

## DATA ON THE SUMMER ALGAL FLORA OF DEAD-ARMS IN THE VICINITY OF TISZAFÜRED

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### Abstract

The algological composition of the dead-arms being in different states of filling up is different. Their individualization is influenced by the degree of flood of the river.

### Introduction

The river stretches — dead-arms — separated from the Tisza in a natural or artificial way are showing a very varied picture. The dead-arms investigated in this paper are in different stages of filling up; but it is common in them that they take place in the flood-plain, without any direct connection with the river. In time of flood — mostly in Spring — they may come under water.

The algological investigation of the Tisza dead-arms was dealt with by several researchers. The results were summarized by Uherkovich (1971: literature *ibid.*). The research of the dead-arms in the vicinity of Tiszafüred became particularly timely because they lie in the area of the future Kisköre Reservoir (Fig. 1).

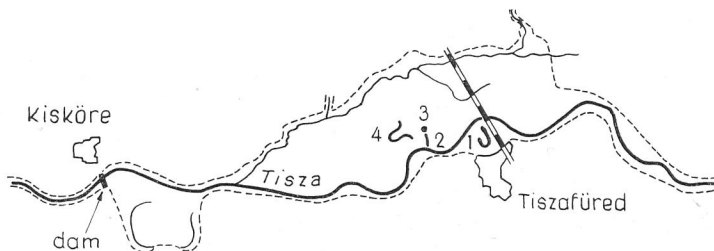


Fig. 1. Localization of dead-arms in the vicinity of Tiszafüred. 1: Tisza dead-arm at Tiszafüred, 2: Long reach, 3: Round reach, 4: Borzanat.

### Materials and Methods

Sampling took place on September 18—19, 1969. Algae were investigated from samples drawn. The chemical analysis of water was performed by the laboratory of the Water Management of the Middle Tisza Region. To recognize the water-plant associations, help was rendered by Gy. BODROGKÖZY (1965) and K. BÁBA.

The names of dead-arms are mostly popular denominations.

The habitats of species and the characteristics of the biotopes investigated are given in the following enumeration:

At Tiszafüred:	dead-Tisza:	1
	open water	a
	close to the riverside	b
	below <i>Trapa natans</i>	c
Long reach		2
Round reach		3
	open water	a
	close to the riverside	b
“Borzanat”		4
	open water	a
	close to the riverside	b

## Results

### (1) Dead-Tisza at Tiszafüred

The U-shaped dead-arm is surrounded by a high bank. Between the open water and the riverside some water-vegetation is to be found, formed by the complex of

Table 1. *Chemical investigation into the water of the dead-arms in the vicinity of Tiszafüred*

		Tiszafüred		Hosszú- böge	Kerek- böge	Borza- nat
		Open water	River- side			
Weather		sunshine	sunshine	sunshine	sunshine	sunshine
Air temperature	°C	32,0	32,0	30,0	30,0	30,0
Water temperature	°C	24,0	21,0	24,0	21,0	22,0
Colour		greenish	greenish	dark grey	greenish	greenish
Smell		smell- less	smell- less	smell- less	smell- less	smell- less
Transparency	mm	180	180	180	170	180
Oxygen consumption	mg/l	5,12	5,68	6,5	5,68	10,7
BOI 5	mg/l	2,24	2,56	2,72	2,72	3,3
Dissolved oxygen	mg/l	8,65	10,4	10,7	10,72	11,05
Percentage of oxygenation		104,0	118,0	129,0	121,2	127,5
pH		7,3	7,2	7,1	7,2	7,2
Conductivity	$10^{-6}$ ohm $^{-1}$ cm $^{-1}$	510	510	540	450	540
Ca <sup>2+</sup>	mg/l	30,5	32,1	52,9	42,5	34,5
Mg <sup>2+</sup>	mg/l	9,7	11,7	12,2	12,6	23,8
Na <sup>+</sup>	mg/l	32,2	34,2	10,5	11,0	17,0
K <sup>+</sup>	mg/l	2,4	2,4	3,7	3,6	2,6
Cl <sup>-</sup>	mg/l	17,7	19,0	19,7	18,3	18,3
SO <sub>4</sub> <sup>2-</sup>	mg/l	24,5	29,8	27,8	26,4	33,6
HCO <sub>3</sub> <sup>-</sup>	mg/l	183,0	183,0	207,4	183,0	207,4
CO <sub>3</sub> <sup>2-</sup>	mg/l	0,00	0,00	0,00	0,00	0,00
Free carbon dioxide	mg/l	1,76	3,52	5,27	5,27	5,27
Fe <sup>2+</sup>	mg/l	0,01	0,01	0,01	0,01	0,01
Mn <sup>2+</sup>	mg/l	0,00	0,00	0,00	0,00	0,00
NH <sub>4</sub> <sup>+</sup>	mg/l	0,16	0,35	0,35	0,15	0,36
NO <sub>2</sub> <sup>-</sup>	mg/l	trace	0,03	0,016	trace	trace
NO <sub>3</sub> <sup>-</sup>	mg/l	1,12	3,8	0,47	1,44	2,07
PO <sub>4</sub> <sup>3-</sup>	mg/l	0,05	0,1	0,1	0,12	0,1
Total dissolved matter	mg/l	207	218	228	185	207
Total floating matter	mg/l	189	122	191	88	163
Total dry matter	mg/l	396	122	419	273	370
Cation type		Ca—Na	Ca—Na	Ca—Mg	Ca—Mg	Mg—Ca
Anion type		HCO <sub>3</sub>	HCO <sub>3</sub>	HCO <sub>3</sub>	HCO <sub>3</sub>	HCO <sub>3</sub>

*Nymphaeetum albo-luteae* NOWINSKI 28 and *Trapaetum natantis* MÜLLER & GÖRS 60, subm. plant: *Ceratophyllum demersum* L. Depth of the open water is 2 to 4 m. The water is of chemically pure Ca—Na—HCO<sub>3</sub> type (Tabl. 1).

