Algological data on the upper reach of River Tisa[1]

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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 Ádámosi et al. 1977, Hamar 1991) studied the algological structure of the Hungarian reach.

Key words: phytoplankton, River Tisa

[1] FThe 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 occurence 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 precence 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 allochtonous 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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Table 1.

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

Table 1. continued

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