

DATA TO THE KNOWLEDGE OF THE MICROORGANISMS OF THE JUGOSLAV REACHES OF TISZA AND THE „DANUBE—TISZA CANAL”

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The inferior floral and faunal organisms of the Tisza reaches between Szeged in Titel belonging to Yugoslav territory and those of the Danube—Tisza canal have not been examined by anybody until now. In July 1960 I had the opportunity (the 18th, 19th, 20th, 21st) to carry out hydrobiological investigations in that area. In the present paper I am summarizing the results of my observations on that occasion.

Collecting stations were:

1. Senta : for Tisza (with obtained material!),
2. Bečej : for Tisza,
3. Titel : for Tisza,
4. Srbobran : Danube—Tisza canal.

My examinations have been carried out taking into consideration the following biotopes:

I. In Tisza :

- a) surface layers of water,
- b) covers of riparian stones and wessels,
- c) mud at the riverside,
- d) detritus, polluted water area.

II. In the Danube—Tisza-canal :

- a) surface layers of water,
- b) polluted water area near the swimming bath,
- c) mud at the riverside,
- d) soggy, marshy area.

The material of collection, performed by planctonnet No. 25 and immersion, was examined partly alive, partly fixed in formaldehyde solution (1:9!).

COLLECTING STATIONS



D. SzM.

M: 1:900.000

Limnologic conditions of the collecting stations

There are indicated below the limnologic-biocoenologic conditions of the collecting stations by enumerating the most characteristic species.

I. The reaches of Tisza from Szeged till Titel are of typical lower-course character. His falls is at Szeged 2,5 cm km, Titel near the mouth, 1,28 cm/km. Owing to the extremely little fall, it Tisza has low water and Danube a higher one, the damming up of Danube may be felt until Szolnok. Tisza falls between Tokaj and Titel from 90 m to 70 m. At higher Danube water Tisza flows at Titel backwards. His breadth is at Titel 232 m at low water. The flow of the reaches is slow, their climate is warm, their water rich in lime. The Tisza reaches from Szeged till Senta are closed, the high places that interrupt the dams here and there lying very near the river bed. The dams at both banks alternate with high places, thus at the right riverside the bed is bordered by high places until the upper perimeter of town Senta. The inundation area at the right riverside is here narrow, the bank is defended between the bridge and the landing stage by a river wall. (S z i b e r t h i, A., 1902.)

1. At Senta the collection took place below the town July 18 (with obtained material). The colour of water was weakly yellowish-green. Microscopic examinations revealed that the colouring of water had been caused by the proliferation of the cells of *Ceratium hirundinella* and *fo. furcoides*. In the sample got from the surface there were found single organisms of the species *Anthophysa vegetans*, *Trachelomonas planktonica*, *Trachelomonas volvocina*, *Bodo celer*, *B. globosus*, *B. putrinus*, *B. triangularis* and *Monas vulgaris*.

From Senta the direction of the Tisza bed curves to more and more south-east downwards.

2. At Bečej the Tisza dam is in connection with the high places of the town area. The collection took place July 19, at the right Tisza side, below the community, 500 m north of the swimming bath. The bank is muddy, at its highly sloping edge bordered by willowy bushes. The water is of falling character, its temperature is 23° C, that of air 33° C (strong sunshine, weak east wind). The plankton test from surface layers resulted in some members of *Bacillariophytes* [*Navicula exilissima*, *Diatoma elongatum* var. *tenuis*, *D. vulgare*] nice colonies of the *Anthophysa vegetans* and several exemplars of the *Ceratium hirundinella* var. *furcoides*. The zooflagellates were represented by the *Bodo celer*, *B. globosus*, *B. ludibundus* and *Entosiphon ovatum*.

The other collecting station was 200 m south of the swimming pool. The water here was perceptively polluted. First of all species *Flagellatae* saprophytae took place in it (*Menoidium incurvatum*, *M. pellucidum*, *Entosiphon ovatum*, *E. sulcatum*, *Petalomonas angusta*, *P. mediocanellatu*, *Anisonema ovale*, *A. pusillum*, *Trepomonas Steinii*). At the river side in small water places, polluted by the droppings of poultry, individuals of the *Euglena vermicularis*, *E. viridis*, *E. terricola*, *Phacus alata*, *Ph. longicauda*, *Ph. orbicularis* and *Ph. tripteris* caused a minor water blooming.

