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PRELIMINARY STUDIES ON THE STRUCTURE OF DIATOM COMMUNITIES IN THE PONDS OF THE NATURE RESERVE FÂNAȚELE CLUJULUI (TRANSYLVANIA, ROMANIA)

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Abstract: Preliminary studies on the structure of diatom communities in the ponds of the nature reserve „Fânațele Clujului" (Transylvania, Romania). The examination of epiphytic and epipelic samples collected from the ponds of the nature reserve „Fânațele Clujului" revealed the presence of 92 diatom taxa, which belong to 19 genera. Most of the species were cosmopolitan and characteristic for salt waters. Pollution tolerant species were present as well. Species richness and diversity were higher in the spring samples. Spring samples also contained more species that prefer lower concentration of organic substance. The BDI (biological diatom index) was different according to the ponds and substrata, it denoted bad, medium and good water qualities. The BDI values were higher in spring , which means better water quality.

Key words: diatom community, epiphyton, epipelon, substratum, microclimate, species diversity, water quality, organic substance

Introduction

The nature reserve Fânațele Clujului is located 3 km North from the city Cluj-Napoca, at the western boundary of the so called Transylvanian Plain (Câmpia Transilvaniei). It was founded in 1932 as a botanical reserve.

This territory exhibits specific geomorphologic features. It is a bumpy area, formed by landslide. The sand layers slide on the clay layers that retain water and become slippery. The land is covered by humps called „coffins" (copârşaie) by the local people. In the shallow dents among the humps appeared temporal or permanent ponds. The water of these ponds contains salt that is washed out from the clay layers [1].

Because of its specific microclimate this area developes a mixture of xerophil and mesophil vegetation inlays. There were reported 474 plant species in the reserve. Many of them are rare or originating from the Ukrainian steppes, eg.: *Cephalaria uralensis, Serratula radiata, Centaurea trinervia, Crambe tataria, Adonis volgensis, Frittilaria orientalis, Trollius europaeus.* Regarding its fauna, the nature shelters the only population in Romania of the lepidopterous species *Maculinea nausithous.* Unfortunately the endemic snake *Vipera ursinii rakosiensis* became extinct 30 years ago [3, 4].

However, the flora and the fauna of the nature reserve had been completely explored long ago, algolgical studies have not yet been performed.

The purpose of this research was to determine the diatom taxa of the ponds and to infer water quality based diatom assemblages, using the biological diatom index. Diatom indices were developed for rivers and there are very few studies that prove their applicability in case of shallow lakes and fish ponds [2, 5].

Materials and Methods

Samples were collected in three ponds, from the surface of aquatic macrophytes (epiphytic samples) and from the surface of sludge (epipelic samples). The distance among the chosen ponds was approximately 200 m. The pond 2. was outside the reserve boundary.

Diatoms were sampled twice, in november 2005 and in april 2006.

Diatom taxa were identified using standard methods, by using standard identification books [6, 7].

Data analysis included the relative abundance of diatom taxa, diversity and evenness using the Shanon-Wiener formula. To estimate the floristic similarity among diatom assemblages we used the Jaccard formula. We assessed water quality from diatom community structure by computing the BDI-biological diatom index developed by Lenoire and Coste in 1999 [8].

Results and Discussion

There were identified 92 diatom taxa (Tab. 1), which belong to 19 genera. The number of taxa per genera was as follows: *Nitzschia* - 32, *Navicula* - 19, *Fragilaria* - 7, *Gomphonema* - 5, *Pinnularia* - 4, the other genera were represented by 3 or less than 3 taxa (Fig. 1).

70,65% of the identified species are cosmopolitan (*Achnanthes minutissima*, *Fragilaria ulna*). 63,04% of the taxa prefer high concentration of electrolytes and are characteristic for salt waters (*Navicula halophila*, *Rhopalodia gibba*). Regarding their pH affinity, 8,69% of the taxa prefer alkaline water conditions (*Navicula vitabunda*, *Epithemia adnata*). 14,13% of the taxa indicate eutrophic water (*Navicula veneta*, *Aulacoseirea granulata*).The percentage of pollution tolerant taxa is relatively high, 18,47% (*Nitzschia palea*, *Nitzschia amphibia*).

