

**PRELIMINARY STUDIES ON THE EPILITHIC DIATOM
COMMUNITIES OF THE TURDA GORGE (CHEILE TURZII),
TRANSYLVANIA, ROMANIA**

Boglárka BÍRÓ – *HALMÁGYI*¹, *Annamária KISS*¹, *Dorottya BÁNYÁSZ*¹, *Leontin Ștefan PÉTERFI*^{1,2}

¹Universitatea “Babeș-Bolyai”, Facultatea de Biologie și Geologie,
Catedra de Taxonomie și Ecologie, str. Republicii, nr. 42, RO-400015 Cluj-Napoca
²Institutul de Cercetări Biologice. str. Republicii, nr. 48, RO-400015 Cluj-Napoca

Abstract: Preliminary studies on the epilithic diatom communities of the Turda Gorge (Cheile Turzii) Transylvania, Romania. Species composition of epilithic diatom communities were studied in 7 sampling sites distributed on the “Pârâul Hășdate” rivulet which flows along the Turda Gorge. There have been identified 107 diatom species, most of them being cosmopolitan, eutrofic, basophilic or indifferent forms, widely distributed in rivers and rivulets. Species diversity and relative information calculated for each sampling site by using the Shannon-Wiener formula shows a decreasing tendency towards downhill, presumably due to suboptimal light conditions.

Introduction

The Turda-Gorge is situated on the eastern rim of the Romanian Western Mountains (Munții Apuseni) in the northeast of the Trascăului Mountains (Mții. Trascăului). It is not very far from the town of Turda (Cluj County). This very beautiful gorge with high and steep slopes and with almost vertical walls in some places, is only 1650 m long, and had been cut by the “Pârâul Hășdate” rivulet (a tributary of the Arieș river) in the chalk massif of the “Culmea Petreștilor”, located between Buru and Tureni villages.

The “Pârâul Hășdate” rivulet is usually slow, about 2–5 m wide, relatively unpolluted, clear watered, except the springtime heavy rainfalls and snow melting period.

The Torda-Gorge is well known for its varied terrestrial vegetation including rare and endemic plants, tertiary and glacial relics (Csűrös and Pop, 1965; Nyárádi, 1937, 1939; Pop, 1969). The Turda Gorge was declared in 1938 a Natural Floristic Reserve. Some of the most important endemic forms and relics are *Aconitum fissurae*, *Hieracium tordanum*, *Sorbus dacica*, *Ferula sadleriana* and *Allium obliquum*. Although the terrestrial flora and fauna of the Turda Gorge is relatively well known, its algae have entirely been neglected.

Materials and Methods

Epilithic diatoms have been collected during spring, summer and early fall of 2003, in 7 sampling sites (Fig. 1), selected along the rivulet flowing trough the gorge: outside the entrance (site 1), at the beginning of the gorge (site 2), towards its middle portion (sites 3 – 5), as well as at the outflow of the rivulet (sites 6 and 7).

The diatom samples were repeatedly washed in distilled water in order to remove the fixative. The frustules were cleaned by heating and than mounted in colophony. Water samples were also taken for chemical analysis (Tab. 1), but near the inflow of the rivulet into the Arieș river. The water of the rivulet is relatively rich in calcium (up to 127 mg·l⁻¹), magnesium (up to 18 mg·l⁻¹) and sulfate (up to 115 mg·l⁻¹), but low in nitrates and phosphates. The pH of the water varied between 7.5 and 7.8.

The species diversity of each community was expressed by using Shannon –Wiener formula.

