

Algological data on the upper reach of River Tisa¹

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Introduction

The waters of the Eastern half of the Carpathian basin are collected and carried into the Danube by River Tisa. The catchment area of the river is about 150,000 sq.km and the river is approximately 1,000 km long. The upper reach of the river is 266 km long, measured from the sources (in Ukraine) to the confluence with River Szamos (one of its largest tributaries), in Hungary. The bottom of the Carpathian basin was formed by alluvial deposition created by the river. Deposits were discharged from the surrounding mountains into the Tertiary Pannonian Sea which had been filled by the beginning of the Pleistocene. River Tisa has an important role in the sedimental deposition of the Basin.

The highest section of the Upper Tisa is a typical mountainous region with stony bed, while the next section is in a hilly environment, with gravel bed. The dynamism of water discharge is considerable, thus there is a great difference in the ecological conditions between waves of flooding and low water outflow.

The river's suspended matter content is extremely high, especially at the time of the floods; therefore its popular name is 'Fair Tisa'.

Algae play an important role in riverine ecosystems: they produce oxygen, serve as food for animals, and indicate conditions of and changes in the environment.

At sites near the source and in the upper sections of rivers, attached algae (periphyton) are found subsurface as inhabitants of the planktonic environment (pseudoplankton, tychoplankton). Due to both the high velocity of water flow in the upper sections of river basins, and the high turbidity caused by inorganic particles, diatoms are the main group of algae. A decrease in velocity and/or an increasing nutrient load can lead to the dominance of other groups of algae (for example green algae). In the middle and lower sections of rivers real planktonic algae (potamoplankton) can become increasingly dominant.

The first reports on algae in the Ukrainian section of the Upper Tisa region were provided by Szabados, and the Hungarian section was observed by Uherkovich (1971). Hamar (in Ádamosi et al. 1977, Hamar 1991) studied the algological structure of the Hungarian reach.

Key words: phytoplankton, River Tisa

¹ The Hungarian name of the river is Tisza

Material and methods

Samples were taken at 11 sampling sites during a longitudinal sampling trip along the Upper Tisa in August 1996. Samples were fixed in Lugol's Iodine. Algae were counted under an inverted microscope. An Olympus type microscope was used in the identifications.

River Tisa has two source branches. One of them is Bila (White) Tisa (1) and the other is Chorna (Black) Tisa (2); there were the first and second sampling sites. These branches originate from the mountainous area of Ukraine. In the first section of the river, even below the confluence, the branches have relatively great dip and high speed. The third sampling site was at the village Rahiv (3), and the next at Delove (4). Here we nearly reach the mouth of River Vişeu, one of the main tributaries of River Tisa. There were no sampling sites near the Ukrainian and Romanian border line. The next site was before the mouth of River Teresva (5) and after the confluence of the two rivers (6). The following site was at Viskove (7), and the next was not far from Vinogradiv (8), after River Rika which is the largest tributary of River Tisa on the right. The next site was at the Ukrainian-Hungarian border at Vilok which is a regularly used international monitoring station (9). The two last sampling sites were on the Hungarian part of the catchment area of River Tisa before (at Tivadar 10) and after the mouth of River Szamos (at Tiszaszalka 11), which is the main tributary of the Upper Tisa in Hungary.

The total catchment area of River Tisa to the mouth of River Szamos is about 13.172 sq. km.

Results and discussion

Species composition

During this study 61 taxa of algae were found in the Upper Tisa:

Euglenophyta	5
Pyrrophyta	4
Chrysophyceae	2
Bacillariophyceae	25
Chlorophyta	25
Total	61

Euglenophyta

Algae belonging to this group are sporadic in the whole section, except for the section below the River Szamos junction (Sample No. 11) where species indicating polluted conditions appeared (*Euglena viridis*, *Euglena proxima*).

Pyrrophyta

Their occurrence is sporadic in the Upper Tisa except for the section below the River Szamos junction where species (*Chroomonas acuta*, *Cryptomonas curvata* and *C. obovata*) indicated eutrophicated environment.

Chrysophyceae

They are rare all along this upper part.

