

Diversity of testacean Protozoa in River Tisza after a cyanide and metall pollution at the beginning of year 2000

Preliminary study

By

J. K. TÖRÖK*

Abstract. In spite of the damageous environmental perturbation suffered early in 2000, River Tisza is inhabited by prospering protozoan assemblages with 80 testacean species detected during a sampling tour along the upper and middle course of the river in July, 2000. *Cochliopodium actinophorum* Auerbach, *Diffugia amphoralis* Cash and *Lecythium hyalinum* Hertwig & Lesser are new species to the Hungarian fauna.

The severe cyanide and metall pollution of Rivers Szamos and Tisza early in 2000 directed the attention of scientists toward the study of biodiversity of these rivers to ascertain the degree of damage concerning living organisms. Some microfauna elements, the protozoans, mainly testate amoebae and zooflagellates, to a lesser extent the ciliates, too, have been subject to various former faunistic and ecological investigations (Gál, 1961-81; Szabados, 1966; Jósa, 1981).

The aim of the present study is to establish the testacean species diversity in six different locations including polluted and non-polluted courses of the Szamos-Tisza water system, furthermore an oxbow as a lentic controll area. The following results are the first ones of a two-year survey which is intended to monitor testacean diversity through regular, seasonal sampling of the area.

Materials and methods

Sampling was carried out on 17-18th July, 2000. The sampling points were set so as to avoid anthropogenic influence as much as possible. The first site was in the Upper-Tisza, above the polluted course (lotic controll area, above the mouth of River Szamos) in the vicinity of the small village Jánd. The next one was in River Szamos at Olcsva, close to the river's mouth upstreams. The forthcoming lotic sites were in the Middle-Tisza, downstreams Szabolcs,

*Júlia Katalin Török, ELTE Állatrendszertani és Ökológiai Tanszék (Systematic Zoology and Ecology of the Eötvös Loránd University), 1088 Budapest, Puskin u. 3, Hungary.

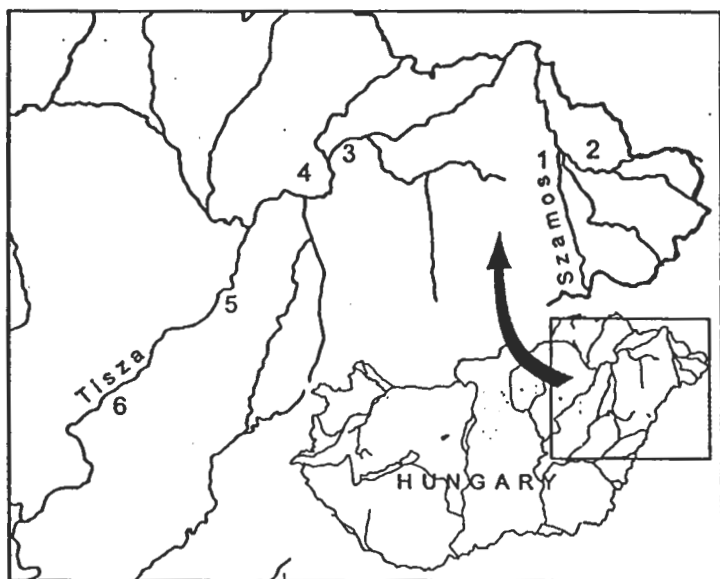


Fig. 1. Location of the sampling sites

Tiszacsege and south of Abádszalók. An oxbow was sampled as a lentic control area in the vicinity of Tiszaladány (Fig. 1). All the samples were collected inshore, within 50 cm distance from the shoreline. Waterdepth varied within ca. 20–40 cm.

Characterization of the sampled habitat types is described according to the locations in Table 1.

Six subsamples were taken from each site to assess maximum variance in species composition. One subsample from each set was preserved alive, the remaining five were fixed in 4 % formaldehyde solution and stained with bromphenol-blue to distinguish easily between living cells and empty shells. The samples were examined under lightmicroscope using brightfield, nomarski or phase technics. Metric multidimensional scaling (Syntax, Podani, 1994) was applied to assess the relation of the sampled localities to each other on the basis of the presence-absence of testacean taxa.

Results

Altogether 80 testacean species and subspecies have been detected (Table 2), Fig. 2 shows the distribution of genera among the sampling sites. The Upper-

Tisza (lotic controll area) proved to be the richest site with as many as 40 taxa, followed by the oxbow at Tiszaladány (lentic controll, 29 taxa). The River Szamos and the Szabolcs samples yielded 28 and 26 taxa, respectively, while the two remaining ones counted not more than 15 taxa (Tiszacsege) and 6 taxa (Abádszalók). *Cochliopodium actinophorum* Auerbach, 1853, *Diffugia amphoralis* Cash, 1909 and *Lecythium hyalinum* Hertwig & Lesser, 1874 are first records in Hungary (Fig. 3).