The number of taxa was higher in the spring samples than in the autumn ones (Fig. 2).

Table 1: Diatoms identified in the ponds (1-3) of the nature reserve „Fânațele Clujului”. (ef- epiphyton; ep- epipelon)

No.	Taxa	November 2005						April 2006					
		Samples											
		1 ef	1 ep	2 ef	2 ep	3 ef	3 ep	1 ef	1 ep	2 ef	2 ep	3 ef	3 ep
1	Achnanthes impexiformis Lange-Bartalot & Krammer	+					+						
2	Achnanthes lanceolata (Brébisson) Grunow	+					+				+		
3	Achnanthes minutissima Kützing	+	+		+				+		+		+
4	Amphora lybica (Ehrenberg)		+			+				+		+	
5	Amphora ovalis (Kützing) Kützing		+			+							
6	Amphora veneta Kützing						+		+		+		
7	Anomoeoneis sphaerophora (Ehrenberg) Pfitzer				+		+					+	
8	Aulacoseirea granulata (Ehrenberg) Simonsen	+	+	+				+	+	+	+		
9	Caloneis silicula (Ehrenberg) Cleve						+				+	+	
10	Cocconeis pediculus Ehrenberg	+			+	+	+						
11	Cocconeis placentula Ehrenberg						+						
12	Cyclotella iris Brun et Heribaud	+											
13	Cyclotella meneghiniana Kützing						+				+		
14	Cymbella affinis Kützing							+					
15	Cymbella cistula (Ehrenberg) Kirchner	+											
16	Cymbella silesiaca Bleisch	+											
17	Denticula kuetzingii Grunow	+											
18	Epithemia adnata (Kützing) Brébisson	+	+		+	+	+	+					

19	Epithemia argus (Ehrenberg) Kützing										+		
20	Fragilaria capucina Desmaziéres						+		+		+	+	+
21	Fragilaria construens (Ehrenberg) Grunow										+		
22	Fragilaria crotonensis Kitton										+		
23	Fragilaria pinnata var. pinnata Ehrenberg	+											
24	Fragilaria tenera (W. Smith) Lange-Bertalot	+				+		+	+	+	+	+	+
25	Fragilaria ulna (Nitzsch) Lange-Bertalot	+	+	+	+		+	+	+	+	+	+	+
26	Fragilaria ulna var. acus (Kützing) Lange-Bertalot								+		+	+	
27	Gomphonema augur Ehrenberg											+	
28	Gomphonema gracile Ehrenberg				+	+	+	+				+	+
29	Gomphonema minutum (Agardh) Agardh	+		+									
30	Gomphonema parvulum (Kützing) Kützing	+	+	+	+	+	+	+	+	+	+	+	+
31	Gomphonema pseudoaugur Lange-Bertalot											+	
32	Gyrosigma acuminatum (Kützing) Rabenhorst	+											
33	Gyrosigma spencerii (W. Smith) Cleve	+			+								
34	Hantzschia amphioxys (Ehrenberg) Grunow												+
35	Navicula angusta Grunow		+				+						
36	Navicula angustata W. Smith											+	
37	Navicula cincta (Ehrenberg) Ralfs								+		+	+	
38	Navicula crucicula (W. Smith) Donkin							+		+			
39	Navicula cuspidata Kützing		+		+		+					+	+
40	Navicula eidrigiana Carter											+	
41	Navicula halophila (Grunow) Cleve			+	+		+						
42	Navicula lanceolata (Agardh) Ehrenberg										+		
43	Navicula minuscula Grunow												+
44	Navicula mutica Kützing				+								+
45	Navicula ordinaria Hustedt											+	
46	Navicula pupula Kützing		+				+			+			
47	Navicula radiosa Kützing						+					+	
48	Navicula recens (Lange-Bertalot) Lange-Bertalot						+				+		+
49	Navicula schadei Krasske												+
50	Navicula tenelloides Hustedt												+
51	Navicula veneta Kützing						+		+	+	+	+	+
52	Navicula viridula (Kützing) Ehrenberg											+	
53	Navicula vitabunda Hustedt								+	+			+
54	Nitzschia acicularis (Kützing) W. Smith										+	+	+
55	Nitzschia amphibia Grunow			+		+	+		+	+	+		
56	Nitzschia angustata Grunow	+											
57	Nitzschia angustiforaminata Lange-Bertalot					+							
58	Nitzschia aurarie Cholnoky					+							
59	Nitzschia bilobata W. Smith				+							+	
60	Nitzschia brevissima Grunow						+					+	+
61	Nitzschia calida Grunow							+		+		+	+
62	Nitzschia capitellata Hustedt							+					
63	Nitzschia communata Grunow in Cleve & Grunow				+								