Bacillariophyceae

The upper section of River Tisa is characterized by rheophylic elements which indicate a clear environment, although the number of species that generally occur in streams (like *Achnanthes minutissima*, *Nitzschia fonticola*, *Ceratoneis arcus*) is rather low. Some species indicating moderately polluted environments and eutrophic conditions appear right below the source (*Nitzschia acicularis*, *Nitzschia palea*, *Cyclotella meneghiniana*, *Navicula rhynchocephala*). The presence of these taxa refer to moderately eutrophicated and polluted water conditions in the rheophilic environment.

The composition of diatoms in the last sample (No. 11.) indicated strongly eutrophicated and polluted water quality caused by River Szamos.

Chlorophyta

The occurrence of green algae is sporadic in the upper section of the river. Benthic elements (*Spirogyra*) occurred sometimes. Larger numbers of green algal taxa could be found only below the River Szamos junction. Most of them are cosmopolitan and occur in eutrophic waters.

Quantitative changes (Table 1.)

In the mountainous region of River Tisa small numbers of individuals were found and diatoms dominated. In the hilly part of the section the occurrence of other groups of planctonic algae indicated a moderately local contamination. As an effect of River Szamos, the last part of the upper section was eutrophic and pollution was indicated by a higher number of individuals (see sample 11. in Table 1.).

Ecological considerations

The composition of algal communities reflect both the hydrographical properties of the river and the effects of allochthonous factors like human activity. The mountainous-type headwater section is clear with local contamination. The adding up of contaminations caused a gradually increasing slight pollution along the Upper Tisa. Yet, the Upper Tisa is one of the clearest river sections in Europe, on the basis of this investigation and other information.

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References

- Ádamosi et al. (1978): Limnological investigations in the longitudinal section of the River Tisza. - *Tiscia* 13, 99-140.
- Kiss, K. T., Szabó, A., (1975): Longitudinal profile investigations in the Tisza and Eastern Main Channel I. Quantitative changes in phytoplankton. - *Tiscia*, 10: 3-14.
- Szabados, M., (1949): Kárpát Ukrajna vizeinek hydrobiológiai vizsgálata. (Hydrobiological investigations of waters of Carpathian Ukraine - in Hungarian). - *Acta Bot. (Szeged)*, 4: 35-53.
- Szabados, M., (1957): Das Leben der Tisza. II. Beiträge zur Kenntnis der Algen der oberen Tisza. - *Acta Biol. (Szeged)*, 3: 189-206.
- Uherkovich, G., (1959 b): Characteristics of the potamophytoplankton in the upper reach of the River Tisza at times of extremely high and extremely low water. - *Acta Biol. Hung. Suppl* 3: 21-22.
- Uherkovich, G., (1960 b): Das Leben der Tisza. IX. Über die Algenvegetation der Oberen-Tisza /Theiss/ in den Jahren 1958 und 1959. - *Acta Biol. Szeged*, 6. 107-126.
- Uherkovich, G., (1961 b): Das Leben der Tisza. XII. Weitere synoptische Beobachtungen über die Algenvegetation der Tisza (Theiss) zwischen Tiszabecs und Tiszacsege und ihrer Nebenflüsse. - *Acta Biol. Szeged*, 7: 103-119.
- Uherkovich, G., (1971): A Tisza lebegő paránynövényei (A Tisza fitoszesztonja.) (Floating miniature plants of River Tisa - in Hungarian). - *Szolnok Megy. Múz. Adattár*, 20-22: 1-282 + I-CXI.III.

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Table 1.