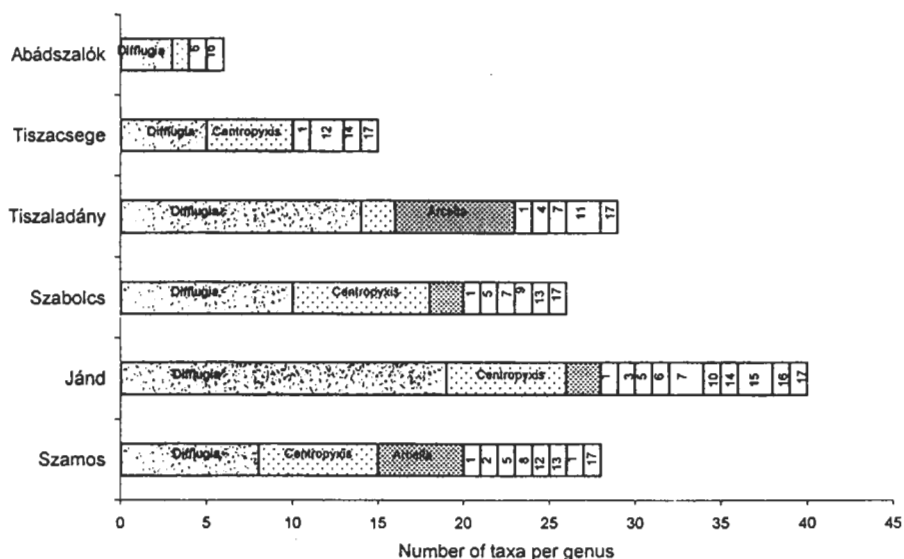


Fig. 2. Distribution of genera among sampling sites. (1: *Clypeolina*, 2: *Cochliopodium*, 3: *Cryptodiffugia*, 4: *Cucurbitella*, 5: *Cyclopyxis*, 6: *Cyphoderia*, 7: *Euglypha*, 8: *Filosea*, 9: *Lecythium*, 10: *Lesquereusia*, 11: *Netzelia*, 12: *Phryganella*, 13: *Plagiopyxis*, 14: *Pontigulasia*, 15: *Pseudodiffugia*, 16: *Trinema*, 17: *Zivkovicia*)

The ordination plot reflects the similarity of the sampling localities based on the qualitative composition of their testacean assemblages (Fig. 4). The lentic controll area and the last two sampling sites are plotted far from all the others, while the Upper-Tisza (lotic controll), Szamos and Szabolcs samples are grouped together.

Location	Sampled habitat	Bank	Location	Sampled habitat	Bank
1. Szamos	sediment (mud)	flat	4. Tiszaladány	sediment (mud), biotecton	flat
2. Jánd	sediment (mud)	flat	5. Tiszacsege	sediment (sand), biotecton	steep
3. Szabolcs	sediment (mud), biotecton	flat	6. South from Abádszalók	sediment (sand)	steep



Fig. 3. *Diffflugia amphoralis* Cash, 1909, a testacean species new to the Hungarian fauna

Discussion

Gál (1961-1981) identified 46 taxa during his investigations in nearly the same courses of the Tisza and the Szamos. 22 of them occurred in the present study, which means that as a whole 104 testacean taxa have been found in this water-system.

The species list reflects the usual composition of aquatic testacean assemblages. The lotic controll area yielded the highest number of testacean taxa (40), however, 11 of them occurred as one specimen only, 4 of which not identified *Diffflugia* species. The large number of single specimens of different testacean species is typical for the running water habitat. The lentic controll site can be characterized with some large-sized *Diffflugia* species which were not found at any other sites. *Diffflugia bicurris*, *D. lithoplites*, *D. parva* and *D. viscidula* with their more than 250 μ body length are among the largest testacean species. Their presence is typical for standing waters.

Similarity composition of the Szamos - Jánd (control!) - Szabolcs samples suggests that the pollution did not influence strongly the species composition of the testacean assemblages.

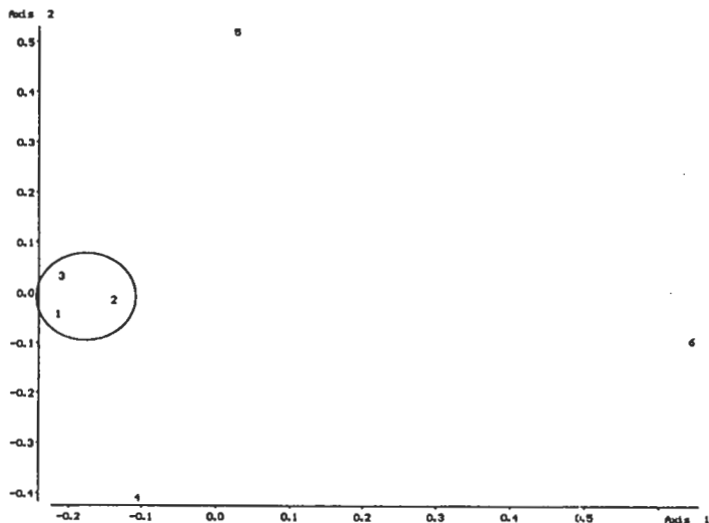


Fig. 4. Ordination of sampling sites according to the species composition of their testacean assemblages