64	Nitzschia communis Rabenhorst	+					+	+	+				
65	Nitzschia commutatoides Lange-Bertalot											+	
66	Nitzschia constricta (Kützing) Ralfs	+	+		+	+	+	+	+				
67	Nitzschia dissipata (Kützing) Grunow		+							+	+	+	
68	Nitzschia dubia W. Smith									+		+	+
69	Nitzschia filiformis (W. Smith) Van Heurck		+					+	+	+	+	+	+
70	Nitzschia flexoides Geitler										+		
71	Nitzschia fonticola Grunow							+	+	+	+	+	+
72	Nitzschia hybrida Grunow									+			
73	Nitzschia lacunarum Hustedt								+				
74	Nitzschia linearis (Agardh) W. Smith				+							+	+
75	Nitzschia littoralis Grunow		+		+						+		
76	Nitzschia lorenziana Grunow			+									
77	Nitzschia palacea Grunow							+					
78	Nitzschia palea (Kützing) W. Smith		+		+	+	+	+	+	+	+	+	+
79	Nitzschia palustris Hustedt		+						+		+	+	+
80	Nitzschia pellucida Grunow				+			+				+	+
81	Nitzschia sigma (Kützing) W. Smith	+	+			+		+		+	+	+	+
82	Nitzschia sigmoidea (Nitzsch) W. Smith	+	+	+	+	+	+					+	
83	Nitzschia solita Hustedt							+					
84	Nitzscia vitrea Norman									+		+	
85	Nitzshia umbonata (Ehrenberg) Lange-Bertalot		+		+	+		+	+	+		+	+
86	Pinnularia brevicostata Cleve		+		+								
87	Pinnularia microstauron var. Brébissoni (Ehrnberg) Cleve							+	+	+	+	+	+
88	Pinnularia viridis (Nitzsch) Ehrenberg		+		+	+	+	+	+	+	+	+	
89	Pinnulria similis Hustedt									+			
90	Rhopalodia gibba (Ehrenberg) O. Müller	+				+	+				+		
91	Surirella angusta Kützing								+				
92	Surirella ovalis Brébisson	+										+	