The water was covered sporadically along the bank by specimens of *Lemna minor*. The water collected in the tracks of animals was coloured green by the specimens of *Euglena terricola*. I have collected yarns of *Cladophora glomerata*, *Cl. fracta*, *Spirogyra varians*, *Sp. Weberi* and specimens of *Bacillariophyta* [*Diatoma vulgare*, *Fragilaria construens*, *Fr. intermedia*, *Navicula exigua*] living them from the side of an old boat.

The proper mouth reaches of Tisza extend south from Bečej until Titel. The bed here is broad, with islands and shallows. Its bends are mild, a livelier bending is only in the parts below Titel. The inundation area is bordered by dams on both sides (except a lesser sector of the right bank above Titel). In the above mentioned parts of the right bank the rim of inundation area is created by the plateau at Titel arising abruptly 20 m above the natural features.

Tisza flowing downwards from Bečej takes a more and more southern direction, running at the lower end of the Titel plateau nearly thoroughly southwards and turning a little westwards but immediately below Titel, at the mouth.

July 21st I collected in sunny weather (temperature of water 24° C, that of air 34° C, weak south-eastern wind). The collection took place near the swimming pool. The bank here is highly sloping, its rim is muddy, the water is of falling character. In the water strife at the riverside the *Lemna minor* proliferated. In the open water I have found the nice colonies of the *Anthophysa vegetans* among species *Bacillariophyta* (*Cymbella ventricosa*, *Navicula exilissima*, *N. microcephala*, *Synedra ulna*, *S. tenera*, *Tabellaria fenestrata*) and *Cyanophyta* (*Spirulina minor*, *Oscillatoria tenue*, *Lyngbia Lagerheimii*), as well specimens of species *Ceratium hirundinella* var. *furcoides* and *Monadophytæ* (*Bodo amoebinus*, *B. triangularis*, *B. celer*, *B. minimus*). In the same place in the water collected in lesser dips along the bank, apart from colonies of the *Monas sociabilis* and species of *Bacillariophyta* (*Diatomella Balfouriana*, *D. elongatum* and var. *tenue*, *Navicula exigua*, *N. microcephala*), first of all the association *Euglena* (*E. proxima*, *E. terricola*) — *Phacus* (*Ph. orbicularis*, *Ph. suecica*, *Lepocinclis texta*) — *Trachelomonas* (*Tr. volvocina*) caused a lesser water blooming. Also the multiplication of specimens of the species *Chilomonas paramaecium* was obvious. The *Chlorophytone*s were represented by the species *Pediastrum Boryanum*, *P. duplex*, *Scenedesmus acuminatus*, the *Monadophytæ* by that of *Rhynchomonas nasuta*, *Mastigamoeba invertens*.

II. Danube — Tisza canal.

It has its origin in Danube at the island of Mohács and joins Tisza at Tiszaföldvár. It was made in 1802. Its bed was cut in the ridge between Danube and Tisza, following exactly the pleistocene Danube marshes. Its length is 108 km, its breadth 18 m, mean depth 2 m. Its water is retained by sluices. At present the bed begins to be muddy therefore it is swept by machines. (These operations were proceeding even during the collection!) The canal obtains its water partly from Danube, partly from Tisza. It is a rather closed biotope exposed to no major changes, being nearly standing water in nature. The water of canal ensures, along its whole length, almost the same environment to the organisms living in it. This

nearby identity of the circumstances of life does not mean, however, a rigid constancy of species living there, as the microorganisms getting there for Danube and Tisza, the cysts brought in by wind and animals (birds!) change somewhat the composition of plankton. From the point of view of the biotope it means, because of its lack of outflow, a transition from the water of river to stagnant water. Its microscopic living world is the next to that of backwaters.

I have examined the canal water at Srbobran. The collection took place July 20. (The temperature of water was 25° C, that of air 34° C.) The bed of canal at the community is weakly tortuous, its water is nearly of standing character.