(1a) The high individual number and low species number are characteristic of the algal stock of open water (Fig. 2). The high individual number was induced by *Ceratium hirundinella* f. *furcoides* (SCHOERED) HUBER-PEST. and *Peridinium volzii* LEMM. The majority of the stock are pelagic organisms.

(1b) The algological composition of the area overgrown by water-plants between the riverside and open water differs from that of open water. High species number and low individual number are characteristic of it (Fig. 3). The plankton is enriched mainly by Conjugata and Diatoma.

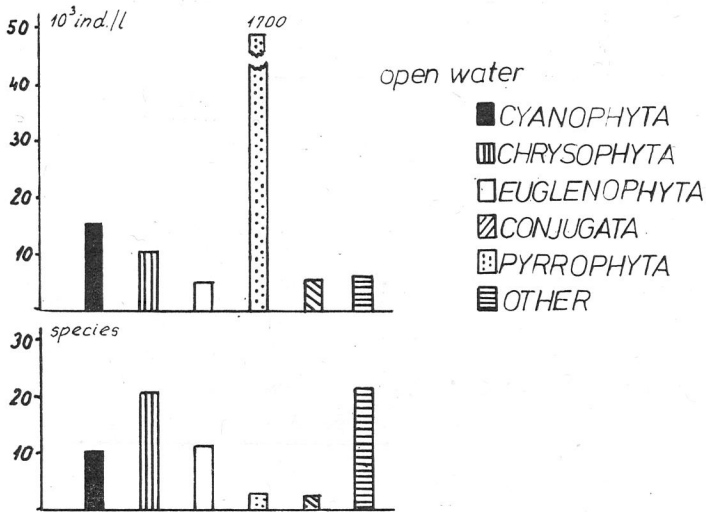


Fig. 2. Algological conditions in the open water of the Tisza dead-arm at Tiszafüred.

(1c) The chemical composition of water in the region close to the riverside is similar to that of the open water but, e.g., its CO<sub>2</sub> content is higher (Table 1). The vegetation close to the riverside, in a narrow stripe, is formed by the complex of *Hydrochari-Stariotetum* (LANGENDONCK 35) WESTHOFF 42 stratiotetosum and *Nymphaeetum albo-lutae* NOVINSKI 28, here and there *Phragmites communies* L. also occur. Of its algological composition the high species number and low individual number are characteristic (Fig. 3). Similarly to the former biotope, the Conjugata and Diatoma predominate.

## (2) Long reach

It is a narrow, 2 m deep dead-arm, its riverside is densely overgrown with birch-trees. It contains no water-vegetation. Chemically its water is pure, of Ca—Mg—HCO<sub>3</sub> type (Table 1). The low species- and individual numbers are characteristic of its algological composition, with the dominance of Diatoma (Fig. 4). There were found some rare diatoms as *Surirella ovata* var. *pinnata* (W. SM.) HUST., *Synedra arcuatus* var. *subrecta* CLEVE, *Navicula cuspidata* var. *hankae* f. *craticularis* SKV.

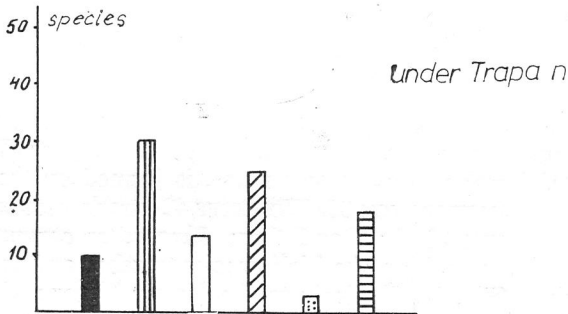
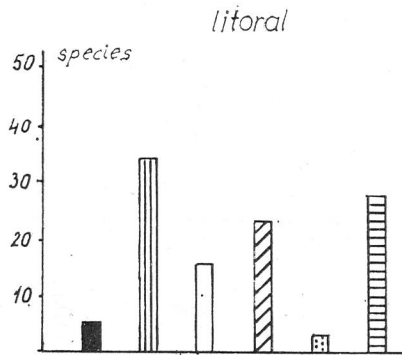
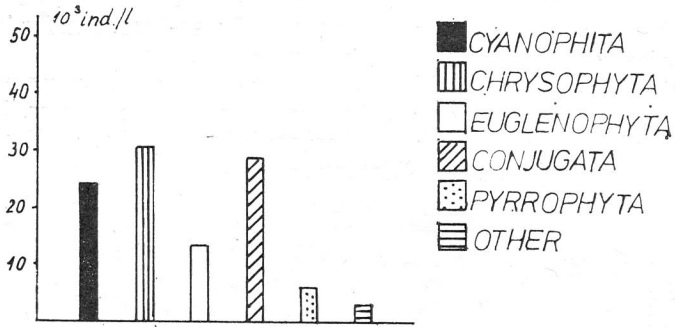


Fig. 3. Algological conditions in the Tisza dead-arm at Tiszafüred close to the riverside and below *Trapa natans*.