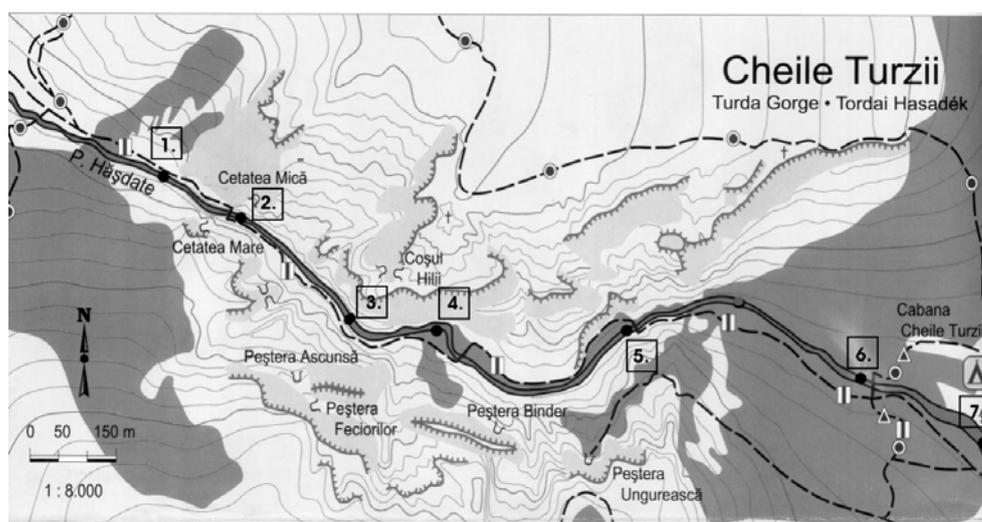


Fig. 1: Map showing the sampling sites located along the “Pârâul Hășdate” rivulet

Table 1: Chemical composition of water samples collected from the “Pârâul Hășdate” rivulet

Parameters	Water samples		
	May	August	October
Ca ²⁺ (mg·l ⁻¹)	66.0-127.0	67.0-89.0	87.5-96.0
Mg ²⁺ (mg·l ⁻¹)	10.5-12.0	9.2-11.3	12.0-18.0
Fe (mg·l ⁻¹)	0.11-0.15	0.12-0.15	0.12-0.15
Cl ⁻ (mg·l ⁻¹)	35.46	34.50	35.28
SO ₄ ²⁻ (mg·l ⁻¹)	78-115	75-78	49-80
NO ₃ ⁻ (mg·l ⁻¹)	7.05	6.89	7.06
PO ₄ ³⁻ (mg·l ⁻¹)	0.08-0.18	0.15-0.17	0.11-0.12
O ₂ (mg·l ⁻¹)	5.2-15.7	6.5-6.8	6.0-6.2
pH	7.5-7.8	7.5-7.8	7.5-7.8

Results

There were identified 107 diatom species (Tab. 2), which belong especially to the following genera: *Navicula* 24, *Nitzschia* 16, *Surirella* 9, *Gomphonema* 8 and *Cymbella* 7, the other genera were represented by less than 6 taxa (Fig. 2).

Table 2: Epilithic diatoms identified in the “Pârâul Hășdate” rivulet (Turda Gorge)

No.	Taxa	Sampling sites						
		1	2	3	4	5	6	7
1.	<i>Achnanthes lanceolata</i> (Brébisson) Grunow	+	+	+	+	+	+	+
2.	<i>A. minutissima</i> Kützing		+	+			+	
3.	<i>Amphora libyca</i> Ehrenberg	+	+	+	+	+	+	+
4.	<i>A. ovalis</i> (Kützing) Kützing	+	+	+			+	+
5.	<i>A. pediculus</i> (Kützing) Grunow	+	+	+	+	+	+	+
6.	<i>A. veneta</i> Kützing			+	+			+
7.	<i>Bacillaria paradoxa</i> Gmelin	+			+	+		
8.	<i>Caloneis amphisbaena</i> (Bory) Cleve	+	+		+	+		
9.	<i>C. bacillum</i> (Grunow) Cleve	+				+		
10.	<i>C. silicula</i> (Ehrenberg) Cleve	+						
11.	<i>Campylodiscus hibernicus</i> Ehrenberg				+			
12.	<i>Cocconeis pediculus</i> Ehrenberg	+	+	+	+	+	+	
13.	<i>C. placentula</i> Ehrenberg	+	+	+	+	+	+	+
14.	<i>Cyclotella atomus</i> Hustedt		+					

