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LONGITUDINAL PROFILE INVESTIGATION IN THE TISZA AND EASTERN MAIN CHANNEL I. QUANTITATIVE CHANGES IN PHYTOPLANKTON

T. K. KISS and A. SZABÓ

Town Water Works, Debrecen University for Agricultural Sciences, Debrecen, Hungary
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Abstract

Of late years, the hydrobiological investigations are unequivocally referring to that eutrophisation is a more and more frequent phenomenon in rivers and other fresh waters, as well. A concomitant of the periodical, recurrent eutrophysation of fresh waters is the quick, considerable multiplication of algae. The phytoplankton communities, rich in species and individuals, can mostly be observed at the time of the low waters in Autumn (PROWSE, TALLING 1958, UHERKOVICH 1971, SZEMES 1966, KISS KEVE 1974a, b, VÁNCSA 1974).

Our investigations in the Tisza were carried out in a period like that. We have established that in the Upper Tisza Region of swift flowing the number of algae is low, the alga association is of rheoplankton-character. After discharge of the Szamos of rich alga population into the Tisza, the quick multiplication of the phytoplankton began there, too, reaching its maxima (18 million ind./l) in the reaches between Záhony and Dombrád (Fig. 1). Below Tokaj, after the discharge of Bodrog, the number of individuals in the alga association was considerably reduced. The phytoseston of the Eastern Main Canal was similarly poor. The dominance of *Cyclotella* species, Nitzschia acicularis W. Smith, and Chlorococcales was characteristic of the algal association.

Introduction

A concomitant of the periodical, recurrent eutrophisation of fresh waters is the quick, considerable multiplication of phytoplankton. In rivers, apart from the increased mass of the vegetable nutritive materials, other ecologic factors (water speed, stream-deposit content, light climate, temperature), as well, take place in multiplying the algae. We may speak in case of rivers about a periodical, recurrent eutrophisation as the phytoplankton appears in a large mass only if the alluvial deposit-content is low and the water temperature is favourable. And that can occur mostly only on the occasion of low waters in Autumn (PROWSE, TALLING 1958, UHERKOVICH 1968a, b, 1969a, b, 1970, 1971, SZEMES 1966, KISS KEVE 1974a, b, VÁNCSA 1974).

It is characteristic of the Tisza as a river of a changeable direction of water and of large deposit-content that its quantitative and qualitative phytoseston-composition often and considerably changes during the year. We may observe well-discernible differences subject to the character of river-reaches, as well, first of all in the periods of balanced low waters (UHERKOVICH 1971).

We observed at the end of Summer, in early Autumn of every year since 1967 that plankton-alga population maxima develop in the impounded bed of Tisza at the Tiszalök reaches (KISS KEVE 1974a, b).

In the Eastern Main Canal forking from this impounded bed-section (length 98 km, breadth 40 m, depth 2.3—4.2 m, maximum water-transport 60 cubic metre/s.) a surface water-purifier is to be built for supplying the town Debrecen with drinking-water. From the point of view of purifying the drinking water, the algologic quality of the water of the main canal is very important and it is under the decisive influence of the quality of Tisza water in its reaches at Tiszalök.

The aim of our investigations is, therefore, to recognise in which part of the upper reaches of Tisza these algal associations, rich in species and individuals, develop and how they change moving with the stream in the river and Eastern Main Canal, respectively.

Sampling, method of investigation

The starting-point of our investigations was Tiszacsécse (Fig. 1). From there we sailed with the stream, striving to move, as far as possible, together with the watermass which we took the first water sample of. The water samples were taken in every 20 km, on the surface, ladling from the line of current.

We have supposed that the quality of Tisza water is under the influence of the Szamos and Bodrog, the two tributaries discharging into the Tisza at the reaches investigated: we took therefore samples from these, too, at the place before the mouth.

