A short account on the algal flora of the River Someş/ Szamos[1] (Transylvania)

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Introduction

The catchment area of the River Someş is stretched in North Transylvania of the Carpathian basin. The region is beautifully varied orographically, pedologically, climatically and of course hydrographically. The diversity of the physical conditions brought about a wonderful biological diversity, including naturally the algal flora. The worthiest natural inheritance, the biological diversity is subjected, as everywhere, to the human impact. The Someş collects all waters from its area, meanwhile it has to endure and transport a huge amount of garbage poured in it by nearly 3 million people and by factories. Here and there the river purifies itself for a while only to become more loaded again and brings this polluted water into the Tisza.

Keywords: algal flora, River Someş, Transylvania

Results

In 1992 (02-12. June, 22.07-2.August) two trips have been taken by a joined Hungarian-Romanian team of researchers along the Someş/Szamos river, from its sources to the confluence with the Tisza, during which samples were collected and measurements were made in many significant localities and biotopes as well. From the samples, up to now, 615 algal taxa were determined (the work is not finished yet). Nevertheless, even from these species one can define some guiding groups which hold taxonomic or ecological implications, particularly significant regarding the object we were dealing with. Thus, according to literature data, some species are interesting for the Transylvanian algal flora, e.g.: *Lyngbya circumcreta, Schizothrix lateritia, Euglena clavata, Chlamydomonas paramucosa, Actinastrum fluviatile, Ankistrodesmus stipitatus, Cylindrocellis cylindrica, Fotterella tetrachlorelloides. Solenoderma malmeanano* is derma malmeanarous, composed of two categories of algae: the seasonal, topical species and the potential one's. The latent species, tolerating for a while the unfavourable prevailing conditions, can revive after easing the stresses and regain their place in the given ecosystem. Such species appear in samples collected in artificial nutrient media (e.g. soil-water biphasic medium) preserved in laboratory conditions. This is nothing else than the A. Scherffel's (1911, 1927) and A. Pascher's (1939) idea

[1] The first name is Romanian, and the second Hungarian

and method, which later was emphasized by C. van den Hoek (1964) and recently by D.M. John and L.R. Johnson (1991). Using this method they and other phycologists discovered many algal species, a lot of them belonging even to the *Chrysophyceae* and *Heterokontae* as well. "Investigations of cultures grown under controlled conditions combined with observations on living materials from the nature and, if useful, on herbarium collections should be the base for taxonomic studies" (C. van den Hoek, 1964). The necessity to know much better about most of all the tolerant, cryptic species of algae, primary promoters of the resilience of phycobiocoenoses in damaged biotopes, brings this principle timeliness again. *Cylindrocellis cylindrica* might be considered such species among others.

The coincidence of certain biotic and non-biotic factors could frequently produce algal water blooms. The Hungarian algological literature is abundant in this domain (I. Kiss, 1952, 1959, 1961; T. Hortobágyi, 1961; F. Nagy-Tóth, 1991). This interesting phenomenon was repeatedly observed during the trips along the Someş. It can indicate the ecological status and the trend of development in a biotop. Upstream of Cluj near the River Someş side in the tap-water trickling filter basins a dense water-bloom was observed, dominated by: *Chlorococcum infusionum, Chlorella acuminata, Scenedesmus acutus, Sc. obtusiusculus* (all 4 species were in different stages of development), *Sc. spinosus* and fairly frequent *Cosmarium undulatum* (26.August; temperature 27 °C, pH 9-9,5). Downstream of Cluj, after the Someş received all industrial and domestic wastewater, a rather deplorable water- and soil-bloom was found in the riverbed, produced almost by *Oscillatoria limosa* (26.June; temperature 23 °C, pH 7.5). More delightful was an other water bloom that came across a meadow of Mânău village (Sălaj County) in the valley of Sălaj rivulet, being a tributary of the Someş. This water bloom was dominated by *Dinobryon cylindricum var. alpinum* (23.May; temperature 21 °C; pH=7). Ecologically and regarding the monitoring of the Someş, the water-bloom caused by the huge amount of *Cyclotella meneghiniana* was more significant near Pomi (11.June; temperature 21 °C; pH = 8) after the Lăpuş and Săsar rivulets stream into the river; both of them heavily polluted by toxic metals and domestic wastes. This species emerges firstly here in the Someş water and its abundance appear in the Tisza many times until Szolnok. Its sudden disappearance might be due to the change of the osmotic value of the water, besides or together to with certain physico-chemical factors.