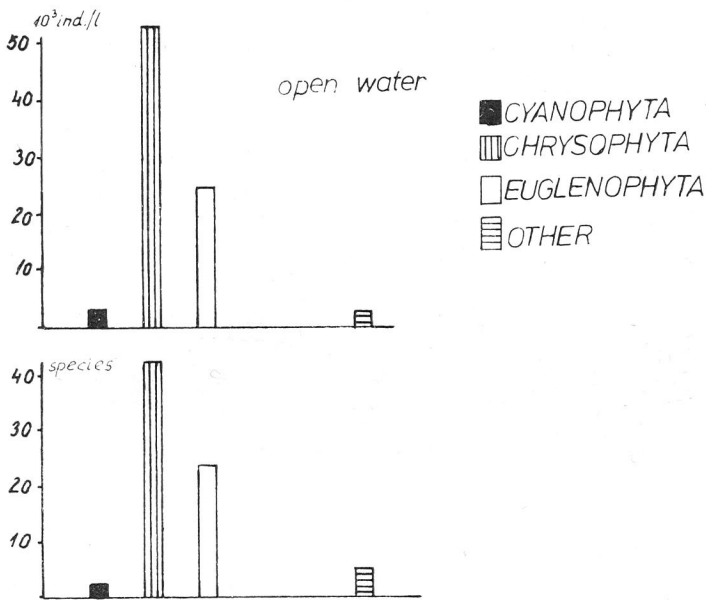


Fig. 4. Algological combination in the water of Long reach.

### (3) Round reach

Its water is chemically pure, of Ca—Mg—HCO<sub>3</sub> type (Table 1). In the open water, in spots, *Nymphaea alba* L. and *Trapa natans* L. can be found, at the riverside *Myriophyllo-Potametum* Soó 34 myriophylletosum spicati subassociation occurs. Water-depth is small, maximum 1—1,5 m.

(3a) In its open water, an algal stock is to be found that is characteristic of shallow waters, with the dominance of *Diatoma* (Fig. 5).

(3b) The species number of the zone at the riverside is very low (Fig. 5), its individual number similarly. *Trachaelomonas-taxons* are the most frequent.

### (4) "Borzanat"

It is a dead-arm in a far-advanced state of being filled-up. Its water-vegetation in the open water: *Nymphoidetum peltatae* (ALLORGE 22) OBERD. & MÜLLER 60, form an association. At the riverside, *Scirpo-Phragmitetum* W. KOCH 26 *schoenoplectetosum lacustris* (ALLORGE) CHOUARD 24 are to be found. Its water is shallow, maximum 1—1,5 m deep. In its chemical composition Ca<sup>++</sup>, Mg<sup>++</sup>, and HCO<sub>3</sub><sup>-</sup> ions dominate (Tabl 1).

(4a) Species- and individual numbers in the open water are low (primarily *Diatoma*), the stock is formed by shallow-water organisms.

(4b) In the stirred water of the region at the riverside there were found several periphytic organisms. The number of species belonging to the Conjugatophyceae was also considerable.

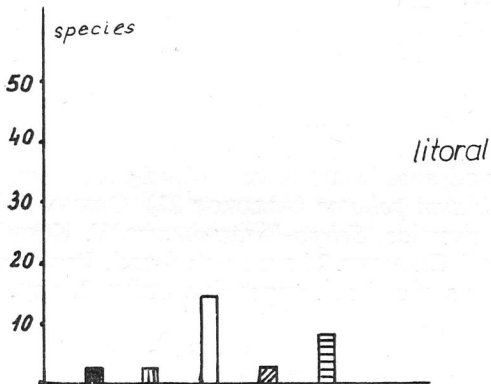
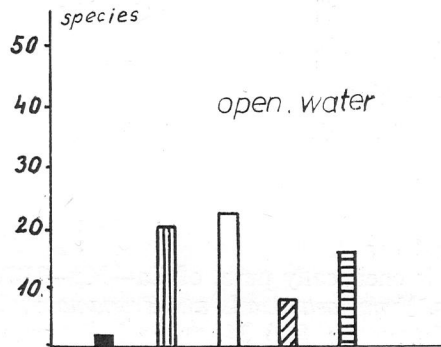
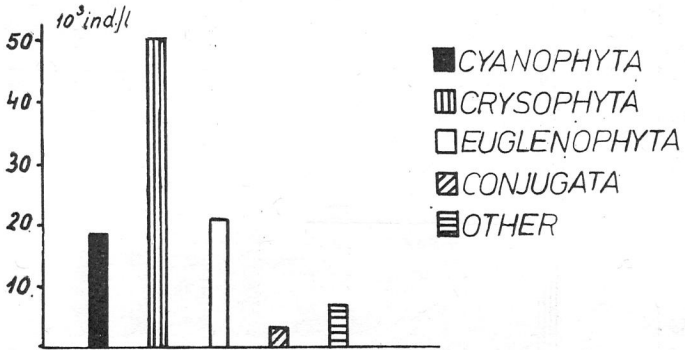


Fig. 5. Algological combination in the open water and riverside region of Round reach.