The last two sites were strikingly poor in testacean taxa, which may rather be assigned to the sampling conditions (steep banks, sand as prevalent compound in the sediment, beginning of flood) than any kinds of pollution.

Concerning habitat types, only the sediment seemed to have considerable amount of species as well as individuals in the running water samples. In the oxbow, however, many testaceans - especially *Arcella* spp. and *Netzelia* spp. - occurred on the surface of the various waterplants.

Having encountered diverse testacean fauna in the polluted sections of Rivers Tisza and Szamos it is to be hoped that the industrial pollution did not give rise to a drastic reduction in the microfauna. Stable persistence of the microfauna - fundamental component in the aquatic foodweb - is a hopeful sign for the recovery of higher organisms. Further results based on quantitative data may give deeper insight into the community structure of the testate amoebae in this region.

Acknowledgement. This work was performed with financial support for the Department of Systematic Zoology and Ecology of the Eötvös Loránd University by a grant from the Ministry of Environment (No. 1543/2).

Table 2. List of testate amoebae taxa. Sz = River Szamos, T1 = Jánd, T2 = Szabolcs, T3 = , Tiszaladány, T4 = Tiszacsege, T5 = south from Abádszalók. Asterisks stand for taxa found by Gál (1961-1981)

Taxa	Sz	T1	T2	T3	T4	T5
* <i>Arcella discoides</i> Ehrenberg, 1872				+		
* <i>Arcella hemisphaerica</i> Perty, 1852	+		+	+		
<i>Arcella hemisphaerica intermedia</i> Deflandre, 1928	+			+		
<i>Arcella megastoma</i> Penard, 1902		+				
<i>Arcella polypora</i> Penard, 1890				+		
<i>Arcella rotundata</i> Playfair, 1918	+			+		
<i>Arcella rotundata stenostoma</i> Deflandre, 1928	+	+	+	+		
* <i>Arcella vulgaris</i> Ehrenberg, 1832	+			+		
* <i>Centropyxis aculeata</i> (Ehrenberg) Stein, 1857	+	+	+		+	
<i>Centropyxis aculeata grandis</i> Deflandre, 1929					+	
<i>Centropyxis aerophila</i> Deflandre, 1929	+	+	+			+
* <i>Centropyxis constricta</i> Deflandre, 1929	+	+	+	+		
* <i>Centropyxis discoides</i> Penard, 1902	+	+	+		+	
<i>Centropyxis ecornis</i> Ehrenberg, 1832	+		+	+	+	
<i>Centropyxis elongata</i> (Penard) Thomas, 1959			+			
<i>Centropyxis gibba inermis</i> Bartos, 1940					+	
<i>Centropyxis laevigata</i> Penard, 1890		+				
<i>Centropyxis marsupiformis</i> Deflandre, 1929	+	+	+			
<i>Centropyxis aerophila sphagnicola</i> Deflandre, 1929	+	+	+			
<i>Clypeolina marginata</i> Penard, 1902	+	+	+	+	+	
<i>Cochliopodium actinophorum</i> Auerbach, 1856	+					
<i>Cryptodifflugia</i> sp.		+				
<i>Cucurbitella mespilliformis</i> Penard, 1901				+		
<i>Cyclopyxis kahli</i> Deflandre, 1929	+	+				
<i>Cyclopyxis</i> sp.			+			
* <i>Cyphoderia ampulla</i> Ehrenberg, 1840		+				
* <i>Cyphoderia laevis</i> Penard, 1902						+
* <i>Difflugia acuminata</i> Ehrenberg, 1838		+		+		
<i>Difflugia amphoralis</i> Cash & Hopkinson, 1909		+				+
<i>Difflugia angusticollis</i> Stepanek, 1952				+		
<i>Difflugia bicornis</i> Penard, 1890		+	+			
<i>Difflugia bicurris</i> G.L. & Thomas, 1959				+		
* <i>Difflugia corona</i> Wallich, 1864		+		+		
* <i>Difflugia curvicaulis</i> Penard, 1899		+		+		
* <i>Difflugia elegans</i> Penard, 1890	+	+	+			
<i>Difflugia elegans teres</i> Penard, 1899	+					
<i>Difflugia fallax</i> Penard, 1890	+					
<i>Difflugia gassowskyi</i> (Gassowsky) Ogden, 1893		+		+		
<i>Difflugia glans</i> Penard, 1902	+		+			
* <i>Difflugia gramen</i> Penard, 1902	+	+	+	+	+	+
<i>Difflugia labiosa</i> Wailes, 1919		+			+	
<i>Difflugia lacustris</i> (Penard) Ogden, 1983		+				

Table 2. (cont.)