In quasi-normal natural conditions the succession of the phycobiocoenoses might be characterised by preponderance of certain groups of algae: diatoms, greens, blue-greens; obviously with significant variations in their specific compositions. Under anthropic impact more profound changes, alterations intervene not only in the species composition, but even as a consequence of stresses, in the trophic chains. The exceeding sensibility of the food chain can be settled (if necessary) from data gathered by artificial (short) food chain experiments, which are numerous. Thus, the copepod *Calamus* filters off the diatom *Ditylum brightwellii* at a greater rate than green *Chlamydomonas*. Similarly, other copepod species (*Mediaptomus meridianus* and *Tropodiaptomus spectabilis*) preferred *Chlamydomonas reinhardii* and *Cyclotella meneghiniana* instead of *Scenedesmus acutus* or *Selenastrum capricornutum*.

The food value of some blue-green algae (*Anabaena flos-aque, Anacystis nidulans, Flococapsa alpicola, Merismopedia sp., Synechococcus elongatus, S. cedrorum, Synechococcus sp.*) was higher than of green algae in a diet of *Daphnia pulex*. It is worth to mention that the toxicity of several blue-green algae to higher animals is quite well established, but few reports of their toxic effects on aquatic invertebrates exist (H. L. Golterman 1975).

Along the Someş and in the river as well, the phycobiocoenoses changes drastically; both in habitats and during the seasons, which is redoubled by the human impact. Upstream Cluj, near Gilău and Floreşti by "Zöldsapka" field, the phycobiocoenoses were dominated by diatoms, which were accompanied in a higher rate by green algae. *Asterionella formosa, Fragilaria crotonensis* and *Synedra ulna* (Table 1.) characterised the phytoplankton both of the artificial water reservoirs on the Someşul Cald by Gilău and Tarniţa. Downstream of Cluj at Someşeni the penurious algal flora was redundant in blue-green algae (*Lyngbya sp., Phormidium sp., Oscillatoria spp.).* At Pomi the percentile composition of the summarised algal flora on the two trips varied as follows (Table 2., 3.).

Species / Season	June 11, 1992	August 2, 1992.
Cyanophyta	24%	8%
Euglenophyta	Not sign.	8%
Chlorophyta	19%	62%
Bacillariophyta	57%	22%

Table 2.

It is interesting among others, that the summer (02.08) coenoses was characterised mainly by green algae (62%) but quantitatively was dominated by diatoms (*Cyclotella meneghiniana* produces the water-bloom). Nevertheless, in non-affected or moderately polluted rivers, in tributaries of the Someş (in rivulets or brooks), the diatoms generally reveal a higher variability of species than other algal groups. Altogether there are some 50 tolerant diatom species (marked with 2-4) which can be found, in variable percentage, in most of the polluted lotic waters (e.g. *Amphipleura pellucida, Caloneis silicula, Cymatopleura elliptica, Cymbella ventricosa, Diploneis elliptica, Frustulia rhomboides, Navicula cryptocephala, N. viridula, Synedra affinis, S. ulna, S. vaucheriae* –after Van den Hoek). Due to their tolerance and their reserve materials (lipids) diatoms can be/are present in the rivers during all seasons of the year.

The plant communities of the River Someş, as in general, are/would be considerably influenced by the riverside hydrophytic macrovegetation, which can have a favourable buffering function between the helpless aquatic organisms and the terrestrial adverse actions. Although the allelopathic effects can not be excluded, an existing vigorous phanerogam flora would promote efficiently the development of a diversified algal flora, which is a supplying source of the river plant communities; the essential constituents of the natural food chain. Unfortunately such a macrophytic vegetation does not exist or it is regrettably scantly, especially in the middle and the lower section of the Someş (cf. Drăgulescu, 1995).