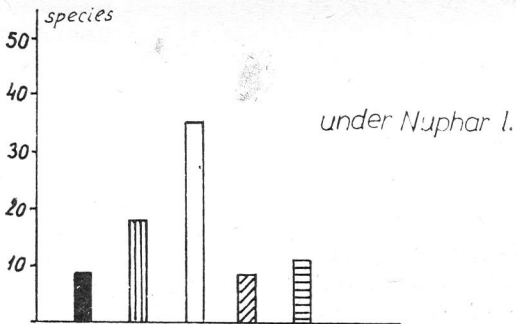
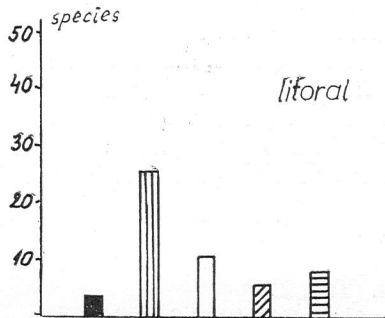
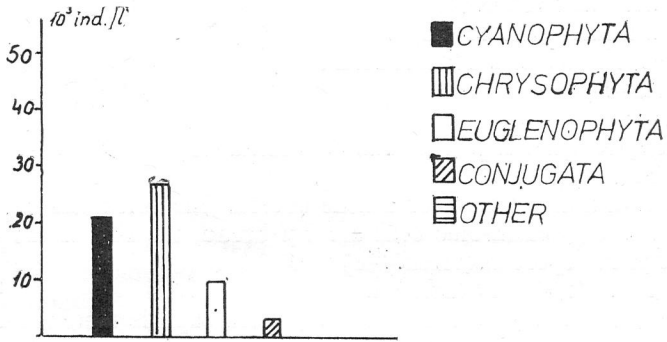


Fig. 6. Algological combination in the riverside region of Borzanat and of its part below *Nuphar luteum*.

## Enumeration

### Cyanophyta

*Achronema articulatum* SKUJA (4b)

*Anabaena affinis* LEMM. (1abc, 4ab)

*A. affinis* f. *viguieri* (DENIS & FRÉMY) KOM. (1a)

*A. spiroides* KLEBS (1a)

*Anabaena* sp. (1b)

*Aphanizomenon flos aquae* f. *gracile* (LEMM.) ELENK. (1a)

*Aulosira laxa* KIRCH. (Tab. 2. 1)

The trichomata are straight or a little curved. The colourless capsule is tight, 8  $\mu$  thick. The greenish-blue cells are 7  $\mu$  broad, the size of the heterocyst is 7 $\times$ 8—10  $\mu$ . No spore occurred. (4a)

*Lyngbya birgei* G. M. SMITH (Tabl. 2.2.)

The trichoma is straight, in the 18—23  $\mu$  thick capsule there are cells of 2,5—3 $\times$ 17—22  $\mu$  to be found. The lumen is almost filled in by gas-vacuoles. (1abc)

*Mycrocystis aeruginosa* KG. (1abc)

*Oscillatoria acutissima* KUFF. (Tab. 2. 3—4)

The end of the trichoma is curved, the size of cells is 8—10 $\times$ 2,5  $\mu$ . (1bc, 3a, 4ab)

*O. granulata* GARD. (2, 4a)

*O. lauterbornii* SCHMIDLE form? (Tab. 2. 6)

The trichoma is straight or a little curved, the size of cells is 6 $\times$ 2,5—3  $\mu$ . The transversal constrictions are well-marked. Within the cells there are large gas-vacuoles. (1b)

*O. limnetica* LEMM. (1b)

*O. limosa* AGH. (4a)

*O. ornata* (KÜTZ.) GOM. (Tab. 2. 5)

The size of the granule-cells is 9 $\times$ 2,5  $\mu$ . (1b)

*O. princeps* VAUCH. (4a)

*Oscillatoria* sp. (1b)

*Pseudanabaena catanea* LAUT. (1b)

*P. constricta* (SZAF.) GEITL. (1a)

*P. papillaterminata* (KISS.) KUKK (1b)

The size of cells is 3—4,5  $\mu$ .

### Euglenophyta

*Colacium arbscula* STEIN (Tab. 2. 13)

The size of cells is 16—15 $\times$ 9—7  $\mu$ . (1b)

*C. cyclopicola* (GICKL.) WORONICH. & POPOVA (3a, 4ab)

*Euglena allorgei* DEFL. (Tab. 3. 12)

The size of cells is 90 $\times$ 12  $\mu$ . (3a)

*E. acus* EHR. (2, 3a, 4a)

*E. acus* var. *angularis* JOHN. (4a)

*E. ehrenbergii* KLEBS (1b)

*E. oxyuris* f. *minor* DEFL. (2, 4a)

*E. pisciformis* KLEBS (2)

*E. proxima* DANG. (Tab. 3. 10) (1c, 2, 3a, 4a)

*E. spathirhyncha* SKUJA (4a)

*E. tripteris* (DUJ.) KLEBS (1b)

*E. tripteris* var. *crassa* SWIR. (2)

*Lapociclis ovum* (EHR.) LEMM. (2, 3a, 4a)



- L. sphagnophila* LEMM. (1a)  
*L. steinii* var. *suecica* LEMM. (4a)  
*L. texta* (DUJ.) LEMM. (1ac, 2, 3a, 4a)  
*Phacus acuminatus* STOKES (1c)  
*Ph. aenigmaticus* DREZ. (3a)  
*Ph. caudatus* HÜBNER (2, 4b)  
*Ph. caudatus* var. *minor* DREZ. (Tab. 2. 16)  
 The size of cells is 29—23×14—12 μ. (2, 3a)  
*Ph. curvicauda* SWIR. (3a)  
*Ph. longicauda* (EHR.) DUJ. (1a, 2, 3a)  
*Ph. moniliatus* var. *suecicus* LEMM. (3b, 4b)  
*Ph. orbicularis* HÜBNER (3a, 4a)  
*Ph. orbicularis* f. *communis* POPOVA?