15.	<i>C. comensis</i> Grunow	+		+		+		
16.	<i>C. meneghiniana</i> Kützing	+	+		+	+	+	+
17.	<i>C. stelligera</i> Cleve et Grunow		+					
18.	<i>Cymatopleura elliptica</i> (Brébisson) W. Smith	+			+		+	
19.	<i>C. solea</i> (Brébisson) W. Smith	+	+	+	+	+	+	+
20.	<i>Cymbella caespitosa</i> (Kützing) Brun	+	+	+	+	+		
21.	<i>C. cystula</i> (Ehrenberg) Kirchner	+	+	+	+	+	+	+
22.	<i>C. hustedtii</i> Krasske	+		+			+	
23.	<i>C. minuta</i> Hilse		+			+	+	
24.	<i>C. prostrata</i> (Berkeley) Cleve	+	+	+	+		+	
25.	<i>C. silesiaca</i> Bleisch	+	+	+	+	+	+	+
26.	<i>C. sinuata</i> Gregory	+	+	+				+
27.	<i>C. tumida</i> (Brébisson) Van Heurck	+				+		
28.	<i>Diatoma vulgare</i> Bory	+	+	+	+	+	+	+
29.	<i>Diploneis oblongella</i> (Naegeli) Cleve-Euler		+	+	+	+	+	+
30.	<i>Fragilaria bicapitata</i> A. Mayer	+	+	+	+	+		+
31.	<i>F. brevistriata</i> Grunow	+			+	+	+	
32.	<i>F. capucina</i> Desmazières	+	+			+		
33.	<i>F. construens</i> (Ehrenberg) Grunow	+	+	+	+	+	+	+
34.	<i>F. ulna</i> (Nitzsch) Ehrenberg	+	+	+	+	+	+	+
35.	<i>Gomphonema acuminatum</i> Ehrenberg	+	+		+	+		+
36.	<i>G. angustatum</i> (Kützing) Rabenhorst	+	+	+	+	+	+	+
37.	<i>G. bohemicum</i> Reichelt et Fricke	+		+				
38.	<i>G. clavatum</i> Ehrenberg		+					
39.	<i>G. curtum</i> Hustedt	+	+	+	+	+		
40.	<i>G. olivaceum</i> (Hornemann) Brébisson	+	+	+	+	+	+	+
41.	<i>G. olivaceum</i> var. <i>calcareum</i> (Cleve) Cleve	+						+
42.	<i>G. truncatum</i> Ehrenberg		+			+	+	+
43.	<i>Gyrosigma attenuatum</i> (Kützing) Rabenhorst	+		+				
44.	<i>G. nodiferum</i> (Grunow) Reimer	+			+	+	+	+
45.	<i>G. peisonis</i> (Grunow) Hustedt	+						
46.	<i>Hantzschia amphioxys</i> (Ehrenberg) Grunow	+	+	+	+	+	+	+
47.	<i>Mastogloia smithii</i> Thwaites						+	+
48.	<i>Melosira varians</i> Agardh	+			+		+	+
49.	<i>Meridion circulare</i> Agardh	+	+	+	+	+	+	+
50.	<i>Navicula accomoda</i> Hustedt	+				+		
51.	<i>N. angusta</i> Grunow		+					
52.	<i>N. brasiliiana</i> (Cleve) Cleve	+	+	+				
53.	<i>N. capitata</i> Ehrenberg		+	+	+	+	+	+
54.	<i>N. capitata</i> var. <i>hungarica</i> (Grunow) Ross	+			+	+		+
55.	<i>N. capitatoradiata</i> Germain	+	+	+	+	+	+	+
56.	<i>N. cincta</i> (Ehrenberg) Ralfs	+	+	+		+	+	
57.	<i>N. cryptocephala</i> Kützing	+	+	+				
58.	<i>N. cryptotenella</i> Lange-Bertalot	+	+	+	+	+	+	+
59.	<i>N. cuspidata</i> Kützing							+
60.	<i>N. expecta</i> Van Landingham	+	+	+	+	+	+	+
61.	<i>N. goeppertiana</i> (Bleisch) H. L. Smith		+					
62.	<i>N. gracilis</i> Ehrenberg	+	+	+	+	+	+	+
63.	<i>N. gregaria</i> Donkin	+	+	+		+	+	+
64.	<i>N. helensis</i> Schulz	+		+				
65.	<i>N. lanceolata</i> (Agardh) Ehrenberg	+	+	+	+	+	+	+
66.	<i>N. menisculus</i> Schumann	+	+	+	+	+	+	+
67.	<i>N. minima</i> Grunow							+
68.	<i>N. mutica</i> Kützing	+			+			
69.	<i>N. pelliculosa</i> (Brébisson) Hilse	+	+	+			+	
70.	<i>N. peregrina</i> (Ehrenberg) Kützing	+		+	+	+		
71.	<i>N. placentula</i> (Ehrenberg) Grunow		+	+			+	