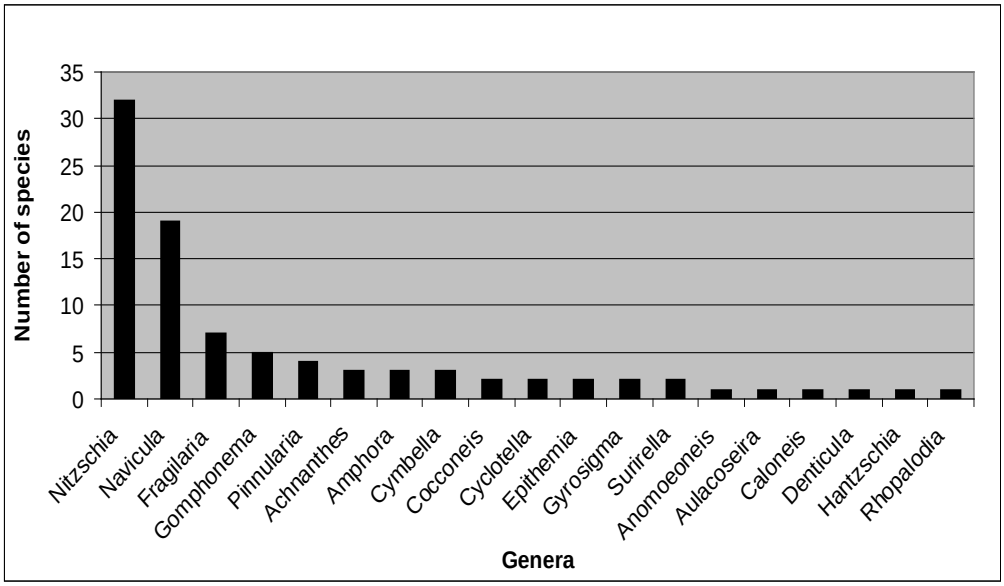

Fig. 1: Distribution of the identified diatom taxa per genera in the ponds of the „Fânațele Clujului" nature reserve

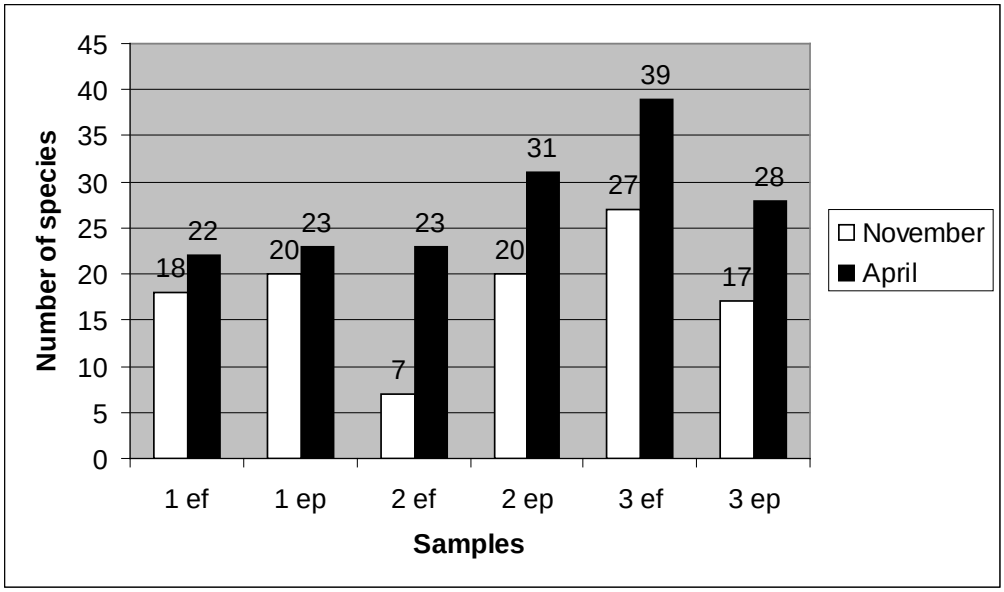

Fig. 2: Number of diatom taxa in the samples (ef- epiphyton and ep- epipelon) in ponds 1-3

Species diversity and evenness differed in the three ponds. Diversity was higher in spring samples than in autumn samples and higher in the epipelon than in the epiphyton, except for the epipelic sample of the pond 3. (Fig. 3). Regarding evennes the difference between the two sampling period was not so clear, but the epipelic samples showed higher evenness values than the epiphytic ones (Fig. 4).