The difference is induced by paramylon divided in four (?). The size of the cell is 47×38 μ. (1c)

- Ph. pleuronectes* (O.F.M.) DUJ. (1b, 4b)  
*Ph. pseudonordstedtii* (DEFL.) POCH. (3a)  
*Phacus pyrum* (EHR.) STEIN (1c, 3a)  
*Ph. raciborskii* DREZ. (3a)  
*Strombomonas* sp. (4a)  
*Trachaelomonas abrupta* f. *minor* DEFL. (2)  
*Tr. acanthostoma* STOKES (3b)  
*Tr. acanthostoma* var. *minor* DREZ. (4ab)  
*Tr. acuminata* var. *verrucosa* TEOD. (2)  
*Tr. armata* (EHR.) STEIN (4a)  
*Tr. armata* var. *steinii* LEMM. em. DEFL. (1b)  
*Tr. bacillifera* PLAYF. (1a, 4ab)  
*Tr. conica* PLAYF.

The size of cells is 24—26×14 μ. (3b, 4a)

- Tr. cordata* ROLL (4a)  
*Tr. crebea* KELL. emend. GEITL. (1a)  
*Tr. crebea* var. *obesa* BAL. (2)  
*Tr. granulata* SWIR. (2, 4a)  
*Tr. granulosa* PLAYF. (1bc)  
*Tr. hispida* (PERTY) STEIN emend. DEFL. (1a, c, 2, 3b)  
*Tr. hispida* var. *coronata* LEMM. (1b)  
*Tr. hispida* var. *crenulatocollis* (MASK.) LEMM. (2)  
*Tr. hispida* var. *macropunctata* SWIR. (3a)  
*Tr. intemedia* DEFL. (4b)  
*Tr. pulcherima* PLAYF. (2, 3b)  
*Tr. raciborskii* WOLOSZ. (1cb)  
*Tr. rugulosa* STEIN (1c)  
*Tr. similis* STOKES (1a, 4a)  
*Tr. stokesiana* PALMER (2)  
*Tr. superba* SWIR. emend. DEFL. (4a)  
*Tr. superba* var. *achinata* (ROLL) POPOVA (4a)  
*Tr. urceolata* STOKES (4a)  
*Tr. verrucosa* STOKES (1bc, 3a, 4b)  
*Tr. volvocina* EHR. (1abc, 2, 3ab, 4ab)  
*Tr. volvocina* var. *compressa* DREZ. (3b)

*Tr. volvocina* var. *derephora* CONRAD (3b)  
*Tr. volvocina* var. *granulosa* PLAYF. (1bc, 2, 3b)  
*Tr. volvocina* var. *punctata* PLAYF. (1a, 2, 3ab)  
*Tr. volvocina* var. *subglobosa* LEMM. (3b, 4a)  
*Tr. volvocina* f. *umbiliciphora* DEFL. (3b)

*Tr. wislousii* SKV. (1b)

*Tr. zorensis* DEFL. (4a)

*Tr. zmiewica* SWIR. (4a)

*Tr. zuberi* v. *nepos* DREZ. (4a)

*Urceolus cyclostomus* (STEIN) MERESCH. Tab. 2. 9)

The size of the micro organism is  $27,7 \times 20 \mu$ . It is a little metabolic. (4b)

## Pyrrophyta

*Ceratium hirundinella* f. *furcoides* (SCHROERED.) HUBER-PEST. (1abc, 3a)

*Gymnodinium* sp. (3a, 4a)

*Peridinium volzii* LEMM. (Tab. 2. 7—8, 10—12)

The diameter of cells is  $41—51 \mu$ ; at the rim of valvae the ornament of the lamina running round is not regular. (1abc, 3a, 4a)

## Chrysophyta

### Chrysophyceae

*Dinobryon bavaricum* IMHOF (1abc, 2, 4a)

*D. divergens* IMHOF (1abc, 2, 3a)

*D. sertularia* EHR. (4a)

*Kephyrion haemisphaericum* (LACKEY) CONRAD (2, 3a, 4a)

### Bacillariophyceae

*Achnanthes hauchiana* GRUN. (4a)

The size of cells is  $10,5—11 \times 5,5 \mu$ , str.  $14/10 \mu$ .

*A. lanceolata* var. *elliptica* CLEVE (3a)

*A. microcephala* (KÜTZ.) GRUN. (1c)

*Amphipleura pellucida* KÜTZ. (1c, 2, 3a)

*Amphora ovalis* KÜTZ. (3a)

*Asterionella formosa* HASS. (2, 3a)

*Attheya zachariaschii* BRUN. (1bc)

*Caloneis silicula* (EHR.) CLEVE (2)

*Ceratoneis arcus* (EHR.) KÜTZ. (2)

*Cocconeis placentula* EHR. (1c, 4ab)

*C. placentula* var. *euglypta* (EHR.) CLEVE (1bc, 2, 4ab)

*Cyclotella meneghiniana* KÜTZ. (1b, 2)

*Cymatopleura solea* (BRÉB.) W. SM. (2)

*Cymbella helvetica* KÜTZ. (1bc, 2, 3a)

*C. ventricosa* KÜTZ. (1bc, 2, 4b)