Collecting stations were: 1. The open water between the bridge and swimming bath, 2. the riparian mud, 3. the polluted water place near the swimming bath, 4. the boggy, marshy meadow (inundation area).

Both banks of the canal are bordered by the *Phragmites communis*, here and there some flowering specimens of the *Butomus umbellatus*, *Sagittaria sagittifolia* were blooming.

1. In open water the specimens of the species *Ceratophyllum demersum*, *Myriophyllum spicatum*, *Polygonum amphibium*, *Utricularia vulgaris* were multiplied, and on the surface of water those of the species *Salvinia natans*, *Trapa natans*, *Lemna minor* and *L. trisulca*. The *Lemna* species carpeted the water from the southern bank of the canal nearly till its middle. Apart from the *Lemna* water blooming, the Cyanophyton (*Chroococcus turgidus*, *Microcystis aeruginosa*, *M. flos-aquae*, *Spirulina minor*, *Oscillatoria tenue*, *O. limnetica*), Chlorophyton (*Pediastrum Boryanum*, *P. duplex*, *Scenedesmus acutus*, *Sc. bijugatus*, *Coelastrum microporum*) species coloured the water bluish-green. Close to the bank, in a narrow water stripe, the Monadophyton (*Bodo celer*, *B. triangularis*)—Euglenophyton (*Euglena oxyuris*, *E. proxima*, *E. polymorpha*, *E. tripteris*, *Phacus alata*, *Ph. orbicularis*, *Ph. pleuronectes*, *Lepocincilis fusiformis*, *L. texta*, *Trachelomonas intermedia*, *Tr. hispida* var. *cylindrica*, *Tr. armata*, *Tr. bacillifera*, *Tr. volvocina* and var. *punctata*, *Anisonema acinus*, *A. pusillus*) species caused a bluish-green water blooming. I have found also the nice colonies of *Dasmarella moniliformis*.

2. From the riparian mud and shallow water place I have found some living individuals and void shells of the *Trachelomonas* species. Here and there the Bacillariophyton (*Amphora commutata*, *Bacillaria paradoxa*, *Cymbella microcephala*, *Diatoma elongatum* and var. *minor*, *D. vulgare*, *Navicula exilissima*, *Nitzschia communis*) species caused some brownish colouring.

3. At the southern bank of the canal, in the small cove besides the swimming pool, in a somewhat polluted water place the individuals of the Monadophyton—Euglenophyton (*Bodo celer*, *B. edax*, *B. minimus*, *B. saltans*, *Cercobodo crassicauda*, *Scitomonas pusilla*, *Monas obliquus*, *M. vivipara*, *M. vulgaris*, *Oicomonas rostrata*, *O. termo*, *Pleuromonas jaculans*, *Dallingeria Drysdali*, *Astasia lagenula*, *Peranema granulifera*, *P. trichophorum*, *Petalomonas mediocanellata*) species have increased in number. On a *Cyclops* sp. carcass I have found the cells of *Salpingoeca convallaria*.

4. The shallow water of the southern bank extended till the grassy-marshy flora of the bank, and in that inundation area, in the shallow water place individuals of the species *Pyrrhophyta* (*Dinoflagellatae*!): *Glenodinium gymnodinium*, *G. oculatum*, *Peridinium cinctum*, *P. umbonatum*, *P. Wierzejskii*, *Sphaerodinium polonicum*, *Amphidiniopsis Kofoidi* have been multiplied in an ensemble *Spirogyra-Zygnema-Chladophora* spec. I have found there the cosmopolite species of the *Monadophytae* and even a new species: *Mastigamoeba spinifera* nov. spec.

Discription of the new species

Mastigamoeba spinifera nov. spec. Szabados The cell is wide ovate, behind bluntly acuminate, before widening, with a cornered shoulder-part. Its length is 30—35 u and width 20—24 u. The pellicule surface is densely covered by small, short spines. The gable-like extensive end of the body has before a smooth surface and bears the flagellum. The measure of flagellum is the double size of the body length. Hab.: Danube—Tisza canal (Jugoslavia), at Srbobran, July 20th 1960, in polluted water place.

A Summary of final results

The results of my examinations carried out in the lower, mouth-reaches of Tisza in Yugoslav territory, as well as in the Danube—Tisza canal in July 1960 are summarized as follows.