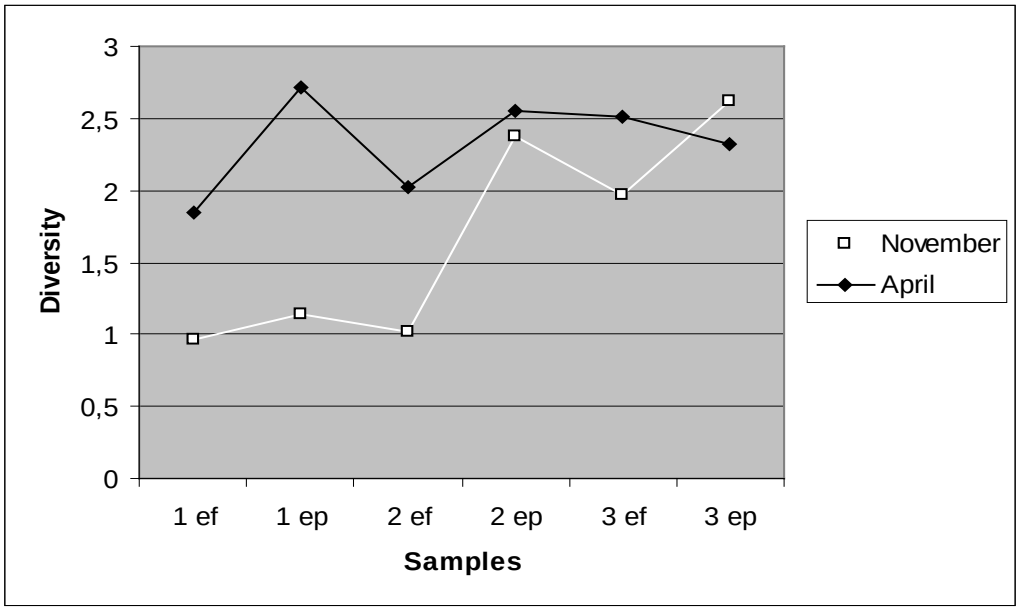

Fig. 3: Species diversity in the samples (ef- epiphyton and ep- epipelon) in ponds 1-3

Concerning saprobity, most species belong to the oligo-β-mesosaprobe and β-mesosaprobe category. There are fewer β-α-mesosaprobic and α-mesosaprobic species too. Oligosaprobic and xeno-β-mesosaprobic species appear as well. There is a difference in saprobity between the autumn and the spring samples, the spring samples contain more species that prefer lower concentration of organic matter. This fact may indicate that in spring the ponds have less organic substances (Fig. 5).

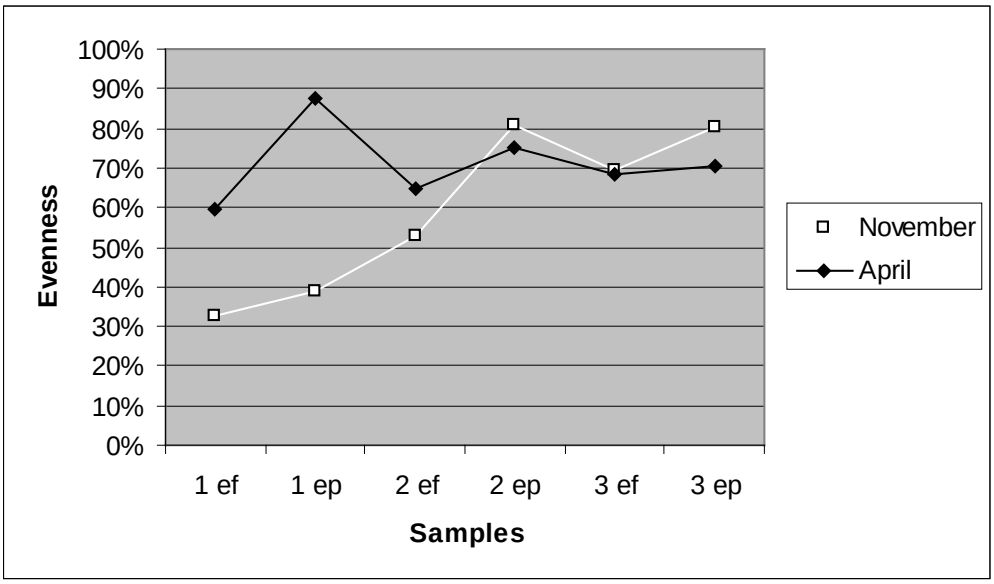

Fig. 4: Species evenness in the samples (ef- epiphyton and ep- epipelon) in ponds 1-3