72.	<i>N. pupula</i> Kützing					+		+
73.	<i>N. pusilla</i> W. Smith	+						
74.	<i>N. pygmaea</i> Kützing	+	+	+	+	+	+	+
75.	<i>N. radiosa</i> Kützing	+	+	+	+	+	+	+
76.	<i>N. rhynchocephala</i> Kützing	+	+	+		+		
77.	<i>N. viridula</i> (Kützing) Ehrenberg	+	+	+	+	+	+	+
78.	<i>Neidium affine</i> (Ehrenberg) Pfitzer						+	+
79.	<i>N. ampliatum</i> (Ehrenberg) Krammer						+	+
80.	<i>Nitzschia acicularis</i> (Kützing) W. Smith	+	+		+	+		
81.	<i>N. amphibia</i> Grunow	+	+					
82.	<i>N. dissipata</i> (Kützing) Grunow	+	+	+	+	+	+	+
83.	<i>N. fonticola</i> Grunow	+	+	+	+	+	+	+
84.	<i>N. heufleriana</i> Grunow			+	+			
85.	<i>N. hungarica</i> Grunow		+		+	+	+	+
86.	<i>N. inconspicua</i> Grunow	+	+	+	+		+	+
87.	<i>N. incrustans</i> Grunow		+	+	+			
88.	<i>N. palea</i> (Kützing) W. Smith	+	+	+	+	+	+	+
89.	<i>N. pseudofonticola</i> Hustedt	+	+	+	+	+	+	+
90.	<i>N. sigmoidea</i> (Nitzsch) W. Smith	+		+		+		
91.	<i>N. subacicularis</i> Hustedt		+					+
92.	<i>N. tryblionella</i> Hantzsch	+	+	+	+	+	+	
93.	<i>N. umbonata</i> (Ehrenberg) Lange-Bertalot		+					
94.	<i>N. vermicularis</i> (Kützing) Hantzsch	+						
95.	<i>N. vitrea</i> Norman			+				
96.	<i>Pinnularia viridis</i> (Nitzsch) Ehrenberg	+				+		
97.	<i>Rhoicosphenia abbreviata</i> (Agardh) Lange-Bertalot	+	+	+	+	+	+	+
98.	<i>Surirella angusta</i> Kützing	+		+		+		
99.	<i>S. biseriata</i> Brébisson		+	+				
100.	<i>S. brightwellii</i> W. Smith		+					
101.	<i>S. echinulata</i> Skabitsch		+					
102.	<i>S. linearis</i> W. Smith	+						
103.	<i>S. ovalis</i> Brébisson	+			+			
104.	<i>S. ovata</i> Kützing	+	+	+	+	+	+	+
105.	<i>S. ovata</i> var. <i>pseudopinnata</i> A. Mayer	+						
106.	<i>S. tenera</i> Gregory		+					
107.	<i>Synedra parasitica</i> var. <i>subconstricta</i> Grunow	+						

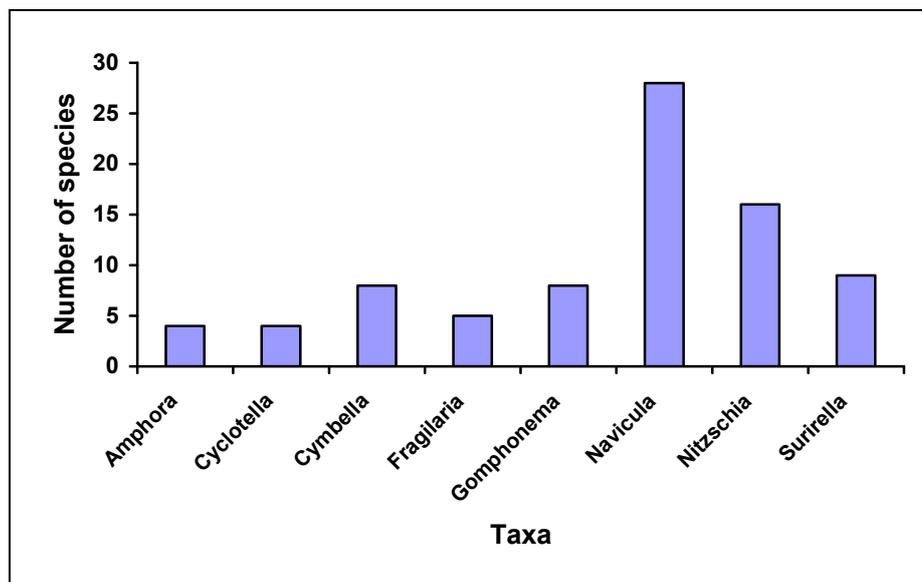


Fig. 2: Floristic composition of epilithic diatom flora of the Turda Gorge (only the richest genera are represented)

The number of diatom taxa identified in the main flow of the rivulet exhibited decreasing tendency towards downstream. The highest species number (78 and 66 taxa) was recorded uphill, at the entrance to the gorge, (almost twice as high as in the middle course), and about 2.5 times higher than downhill, at the end of the gorge (29 and 30 taxa). Similarly, the species diversity computed by using the Shannon – Wiener formula (Fig. 3), exhibited decreasing tendency from upstream towards downstream, possibly due to the lower availability of radiation energy inside the narrow portion of the gorge.