Taxa	Sz	T1	T2	T3	T4	T5
<i>Diffugia limnetica</i> (Levander) Penard, 1902		+	+	+		
<i>Diffugia linearis</i> (Penard) G.L. & Thomas, 1958				+		
<i>Diffugia lithophila</i> (Penard) G.L. & Thomas, 1958		+	+			
<i>Diffugia lithophilites</i> Penard, 1902				+		
* <i>Diffugia lobostoma</i> Leidy, 1879	+	+	+	+		
* <i>Diffugia mamillaris</i> Penard, 1893	+	+				
<i>Diffugia manicata</i> Penard, 1902				+		
<i>Diffugia minuta</i> Rampi, 1950	+					
* <i>Diffugia oblonga</i> Ehrenberg, 1838		+			+	
<i>Diffugia oblonga gigantea</i> Leidy, 1879			+			
<i>Diffugia parva</i> (Thomas) Ogden, 1983				+		
<i>Diffugia viscidula</i> Penard, 1902				+		
<i>Diffugia</i> sp. 1					+	
<i>Diffugia</i> sp. 2			+		+	
<i>Diffugia</i> sp. 3		+				
<i>Diffugia</i> sp. 4						+
<i>Diffugia</i> sp. 5		+				
<i>Diffugia</i> sp. 6		+				
<i>Diffugia</i> sp. 7		+				
<i>Diffugia</i> sp. 8			+			
* <i>Euglypha alveolata</i> Dujardin, 1841		+	+			
<i>Euglypha acanthophora</i> Ehrenberg, 1843				+		
* <i>Euglypha laevis</i> Perty, 1849		+				
<i>Filosea</i> sp.	+					
<i>Lecythium hyalinum</i> Hertwig & Lesser, 1874			+			
<i>Lesquereusia modesta</i> Rumbler, 1855		+				
* <i>Netzelia oviformis</i> (Cash) Ogden, 1979				+		
<i>Netzelia tuberculata</i> (Wallich) Ogden, 1979				+		
<i>Phryganella hemisphaerica</i> Penard, 1902	+				+	
* <i>Phryganella paradoxa</i> Penard, 1902					+	
<i>Plagiopyxis declivis</i> Thomas, 1955			+			
<i>Plagiopyxis intermedia</i> Bonnet, 1959	+					
<i>Pontigulasia incisa</i> Penard, 1893		+			+	
<i>Pseudodiffugia gracilis</i> Schlumberger, 1855	+	+				
<i>Pseudodiffugia fulva</i> Archer, 1872		+				
* <i>Trinema enchelys</i> Ehrenberg, 1838						+
* <i>Trinema lineare</i> Penard, 1890		+				
<i>Zivkovicia compressa</i> (Carter) Ogden, 1983	+	+	+	+	+	

REFERENCES

1. GÁL, D. (1961): Das Leben der Tisza, X. Die Rhizopodenfauna der auf ungarischem Boden fließenden oberen Strecke der Tisza im Jahre 1959/60. - *Acta Univ. Szeged. Biol.*, 7: 77-83.
2. GÁL, D. (1970-71): Die Rhizopodenfauna der ungarischen Strecke der Theiss und des Mündungsteiles ihrer Nebenflüsse. - *Tiscia (Szeged)*, 6: 31-40.
3. GÁL, D. (1972): Rhizopodenfauna der Theiss-Strecke über der im Bau begriffenen II. Theiss-Stufe. - *Tiscia (Szeged)*, 7: 29-35.
4. GÁL, D. (1981): Studies on the benthic Testacea fauna in the longitudinal section of the Tisza. - *Tiscia (Szeged)*, 16: 131-140.
5. JÓSA, Z. (1981): Studies on the Ciliata fauna of sediment samples from the Hungarian reach of the Tisza. - *Tiscia (Szeged)*, 16: 11-154.
6. PODANI, J. (1994): Multivariate analysis in ecology and systematics. - SBP Academic Publishing, The Hague, pp. 316.
7. SZABADOS, M. (1966): Das Leben der Tisza. Protisten: Flagellaten. - *Tiscia (Szeged)*, 2: 13-24.
8. TÖRÖK, J. K. (1997): Distribution and coenotic composition of benthic testaceans (Protozoa, Rhizopoda) in the abandoned main channel of River Danube at Szigetköz (NW-Hungary). - *Opusc. Zool. Budapest*, 29-30: 141-154.