*Diatoma elongatum* (LYNGB.) Ag. (1a)

*Epithaemia argus* KÜTZ. (4b)

*E. ocellata* KÜTZ. (1c)

*E. sorex* KÜTZ. (4b)

*E. zebra* (EHR.) KÜTZ. (1c, 4a)

*E. zebra* var. *saxonica* (KÜTZ.) GRÜN. (4b)

*Eunotia lunaris* var. *subarcuata* (NAEG.) GRUN. (4b)

*E. valida* HUST. ? (1b)  
*Eunotia* sp. (4a)  
*Fragilaria capucina* DESM. (1bc)  
*Gomphonema acuminatum* AHR. (4ab)  
*G. acuminatum* var. *coronatum* (EHR.) W. SM. (2, 3a)  
*G. angustatum* var. *productum* GRUN. (4b)  
*G. augur* EHR. (1c, 4b)  
*G. capitatum* EHR. (1bc, 4ab)  
*G. olivaceum* (LYNGB.) KÜTZ. (3a, 4ab)  
*Gyrosigma acuminatum* (KÜTZ.) RABEN. (2)  
*G. attenuatum* (KÜTZ.) RABEN. (1bc)  
*Hantzschia amphioxys* (EHR.) GRUN. (2)  
*Melosira granulata* (EHR.) RALFS (1bc, 2, 3b, 4b)  
*M. granulata* var. *angustissima* (O.F.M.) HUST. (1abc, 4a)  
*Navicula anglica* RALFS (2)

The size of the cell is  $20 \times 7,5 \mu$ , str. 12/10  $\mu$ .

*N. cryptocephala* KÜTZ. (1bc, 2, 3a)  
*N. cryptocephala* var. *intermedia* GRUN. (1bc)  
*N. cuspidata* KÜTZ. (4a)  
*N. cuspidata* var. *hankae* f. *craticularis* SKV. (2)

The size of the cell is  $59 \times 15 \mu$ , that of loculamenta 2—3) 10  $\mu$ .

*N. hungarica* GRUN. (2)  
*N. pygmaea* KÜTZ. (4a)  
*N. radiosa* KÜTZ. (1bc, 3a, 4a)  
*N. rhynchocephala* KÜTZ. (3a)  
*Neidium affine* (EHR.) CLEVE (2)  
*Nitzschia acicularis* W. SM. (1bc, 2, 3a)  
*N. acuta* HANTZSCH. (1c, 2)  
*N. capitellata* HUST. (2)  
*N. closterium* (EHR.) W. SM. (2)  
*N. dissipata* (KÜTZ.) GRUN. (1bc, 4b)  
*N. filiformis* (V. SM.) HUST. (1b)  
*N. hungarica* GRUN. (2, 4b)  
*N. linearis* W. SM. (1b, 4b)  
*N. palea* (KÜTZ.) W. SM. (1bc, 4b)  
*N. sigmoidea* (EHR.) W. SM. (2)

The size of the cell is  $300 \times 12,5 \mu$ , str. 5/10  $\mu$ .

*N. triblionella* var. *levidensis* (W. SM.) GRUN. (2)  
*N. vermicularis* (KÜTZ.) GRUN. (1c, 2, 3a)  
*Pinnularia* var. *brevirostrata* HUST. (2)

The size of the cell is  $32,5 \times 9 \mu$ , str. 5/10  $\mu$ .

*P. interrupta* W. SM. (1b)  
*P. mesolepta* var. *interrupta* CLEVE (Tab. 3. 3.)  
 Syn.: *P. mesolepta* var. *minuta* f. *interrupta* CLEVE

The size of the cell is  $30 \times 6 \mu$ , str. 14/10  $\mu$ . (2)

*P. microstauron* (EHR.) CLEVE (2)  
 The size of the cell is  $42-44 \times 12,5 \mu$ , str. 10—11/10  $\mu$ .  
*P. microstauron* var. *biundutala* O.F.M. (4a)  
*P. microstauron* var. *brebissonii* (KÜTZ.) HUST. (4a)  
*P. nobilis* (KÜTZ.) HUST. (1b)

*P. viridis* (NITZSCH.) EHR. (3a)

*Pinnularia* sp. (4a)

*Rhoicosphaeria curvata* (KÜTZ.) GRUN. (1b, 3a, 4b)

*Rhopaloida gibba* (EHR.) O.F.M. (1ab, 4ab)

*Surirella ovata* KÜTZ. (1a, 2)

*S. ovata* var. *pinnata* (W. SM.) HUST. (2)

The size of the cell is  $30 \times 10 \mu$ , str.  $6/10 \mu$ .

*Synedra acus* KÜTZ. (1c, 3a)

*S. acus* var. *radians* (KÜTZ.) HUST. (1b)

*S. arcuatus* var. *subrecta* CLEVE (Tab. 3. 4)

The size of the cell is  $360 \times 10 \mu$ , str.  $14/10 \mu$ . The stalks are slightly arcuated, the cell is broader in the middle. The pseudoraphe is narrow in the stalk, in the middle it is spear-like broadened. So far, it was only found in the environment of sea- and brackish water (Cleve 1951—55). (2)

*S. capitata* EHR. (1c)

*S. parasitica* (V. SM.) HUST. (2)

The size of cells is  $20 \times 5 \mu$ , they can be found in the *Nitzschia sigmaidea*.