1. As it is apparent from the annexed table: I have demonstrated 121 species, further one species.

I. <i>Cyanophyta</i>	.....	8	species
II. <i>Euglenophyta</i>	.....	42	„
III. <i>Monadophyta</i>	.....	28	„
IV. <i>Chrysophyta</i>	.....	17	„
V. <i>Pyrrhophyta</i>	.....	8	„
VI. <i>Chlorophyta</i>	.....	18	„
		Together:	121 species, one new species.

2. The greatest species number was known by the *Euglenophyta* (42 species!) living first of all in the riparian shallow water of Tisza, in the water places collected in animal tracks and polluted by faecal matters, as well in the polluted water place of the Danube—Tisza canal.

3. From these association *Trachelomonas-Euglena* was the most remarkable for its species and specimen numbers. The shells of *Trachelomonas* species were coloured from golden yellow till dark brown, referring to the iron content of water. In the riparian mud I have found a great lot of empty shells.

4. In the riparian lesser and bigger water places the water bloomings were frequent (*Cynophyta-Trachelomonas-Euglena-Phacus* ensemble!).

5. In the water place of Tisza a lesser colouring was caused by *Ceratium hirundinella* var. *furcoides*. (I have observed a similar phenomenon in the Szegeed reaches of Tisza, as well!)

6. At the southern bank of the Danube—Tisza canal in a marshy living place of shallow I have found some rarely occurring *Pyrrhophyta speciens* (*Peridinium Wierzeskii*, *Amphidiniopsis*, *Kofoidii*) described first from Poland and demonstrated by me also in this country in the primitive marshland at Halas (S z a b a d o s, 1954).

7. The *Monadophyta* species that occur with a very high species number may be found equally in the plankton of Tisza, in the riparian detritus, in the polluted water place and in the water of the Danube—Tisza canal which is a standing water in nature. A great number of them play a role in the demolition of cellulose.

8. I have discovered and described a species belonging to the *Monadophyta* group, the *Mastigamoeba spinifera* nov. spec.

9. At the southern bank of the Danube—Tisza canal in a water place of marshy character the individuals of species *Pyrrhophyta* have increased in number. And very high species and specimen numbers have been shown up also by members of the group *Chlorophyta-Cyanophyta*, producing water blooming in the water of the Danube—Tisza canal. It is proved by the researches carried out in Hungarian waters that in several cases a mass production has occurred owing to the joint association of the two taxonomic groups.

10. Finally, it can be ascertained that, as a result of the collections carried out in the lower, mouth-reaches of Tisza, the microorganisms of the water of Tisza occur with relatively low species and specimen numbers. The population is doubtless the poorest in plankton. The cause of that is, in a not low degree, the pH of water (7,2—7,6!). The population is denser only in places of a more quiet course, in smaller riparian pools and here and there also smaller or bigger water bloomings occur.

11. The water of the Danube—Tisza canal is, from oicologic point of view, a transition from river water to a stagnant water. In the water of weak flow, apart from high-class water plants, there occurred also the mass production of some microorganisms. Its microscopic living world approximates the most that of brackwaters. The cause of that may be that in water places which are rich in disintegrating vegetable fragments and getting warmer first of all the number of saprobionta increases in a higher degree.

In places of calmer flowing the production of a surface membrane is rather frequent created first of all by participation of iron bacteria.

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Figures

Table I, Fig. 1. *Mastigamoeba spinifera* nov. spec.

2. *Chilomonas paramaecium*
- 3., 4. *Desmarella monoliformis*
5. *Anthophysa vegetans*
- 6., 7. *Furcilla lobosa*
8. *Salpingoeca convallaria*
9. *Bodo triangularis*
10. *Bodo globosus*
11. *Bodo celer*
12. *Euglena acutissima*
13. *Monas sociabilis*
14. *Phacus pleuronectes*
- 15., 16., 17. *Trachelomonas volvocina*
18. *Trachelomonas oblonga*
19. *Trachelomonas caudata*
20. *Trachelomonas abrupta*
- 21., 22. *Trachelomonas planktonica*
- 23., 24., 25., 26. *Trachelomonas armata*

