinnularia viridis (Nitzsch) Ehrenberg										+						1
Rhoicosphaenia abbreviata (Agardh) Lange-Bertalot	+						+			+						2
Rhopalodia gibba (Ehrenberg) O. Müll.	+							+		+	+					2
Skeletonema potamos (Weber) Hasle			+		+											1

Table 2. (continued)

	1o	1o	1o	1o	1o	1g	1R	1P	2Ca	2B1	2M	2G	2B2	3g	4g	C
Stephanodiscus hantzschii Grun. f. *hantzschii*	+		+	+	+					+		+	+	+		3
Stephanodiscus hantzschii Grun. f. *tenuis* (Hust.) Hak.et Stoer.	+		+	+	+		+			+	+	+	+	+	+	4
Stephanodiscus invisitatus Hohn et Heller	+		+	+	+		+	+		+			+	+	+	4
Stephanodiscus minutula (Kütz.) Round													+		+	1
Thalassiosira pseudonana Hasle et Heimd	+	+	+	+	+	+	+	+			+	+		+	+	5
CRYPTOPHYTA																
Dinophyceae																
Peridinium wisconsinense Eddy					+											1
Peridinium sp. I	+															1
Peridinium sp. II.			+											+	+	2
Peridinium sp. III.														+		1
Cryptophyceae																
Chroomonas acuta Utermöhl	+															1
Chroomonas caudata Geitler		+														1
Chroomonas sp.			+													1
Cryptomonas ovata Ehrenberg				+	+					+	+		+			2
Cryptomonas platyuris Skuja					+							+				1
Rhodomonas lacustris Pascher et Ruttner		+									+		+			2
CHLOROPHYTA																
Actinastrum hantzschii Lagerh.											+					1
Ankistrodesmus falcatus (Corda) Ralfs															+	1
Ankistrodesmus gracilis (Reinsch) Kors.											+					1
Characium ensiforme Herm.		+	+	+	+	+	+	+	+	+	+	+				4
Chlamydomonas reinhardtii Dang.			+	+	+		+	+	+					+	+	3
Chlamydomonas sp. I.			+		+		+				+		+	+	+	3
Chlamydomonas sp. II.				+			+	+					+		+	2
Chlamydomonas sp. III.															+	1
Cladophora fracta (Dillw.) Kütz.						+		+			+	+	+			2
Cladophora glomerata (L.) Kütz.				+							+					1
Closteriopsis longissima Lemm.												+				1
Closterium acutum Bréb. f. *variabile* (Lemm.) Krieg.										+						1
Coelastrum microporum Näg in A.Br.		+							+							1
Coelastrum pseudomicroporum Kors.								+						+		1
Coelastrum sphaericum Näg.									+		+					1
Coenocystis planctonica Kors.										+		+		+		2
Cosmarium botrytis Menegh.														+		1
Cosmarium granatum Bréb.	+		+					+			+	+		+	+	3
Cosmarium sp.				+	+		+								+	2
Crucigenia punctata (Schmidle) Hajdu										+						1
Crucigenia quadrata Morr.	+							+			+		+			2
Crucigenia tetrapedia (Kirchn.) W. & G.S. West								+								1
Crucigeniella apiculata (Lemm.) Kom.													+			1
Dictyosphaerium anomalum Kors.			+				+		+							2
Dictyosphaerium ehrenbergianum Näg.							+			+						1
Dictyosphaerium pulchellum Wood	+	+					+		+	+	+	+	+			3
Didymocystis planctonica Kors.				+							+			+	+	2
Elecatothrix acuta Pasch.		+														1
Golenkinia radiata Chod.														+	+	1
Gonatozygon kinachanii (Arch.) Rabh.				+									+			1
Granulocystopsis coronata (Lemm.) Hind.	+															1
Juranyiella javorkae (Hortob.) Hortob.				+												1
Kirchneriella obesa (W. West) Schmidle	+															1
Lobomonas sp.	+										+					1

Table 2. (continued)

	1o	1o	1o	1o	1o	1g	1K	1P	2Ca	2B1	2M	2G	2B2	3g	4g	C
Monoraphidium arcuatum (Kors.) Hind.												+				1
Monoraphidium contortum (Thur.) Kom.-Legn.							+						+	+	+	2
Monoraphidium griffithii (Berk.) Kom.-Legn.												+				1
Monoraphidium minutum (Näg.) Kom.-Legn.				+					+	+			+		+	2
Monoraphidium mirabile (W. & G.S. West) Pankow							+								+	1
Mougeotia sp.												+				1
Neodesmus danubialis Hind.														+		1
Oedogonium sp.								+								1
Oocystis borgei Snow.	+	+			+	+	+					+			+	3
Oocystis lacustris Chod.					+							+	+			2
Planctonema lauterbornii Schmidle												+				1
Quadricoccus ellipticus Hortob.									+							1
Scenedesmus acuminatus (Lagerh.) Chod.					+	+				+	+				+	2
Scenedesmus acutus Meyen						+			+					+		2
Scenedesmus apiculatus (W. & G.S. West) Chod.	+															1
Scenedesmus bicaudatus Dedus														+		1
Scenedesmus ecornis (Ehrenb.) Chod.				+						+	+		+	+	+	3
Scenedesmus obtusus Meyen f. *obtusus*										+				+		1
Scenedesmus quadricauda (Turp.) Bréb.						+		+		+	+			+	+	3
Scenedesmus spinosus Chod.										+	+			+		2
Schroederia nitzschioides (G.S. West) Kors.								+								1
Schroederia robusta Kors.														+		1
Schroederia setigera (Schröd.) Lemm.	+							+	+	+						2
Stigeoclonium tenue Kütz.	+	+	+	+	+		+	+	+	+	+	+		+	+	5
Tetraedron minimum (A. Br.) Hansg.						+	−	+					+		+	2
Tetrastrum glabrum (Roll) Ahlstr. & Tiff.		+	+				+	+		+				+	+	3
Ulothrix zonata Kütz.	+					+				+	+	+	+			3
Uronema elongatum Hodg.											+	+		+		2