Taxa, 1000 ind. \ dm ³ \ Sampling sites	1	2	3	4	5	6	7	8	9	10	11
<i>Euglena limnophila</i> Lemm.											120
<i>E. proxima</i> Dang.											60
<i>E. viridis</i> Ehrbg.								6			60
<i>Euglena</i> spp.											180
<i>Trachelomonas hispida</i> (Perty) Stein											6
<i>T. volvocina</i> Ehrbg.								6			
Euglenophyta								12			426
<i>Chroomonas acuta</i> Uterm.		6	12	12	18	48	18	66	84	30	600
<i>Cryptomonas curvata</i> Ehr. em Pen.									6	6	
<i>C. obovata</i> Skuja											1200
<i>Cryptomonas</i> sp.						6		12	12	30	
Cryptophyceae		6	12	12	18	54	18	78	102	66	1800
<i>Chrysococcus rufescens</i> Klebs											12
<i>Mallomonas</i> spp.					6	6					
Chrysophyceae					6	6				12	
<i>Achnantes minutissima</i> Kütz.		18	6	6	24		90	48	108	30	
<i>Asterionella formosa</i> Hassal											600
<i>Hannaea arcus</i> (Ehrbg.) Patrick		6									6
<i>Cyclotella meneghiniana</i> Kütz					36		6	78	42	60	9000
<i>C. silesiaca</i> Bleisch			6	6		6	6	6			
<i>Cymatopleura solea</i> (Breb.) W Smith					6						
<i>Diatoma vulgare</i> Bory	6	6	6						6		
<i>D. vulgare</i> v. <i>linearis</i> Grun.		6	6	6							
<i>Didymosphaeria geminata</i> (Lyngb.) M Schmidt	6		6	6							
<i>Fragilaria crotonensis</i> Kitton											200
<i>F. ulna</i> (Nitzsch.) Lange-Bert.	6					6			6		
<i>F. ulna</i> var <i>acus</i> (Kütz.) Lange-Bert.									6		
<i>Gomphonema augur</i> Ehrbg.					6						
<i>G. minutum</i> Agh.	6										
<i>G. olivaceum</i> (Horn.) Bréb		6								6	
<i>G. truncatum</i> Her.			6								
<i>Navicula cari</i> Her			6								
<i>N. cryptocephala</i> Kütz.		6	12	12					6	6	6
<i>N. rhynchocephala</i> Kutz.				6				6		6	60
<i>Navicula</i> spp.		6	12			6	6	6	18		
<i>Nitzschia acicularis</i> (Kütz.) W.M Smith		6	18	6	60	24	18	72	120	240	1200

Table 1. continue

Taxa, 1000 ind.\ dm ³ / Sampling sites	1	2	3	4	5	6	7	8	9	10	11
<i>N. fonticola</i> Grun. in Cleve et Möller	12	6	6	30	24			6	6	6	
<i>N. palea</i> (Kütz.) W. Smith				6	6			6	6	6	600
<i>Nitzschia</i> spp.	12	12	24	30	36		6	78	60	90	900
<i>Surirella ovata</i> Kütz.					6						
Bacillariophyceae	48	78	102	126	210	36	132	312	390	450	12620
<i>Actinastrum hantzschii</i> Lagerh.											60
<i>Closterium acutum</i> Bréb.						6					
<i>Coelastrum sphaericum</i> Ng.					6						600
<i>Cosmarium botrytis</i> Menegh.											
<i>Crucigeniella apiculata</i> (Lemm.) Kom.									6	6	300
<i>Dictyosphaerium ehrenbergianum</i> Ng.										6	1320
<i>Didymocystis planctonica</i> Kors.											6
<i>Lagerheimia wratislaviensis</i> Schroed.											60
<i>M. contortum</i> (Thur.) Kom. et Legn.											120
<i>M. griffithii</i> (Berk.) Kom. et Legn.							6	12	6		
<i>Oocystis lacustris</i> Chod.											60
<i>Scenedesmus acuminatus</i> (Lagh.) Chod.											420
<i>S. brevispina</i> (G.M.Smith) Chodat											60
<i>S. ecornis</i> (Ehrbg.) Chod.								12	12	6	600
<i>S. longispina</i> Chodat											360
<i>S. ovalternus</i> Chodat											120
<i>S. protuberans</i> Fritsch											120
<i>S. quadricauda</i> (Turp.) Bréb.sensu Chod.								12	12	6	600
<i>S. quadricauda</i> var. <i>setosus</i> (Kirch.) Hansg.											480
<i>S. setigera</i> (Schröd.) Lemm.											120
<i>Spirogyra</i> spp.						12	6				
<i>Tetraedron caudatum</i> (Chod.) Hansg.											60
<i>T. minimum</i> v <i>apiculato-scrobiculatum</i> (Reinsch) Skuja								12	12	6	
<i>T. glabrum</i> (Roll.) Ahlstr. et Tiff.											60
<i>T. heteracanthum</i> (Nordst.) Chod.								6			
Chlorophyta					6	18	12	54	48	30	5526
Total algal number	48	84	114	138	240	114	162	456	540	558	20372