Quantitative study of the phytoplankton showed drastic change along the river (Table 4.).

direction of water flow →

Someşul Cald source area	29				
		Someşul Mic at Gilău	43		
Someşul Rece source area	58	Someşul Mic above Cluj	280		
		Someşul Mic below Cluj	311000		
				Someş at Dej	373000
		Someşul Mare at source area	72	Someş at Someş Odorhei	1440
		Someşul Mare at Sângeorz Băi	250	Someş at Sălsig	38102
		Someşul Mare at Năsăd	760	Someş at Pomi	103680
		Someşul Mare at Beclean	936	Someş above Satu Mare	87000
				Someş below Satu Mare	112000
				Someş at Vásárosnamény	75000

Table 4. Quantitative dinamism of the phytoplankton, ind./ml. (August 1992)

The ecological status of the Someş is alarming. The mournful alteration of the water-body, the riverside and catchment area is mainly a consequence of the intolerant, neglect behaviour of people particularly during the last 75 years towards this wonderful natural inheritance. But this assertion can not be proved experimentally since such metamorphoses have no parallel control to compare with. Nobody can demonstrate how the environment assemblages would be without brutal human interference.

The ambiguous reality resides in the data gathered during the investigations accomplished. The first conclusion of the results obtained is warning, regarding the precarious situations; from which follows the second, that the misfortune of the Someş threatens the Tisa plain too. The third conclusions is that the damages are not irreversible yet and through a concerted action would be possible to reconstruct the Someş ecosystems, since there are still sections, places (e.g. at Bazarul Someşului, Beliş, Tarniţa, Gilău, Rodna, Jibou, Narrowpath from Ţicău, Fărcaşa, Tămaia) which were not completely destroyed.

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Table 1. Diatom flora of the Tarniţa (1, 3, 5 = plankton, 2, 4, = periphyton) and of the Gilău (6 = periphyton from upper side, 7 = plankton, 8 = periphyton from the downer side of the water-body) reservoirs.
(* occasional; + sporadic; ++ slightly frequent; +++ frequent; ++++ very frequent)

Species	1.	2.	3.	4.	5.	6.	7.	8.
Stephanodiscus astrea (Ehr.) Grun. var.. *minutula* (Kütz.) Grun.	*	-	-	-	-	-	-	-
Melosira var.ians G.A.Ag.	-	++	-	+	+	+++	+	++
Diatoma hiemale (Lyngb.) Heib. var.. *mesodon* (Ehr.) Grun	-	-	-	-	-	-	-	*
Diatoma vulgare Bory	-	*	*	*	*	-	+	++
Tabellaria fenestrata (Lyngb.) Kütz.	-	+	-	+	+	-	*	-
T. fenestrata var.. *asterionelloides* Grun.	-	-	-	*	-	-	-	-
T. flocculosa (Roth) Kütz.	*	+++	*	+++	+	-	-	*
Asterionella formosa Hass.	++++	-	++++	-	++	-	+++	*
Ceratoneis arcus Kütz.	+	+	+	*	*	+	+	+
C. arcus var.. *amphioxys* (Rabh.) Brun.	-	-	-	*	*	-	-	-
C. arcus var. *linearis* Holmb.	*	-	-	*	*	-	-	-
Fragilaria capucina Desm.	-	-	-	-	-	+	+	-
F. crotonensis Kitton	+++++	++	+++++	+++	+++++	-	+++++	-
Synedra acus Kütz.	+	+	++	+	+	*	+	*
S. rumpens Kütz.	-	-	-	*	-	-	-	-
S. ulna (Nitzsch) Ehr.	-	++	+	++	++	+++++	++++	+++
S. ulna var. *oxyrhynchus* (Kütz.) V.H.	*	*	+	+	*	-	-	+
S. vauchariae Kütz.	-	*	-	*	-	+	*	-
Achnanthes lanceolata Bréb.	*	-	-	*	-	+	*	*
A. linearis W. Sm.	-	+	-	+	+	-	-	-
A. minutissima Kütz.	++	++++	-	++++	++	+	+	++++
A. minutissima var. *cryptocephala* Grun	++	+	-	+	+	-	+	*