*S. tabulata* (AG.) KÜTZ. (1c)

*S. ulna* (NITZSCH.) EHR. (1c, 2)

## Xanthophyceae

*Ophiocytium capitatum* WOLLE (2)

*O. lagerheimii* LEMM. (Tab. 3. 7)

The size of cells is  $80-72 \times 3-2,5 \mu$ , str.  $8-12 \mu$ . (1c)

*O. arbuscula* (A. BR.) RABENH. (Tab. 3. 1)

The colony is 6—7-armed, the cells are 6—7  $\mu$  thick (4b)

*Centritractus belenophorus* LEMM. (1bc, 3a)

## Chlorophyta

### Chlorophyceae

*Actinastrum hantzschii* LAGERH. (1b, 3a)

*Ankistrodesmus convolutus* CORDA (1b)

*A. falcatus* (CORDA) RALFS (1c, 4a)

*A. falcatus* var. *duplex* (KÜTZ.) VEST (1ab, 4a)

*A. falcatus* var. *mirabilis* W. & V. (1c, 4a)

*A. longissimus* (LEMM.) WILLE (1ac)

*Characium acuminatum* A. BR. ? (Tab. 2. 14—15)

The size of cells is  $17,5-10 \times 6-4 \mu$ . (1c)

*Chlamydomonas pertusa* CHOD. (4b)

*Coelastrum microporum* NAEG. (4b)

*Crucigenia quadrata* G. M. SMITH (1abc, 3a)

*Cr. rectangularis* (A. BR.) GAY (1bc)

*Cr. tetrapedia* (KIRCH.) W. et W. (1bc, 3ab)

*Dictyosphaerium pulchellum* WOOD (1abc, 3b)

*Lagerheimia chodatii* BERN. (3b)

*L. wratislaviensis* SCHROED. (3b)

*Lambertia limnetica* (LEMM.) KORSCHIK. (1c)

*Oocystis borgei* SNOW (1a)

*Pandorina morum* BORY (1b)

*Pediastrum duplex* MEYEN (3b)  
*P. tetras* (EHR.) RALFS (1bc, 4b)  
*Planctonema lauterbornii* SCHMIDLE (1abc)  
*Scenedesmus acuminatus* (LAGERH.) CHOD. (3a)  
*Sc. balatonicus* HORTOB. (1c)  
*Sc. bicaudatus* (HANGS.) CHOD. (2)  
*Sc. bicaudatus* var. *brevicaudatus* HORTOB. (1b, 4a)  
*Sc. denticulatus* var. *linearis* PASCHER (1c, 4a)  
*Sc. ecornis* (RALFS) CHOD. (1ab, 3a)  
*Sc. ecornis* var. *disciformis* CHOD. (1b, 3a)  
*Sc. protuberans* FRITSCH (1a)  
*Sc. quadricauda* (TURP.) BRÉB. (1ab, 2)  
*Sc. raciborskii* f. *granulatus* HORTOB. (1c)  
*Traubaria triappendiculata* BERN. (3a)  
*Ulothrix* sp. (1c)

### *Conjugatophyceae*

*Closterium aciculare* T. WEST (1b)  
*Cl. moniliferum* EHR. (1c, 3a, 4ab)  
*Cl. naegelii* (BRÉB.) V. et W. (1b)  
*Cl. parvulum* NAEG. (1b, 4b)  
*Cl. parvulum* var. *angustum* W. et W. (1bc)  
*Cl. praeacerosum* GAY (1b)  
*Cl. praelongum* BRÉB. (4a)  
*Cl. strigosum* BRÉB. (1b)  
*Cosmarium bioculatum* BRÉB. (1b)  
*C. botrytis* MENEGH. (1bc)  
*C. botrytis* var. *depressum* W. et W. (1b)  
*C. contractum* BRÉB. (1c)  
*C. humile* (GAY) NORST. (1c)  
*C. laeve* RABENH. (1b, 4ab)  
*C. meneghinii* BRÉB. (1bc)  
*C. obtusatum* SCHMIDLE (1c)  
*C. quadrum* LUND (1bc)  
*C. regnellii* var. *kerguelense* KRIEG. et GERL. (1bc)  
*C. reniforme* (RALFS) ARCH. (1bc)  
*C. subcucumis* SCHMIDLE (1b)  
*C. subalatum* W. et W. (1b)  
*C. sublateriundulatum* W. et W.  
*C. turpinii* BRÉB. (1bc)  
*C. vexatum* WEST (1b)  
*C. undulatum* CORDA (1c)  
*Desmidium aptogonum* BRÉB. (4a)  
*Euastrum insulare* var. *silesiacum* GRÖNBL. (1c)  
*E. spinulosum* DELP.  
 The size of the cell is 50—52 × 57—59 μ, ithmus: 12,5 μ (1bc)  
*Gonatozygon monothaenum* DE BARY (1bc)  
*Microsterias crux-melitensis* (EHR.) HASS. (1bc)  
*Moegotia* sp. (1bc, 3a, 4a)  
*Pleurothaenium trabecula* (EHR.) NAEG. (1b)