On the spot we have determined the water temperature and the content of dissolved oxigen. In the course of our investigations so far we have seen that there is some connection between trans-

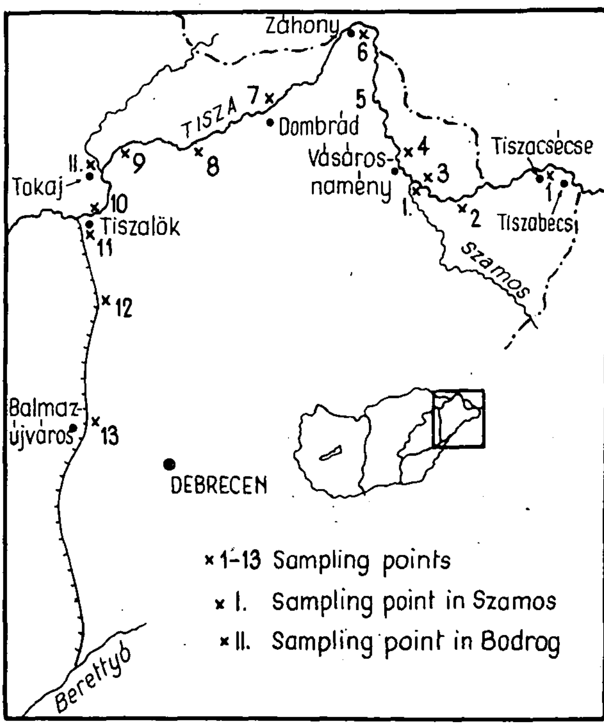


Fig. 1. Sketch map of the Tisza, Szamos, Bodrog, Eastern Main Canal with sampling points.

parence, favourable light climate of Tisza water and the phytoplankton mass multiplied in it (KISS KEVE 1974b, c). We have therefore carried out informative measurings by means of Secchi's disc and underwater light-measurings with Photronic cell. As it is not our aim to give a detailed optical characterisation of the Tisza water and of that of the Eastern Main Canal, we drew up a Table only about the transmission coefficient reckoned on the basis of measurings ($T_{K\ 0,2-1,2\ m}$) (Tab. 2) that is informing us about the light climate of water (FELFÖLDY and KALKÓ 1958, ENTZ and FILLINGER 1961). Fig. 1.

The qualitative investigation of algae was carried out from settled samples and plankton semples netted at the same time. Quantitative analysings were performed with Utermöhl's method (1958).

The results of investigation

UHERKOVICH has carried out several longitudinal-section investigations in the Tisza from Tiszabecs till Szeged, establishing that the algal associations of the river become, as a rule, real plankton associations in the lake-like bed-section dammed up by the sluice at Tiszalök, here it is that the number of species and individuals begins to increase considerably (UHERKOVICH 1968a, b, 1969a, b, 1971). An exception was only found in September 1967 when the rise in the individual number of algae started already at Vásárosnamény, reaching the maxima at Dombrád with an individual number of 11.4 million per litre. Below Tokaj, the number of algae considerably decreased (1—2 mill. ind./l) and till Szeged it has changed but a little. UHERKOVICH has completed his above-mentioned observation in a letter by mentioning that at investigating he took the sample of Vásárosnamény below the inflow of Szamos; it is therefore very probable that the high individual number was caused by the Sza-

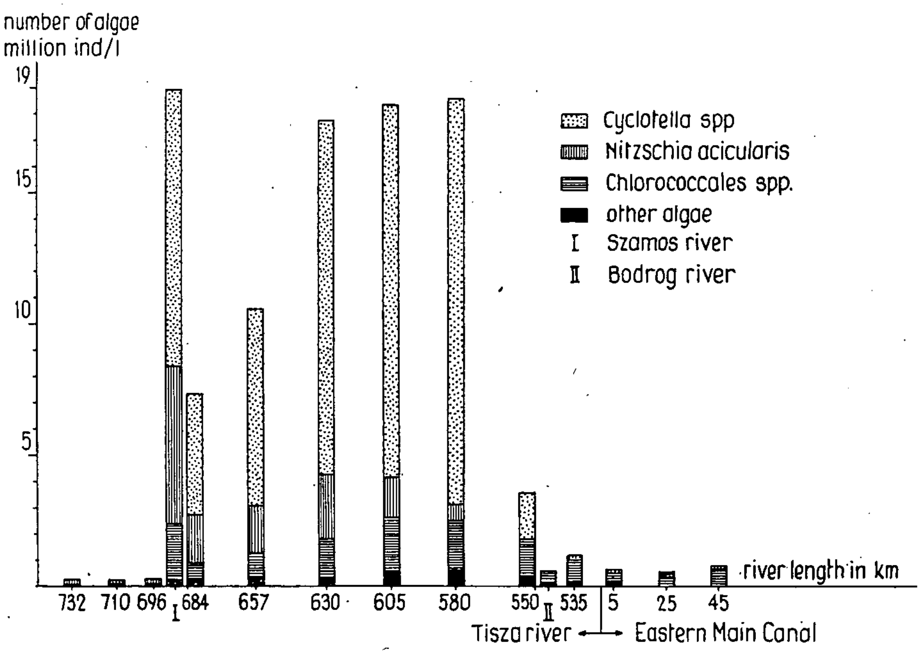


Fig. 2. Quantitative conditions of the phytoplankton of the Tisza, Szamos, Bodrog, Eastern Main Canal between 24—29 August 1973.