Table 1. continue

Species	1.	2.	3.	4.	5.	6.	7.	8.
Cocconeis pediculus Ehr.	-	-	-	-	-	+++	*	++
C. placentula Ehr. var. *euglypta* (Ehr.) Cl.	*	-	-	*	-	+	+	+
Amphipleura pellucida Kütz.	-	*	*	-	-	-	-	+
Caloneis bacillum (Grun.) Mer.	-	-	-	-	-	-	-	+
C. silicula (Ehr.) Cl.	-	-	-	*	-	-	-	-
C. silicula var. *truncatula* Grun.	-	-	-	*	-	-	-	-
Diploneis ovalis (Hilse) Cl. Var. *oblongella* (Naeg.) Cl.	-	-	-	-	-	-	-	*
Frustulia vulgaris Thwait.	-	*	-	*	-	-	*	+
Gyrosigma acuminatum (Kütz.) Rabh.	-	-	-	-	-	-	*	*
G. scalproides (Rabh.) Cl.	-	-	-	-	-	-	*	*
Navicula cryptocephala Kütz.	-	*	-	*	-	-	-	-
N. cryptocephala var. *intermedia* Grun	-	-	-	-	-	+	++	++
N. cryptocephala var. *veneta* (Kütz.) Grun.	+	++	+	++	+	-	*	*
N. cuspidata Kütz.	-	-	-	*	-	-	-	-
N. gracilis Ehr.	*	*	-	-	-	+	-	+
N. hungarica Grun var. *capitata* Mayer	-	-	-	-	-	-	-	+
N. peregrina (Ehr.) Kütz. var. *kefvingensis* (Ehr.) Cl.	-	*	-	-	-	-	-	+
N. radiosa Kütz.	*	+	-	++++	+++	+	*	-
N. rhynchocephala Kütz.	*	+	-	++	+	-	*	-
N. salinarum Grun.	-	*	-	-	-	-	*	+
N. viridula Kütz.	*	-	-	+	-	+	-	*
N. viridula var. *capitata* Meyer	-	-	-	*	-	-	-	*
N. viridula var. *slesvicensis* (Grun.) Cl.	-	*	-	-	-	-	*	-

Table 1. continue

Species	1.	2.	3.	4.	5.	6.	7.	8.
Neidium affine (Ehr.) var. *amphirhynchus* (Ehr.) Cl.	-	+	-	-	-	-	*	*
N. affine var. *amphirhynchus* fo. *capitatum* Skw. Et Mayer	-	-	-	*	-	-	-	-
Pinnularia borealis Ehr.	-	-	-	+++	++	-	-	-
P. gibba Ehr.	-	-	-	++	-	-	-	-
P. gibba fo. *subundulata* Mayer	-	-	-	+	-	-	-	-
P. gibba var. *mesogongyla* (Ehr.) Hust.	-	-	-	*	-	-	-	-
P. mesolepta (Ehr.) W. Sm.	-	-	-	++	+	-	-	-
P. microstauron (Ehr.) Cl.	-	-	-	+	-	-	-	-
P. microstauron var. *brebissonii* (Kütz.) Hust. Fo.*diminuta* Grun.	-	*	-	+	-	-	-	-
P. nodosa Ehr. var. *constricta* Meyer	-	-	-	-	-	-	-	*
P. subcapitata Greg.	-	-	-	*	*	-	-	-
P. viridis (Nitzsch) Ehr.	-	-	-	+	*	-	-	-
P. viridis var. *diminuta* Mayer	-	-	-	*	-	-	-	-
Stauroneis anceps Ehr.	-	-	-	*	-	-	-	-
St. phoenicenteron Ehr.	-	-	-	+	-	-	*	*
Amphora ovalis Kütz.	-	-	-	-	-	+	-	-
A. ovalis var. *libyca* (Ehr.) Cl.	-	-	-	-	-	+	*	+
Cymbella affinis Kütz.	-	+	-	+	+	-	+	+++
C. cistula (Hempr.) Grun.	*	+++	-	+++	++	-	+	+++
C. cymbiformis (Agardh? Kütz.) V.H.	*	+++	*	++	++	-	-	+
C. lanceolata (Ehr.) V.H.	-	++	-	*	-	+	-	-
C. naviculiformis Auersw.	-	*	-	+	*	+	*	*
C. prostrata (Berk.) Cl.	-	-	-	-	-	+	*	*
C. semielliptica Péterfi et Róbert	*	-	-	-	-	-	-	-