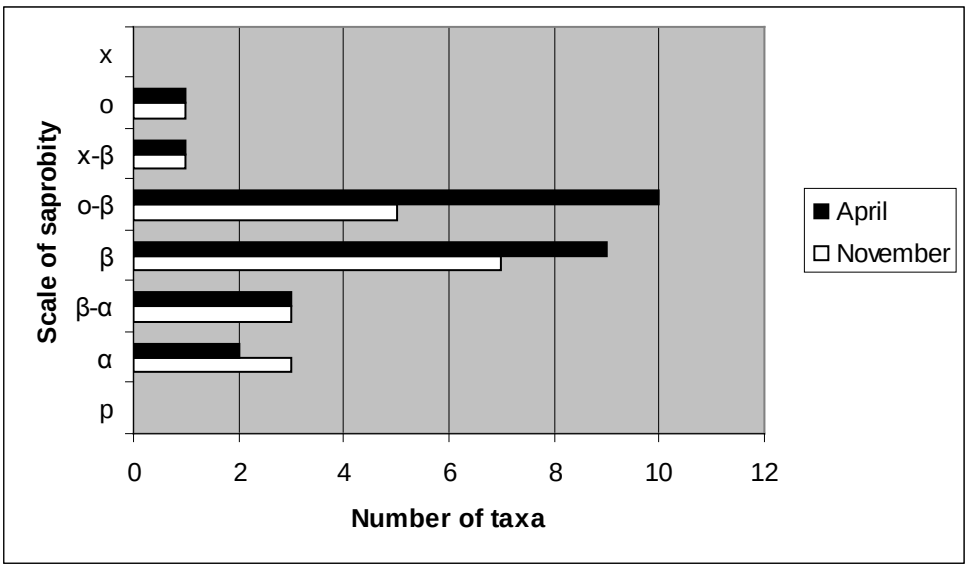

Fig. 5: Comparison between species saprobity tolerance of diatoms in November and April

The water quality indicated by the BDI is different in the ponds and on different substrata. Lower BDI values mean higher level of organic pollution. In autumn samples the BDI values are lower than spring except for the epiphytic sample of the pond 3 (Table 2). A possible explanation might be that during winter and early spring took place the decomposition of organic matter accumulated during late summer and autumn.

Table 2: BDI values of the samples

Samples	BDI in November	BDI in April
1 ef	5.1	9.6
1 ep	3.9	4.8
2 ef	1.0	6.8
2 ep	9.7	14.5
3 ef	8.8	4.5
3 ep	6.3	7.1

Conclusions

Most of the diatoms recorded in the ponds of "Fânațele Clujului" nature reserve are cosmopolitan and prefer high electrolyte concentrations. Spring samples contained higher number of taxa, exhibited higher level of diversity, presented more species that are frequent in oligo-β-mesosaprobe and β-mesosaprobe conditions.

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DATE PRELIMINARE PRIVIND STUCTURA COMUNITĂȚILOR DE DIATOMEE DIN BĂLȚILE DE LA "FÂNAȚELE CLUJULUI"

(Rezumat)

Rezervația floristică Fânațele Clujului este situată la 4 km nord de oraşul Cluj-Napoca, de o parte şi de alta a Văii Fânațelor, care este înconjurată de coline de 500-600 m înălțime şi presărată din cauza alunecărilor de teren cu numeroase movile de pământ numite de localnici "copârşaie". Printre acestea se formează bălți cu caracter temporar sau permanent.

Această lucrare prezintă rezultatele cercetărilor începute în toamna anului 2005, fiind primul studiu cu privire la stuctura comunităților de diatomee din aceste bălți.

Probele de perifiton au fost prelevate din 3 bălți de pe diferite tipuri de substraturi.

Până în prezent au fost identificați 61 de taxoni. Cel mai bine reprezentat este genul *Nitzschia*. Majoritatea speciilor de diatomee sunt elemente cu răspândire cosmopolită. Sunt prezente şi numeroase elemente halofile. În ceea ce priveste saprobitatea apei, majoritatea speciilor sunt elemente β-mezosaprobe. Sunt prezente şi unele elemente indicatoare de nivel saprobic critic (β-α, şi α-mezosaprobe).