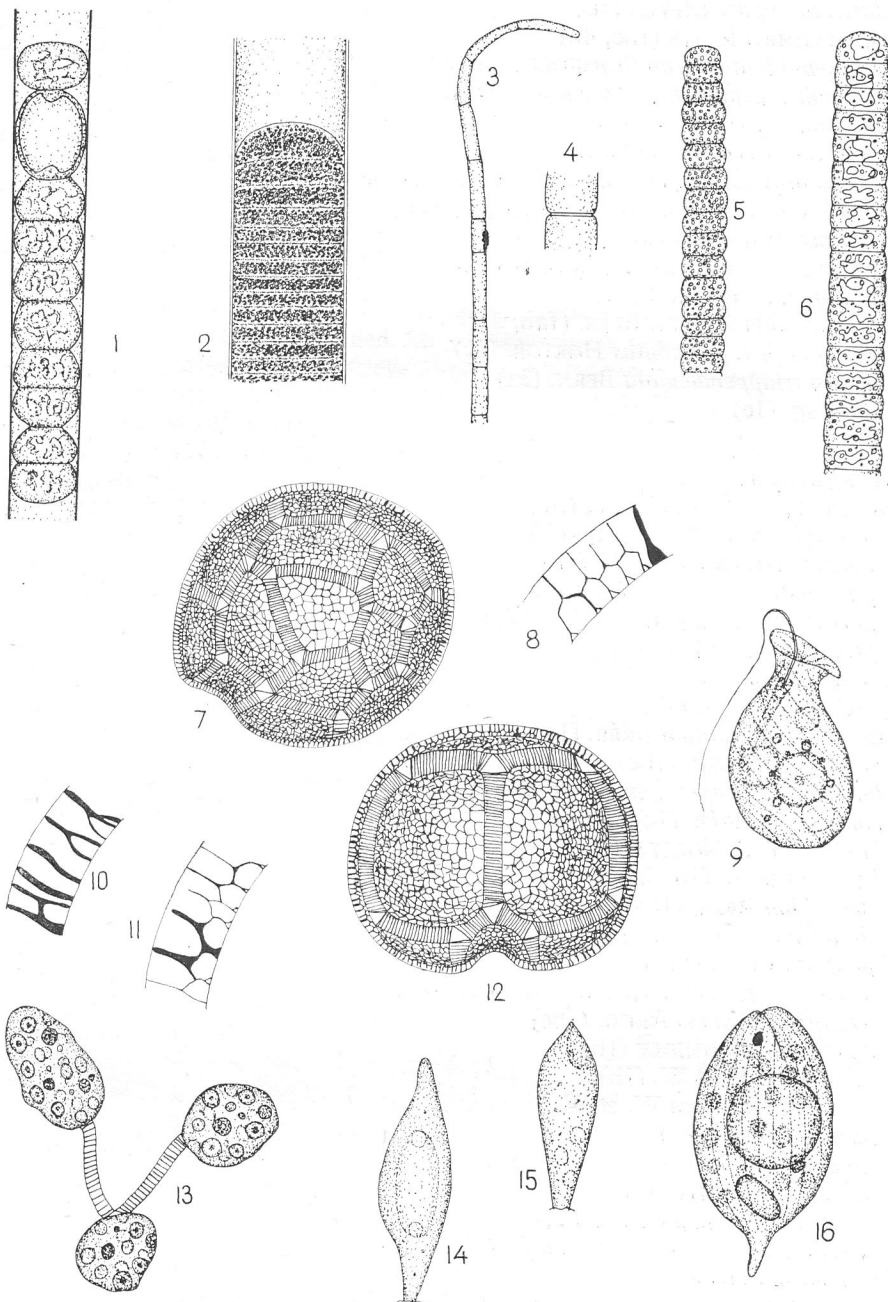


Table 2. (1) *Aulosira laxa*, (2) *Lyngbia birgei*, (3—4) *Oscillatoria acutissima*, (5) *Oscillatoria ornata*, (6) *Oscillatoria lauterbornii* forma ? (7—8, 10—12) *Peridinium volzii*, (9) *Urceolus cyclostomus*, (13) *Colacium arbuscula*, (14—15) *Characium acuminatum* ? (16) *Phacus caudatus* var. *minor*.

*Staurastrum alternans* BREB. (1c)  
*St. brevispinum* BREB. (1bc, 3a)  
*St. gracile* RALFS (1bc, 3a)  
*St. polymorphum* BREB. (1abc, 3a)  
*St. orbiculare* var. *depressum* ROY & BISSET (1b)  
*St. paradoxum* MEYEN (1bc, 3ab)  
*Staurastrum* sp. (1bc, 3a)  
*Staurodesmus convergens* (EHR.) TEIL. (1b)  
*St. triangularis* (LAGERH.) TEIL. (1b)  
*Xanthidium antilopeum* (BREB.) KÜTZ. (1abc)

### Discussion of results

The dead-arms investigated are in different stages of filling up. The largest open water is to be found in the dead-arm of the Tisza at Tiszafüred, while the water depth of the others is shallow, and they are considerably covered with water-vegetation. The dead-arms are only inundated at the great spring flood. Thus they are considered as limnologically individualized biotopes (UHERKOVICH 1971). This individualization is increased by that they are filled up and covered with water-vegetation. In this way, the combination of the algal stock is characterized in open water by the planktonical organisms, while in the parts covered with vegetation and in the regions at the river-side it is rather characterized by periphytons. There often appear in marshes large numbers of organisms, being characteristic of bogs (*Phacus monilliatum* var. *suecicus* LEMM, *Rhopalloida gibba* (EHR.) O.F.M., *Trachaelomonas zuberi* var. *nepos* DREZ., etc. The comparative stability of the dead-arms is denoted by the presence of rare species as: *Synedra arcuatus* var. *subrecta* CLEVE, *Synedra parasitica* (W. SM) HUST., *Cosmarium regnellii* var. *keruelense* KRIEG & GERL., etc.

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