Table 3. The summer (2 August 1992) phytoplankton of the Someş at Pomi

Species	**Ecological characteristics**	**Frequency**
Lyngbya circumcreta G.S. West	Mesosaprobiotic	+
L. martensiana Menegh.	Mesosaprobiotic	+
Schizothrix lateritia (Kütz.) Gom.	Eutrophic, calcicolous	++
Euglena clavata Skuja	Mesosaprobiotic (Tisa)	+++
E. pisciformis Klebs	Mesosaprobiotic	+
E. proxima	Polysaprobiotic	++
Chlamydomonas paramucosa Schiller	Mesosaprobiotic, basiph.	++
Actinastrum fluviatile (Schröd.) Fott.	Rheophilic	+
Ankistrodesmus gracile (Reinsch) Korš.	Mesosaprobiotic-eutrophic	++
A. stipitatus (Chod.) Kom.-Legn.	-	+
Coelastrum microporum Näg.	Eutrophic	++
Cylindrocellis cylindrica (Hind.) Hind.	Rheophilic	+++
Fottarella tetrachlorelloides Buck	Eutrophic	+
Monoraphidium griffithii (Berk.) Kom.-Legn.	Mesotrophic-eutrophic	++

Table 3. continue

Species	Ecological characteristics	Frequency
Pesiastrum boryanum (Turp.) Menegh. var. *boryanum*	Cosmopolitan	++
P. boryanum (Turp.) Menegh. var. *ellesmerense* Croasd.	-	+
P. duplex Meyen var. *duplex*	Cosmopolitan	++
Scenedesmus acuminatus (Lagerh.) Chod. var. *acuminatus*	Cosmopolitan	+
S. acuminatus var. *bernardii* (G.M. Smith) Deduss	Cosmopolitan (Mureş, Tisa)	+
S. dimorphus (Turp.) Kütz.	Cosmopolitan	++
S. intermedius Chod. var. *intermedius*	Cosmopolitan, eutrophic	++
S. longispina Chod.	Mesosaprobiotic	+
S. opoliensis P. Richter	Cosmopolitan	++
S. ovalternans Chod.	Cosmopolitan	+
S. quadricauda (Turp.) Bréb.	Cosmopolitan	++
S. quadricauda f. *granulatus* Hortob.	Mesosaprobiotic	++
Siderocellis irregularis Hind.	Eutrophic	+
Solenoderma malmeana Bohl.	Benthic	+
Cosmarium undulatum Corda	-	+
Cyclotella meneghiniana Kütz.	Mesosaprobiotic-haloph.	+++ Water-bl
Fragillaria crotonensis Kitton	Eutrophic	++
Navicula bacillum Ehrenb.	Mesosaprobiotic, cosmopolitan	+
N. veneta Kütz.	Very eutrophic	++
Nitzschia fruticosa Hustedt.	Eutrophic, lotic	++
Pinnularia subcapitata Gregory	Cosmopolitan	++
Synedra actinastroides Lemn.	Mesosaprobiotic, lotic	++
S. vauchariae Kütz.	Cosmopolitan	++