The floristic composition of the communities investigated in “Cheile Turzii” is very similar with that recorded in the nearby Turului Gorge (Kozma, Momeu and Péterfi, 2001).

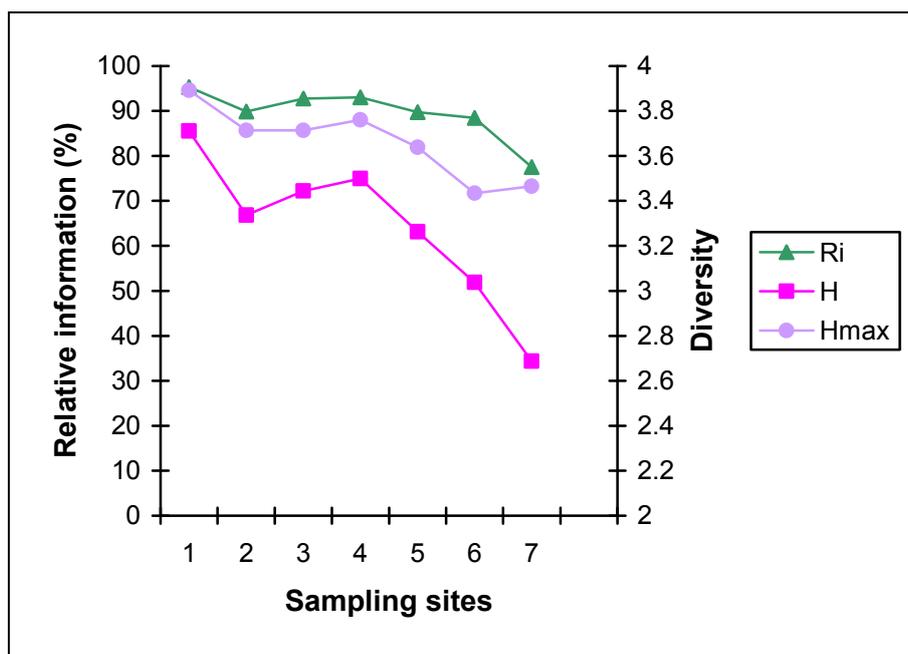


Fig. 3: Evolution of species diversity (H), theoretical diversity (Hmax) and relative information (Ri) in the studied communities

Conclusions

Most of the 107 diatoms recorded herein are cosmopolitan, eutrophic, basophilic or indifferent forms, widely distributed in rivers and rivulets. The number of taxa, as well as the species diversity exhibited a decreasing tendency from upstream towards downstream, possibly due to the markedly lower light intensity available inside the narrow gorge.

REFERENCES

1. Csűrös, Ș., Pop I., 1965, Considerații generale asupra florei și vegetației masivelor calcaroase din Munții Apuseni, *Contr. Bot. Cluj*: 113-131.
2. Kozma, A., Momeu, L., Péterfi, L. Ș., 2001, Diatoms of the Turului Gorge (Transylvania, Romania), *Contr. Bot. Cluj*, XXXVI: 79-87.
3. Krammer, K., Lange-Bertalot, H., 1986, 1988, 1991, *Süßwasserflora von Mitteleuropa*, Band 2. *Bacillariophyceae*, Teil 1-3, Gustav Fischer Verlag, Stuttgart, Jena.
4. Nyárády, E. I., 1939, *Enumerarea plantelor vasculare din Cheia Turzii*, București.
5. Nyárády, E. I., 1937, *Cheia Turzii*, Tipografia „Lyceum”, Cluj: 31-41.
6. Pop, I., 1969, Caracterele generale ale florei și vegetației Cheii Turzii, *Bul. Ins. Ped. Baia-Mare*, 1: 43-51.

**STUDII PRELIMINARE ASUPRA COMUNITĂŢILOR DE DIATOME E EPILITICE DIN CHEILE
TURZII (TRANSILVANIA), ROMÂNIA****(Rezumat)**

Lucrarea de faţă se referă la comunităţile algale epilitice care populează stâncile şi pietrele din Pârâul Hăşdate, un afluent al râului Arieş, în porţiunea sa care traversează Cheile Turzii. Probele au fost prelevate din 7 staţionare distribuite de-a lungul pârâului. În urma investigaţiilor au fost identificaţi 107 taxoni. Majoritatea diatomeelor identificate sunt cosmopolite, eutrofe, bazofile sau indiferente, larg răspândite în râuri şi pârâuri. Comunităţile sunt asemănătoare celor înregistrate anterior în Cheile Turului aflate în vecinătate. Diversitatea specifică calculată pe baza formulei Shannon – Wiener, prezintă o tendinţă descrescătoare spre aval.