Table 1. *Quantitative composition of phytoplankton in the Tisza, Szamos, Bodrog and in Eastern Main Canal*

Sampling points	1	Szamos	4	5	8	9	Bodrog	10	11	13
Asterionella formosa							2,5		5	
Attheya zachariasi		40	5	10	300	60	5	30		3
Ceratoneis arcus	2									
Cyclotella spp.	20	10 560	4600	7 500	15 450	1750	50	120	115	55
Cymbella ventricosa	2									
Diatoma vulgare	23		5	3						
Gomphonema olivaceum	2			3						
Melosira granulata var. angustissima							27,5	5	5	5
M. varians							2,5			3
Navicula cryptocephala	2	10		5					5	
Nitzschia acicularis	165	5 880	1880	1 960	620	30	27,5	10	20	10
N. longissima var. reversa		10	8		5					
N. palea	0,5	10	4							
Rhisosolenia eriensis		60	35	50	150	240		100	25	
Rhoicosphenia curvata	2,5									
Synedra actinastroides			15	17	25	20			5	
S. acus	1	10	5	5	8	20		12	5	
S. ulna		10	5	8	30	20		12		5
other Bacillariophyceae	20	30	45	40	50	20		5	5	
total Bacillariophyceae	240	16 620	6612	9 593	16 638	2160	87,5	294	190	81
Actinastrum hantzschii		110	50	65	140	110		40	20	15
Ankistrodesmus acicularis	1	100	40	50	35	30	10	20	20	5
A. angustus	1	530	140	170	300	210	60	240	90	160

A. arcuatus		50	17	27	20	16	27,5	10	5	5
A. longissimus var. acicularis	0,5		3	5	40	10	7,5	7	5	
Coelastrum cambricum				2						
C. microporum		60	10	7	30	38	17,5	5	20	5
C. sphaericum		30				30	7,5	8		
Crucigenia apiculata		10	10	5	30	27	5	5		5
C. tetrapedia	1	190	30	20	115	140	42,5	140	60	170
Dictyosphaerium pulchellum	0,5	10	8	10	10	7		5		5
Didymocystis planctonica	0,5	40	15	13	60	70	30	55	15	60
D. tuberculata		20	8	10	60	40	10	20	5	10
Kirchneriella lunaris	1	500	120	135	105	90	5	45	5	25
K. obesa	0,5	10	12	18	25	20	30	10	5	40
Lagerheimia longiseta			5	8	60	18		5		
Oocystis borgei		90	20	18	100	60		15	10	15
Pediastrum boryanum			2	3		5				5
P. duplex			3							
Scenedesmus acuminatus		70	15	55	90	45	5	15	10	8
S. acutus		10	5	10	25	10				
S. denticulatus					15	8	2,5		5	3
S. ecornis	0,5	10	3		10	8	2,5	20		4
S. granulatus	1		8	5	10	5		5		5
S. intermedius		50	10	12	75	50	7,5	15	10	10
S. opoliensis	0,5	20	4	10	18	7			5	
S. protuberans					7		2,5	5		
S. quadricauda	1	140	50	45	200	100	22,5	50	45	10
S. spinosus			3	5	10	12	5	80	5	
other Scenedesmus spp.	0,5		3	3	50	22	17,5	12	5	3
Schroederia setigera		80	18	32	70	47		5		5

Sampling points	1	Szamos	4	5	8	9	Bodrog	10	11	12
Siderocelis ornata			10	15	15	15				5
Siderocystopsis fusca			5	3	15	15				3
Tetraedron minymum	1		8	5	15			5		3
T. muticum						5				3
T. triangulare				3				5		2
Tetrastrum glabrum		40	7	5	30	5	25	5	5	17
T. staurogeniaeforme			3		5	7	2,5		5	
Treubaria triappendiculata						5				3
other Chlorococcales	2		60	115	105	120	70	60	25	60
total Chlorococcales	12,5	2 140	705	899	1 895	1407	420	840	380	664
Lyngbya limnetica		10	2	7	5	5				
Merismopedia tenuissima							22,5	5		
other Cyanophyta		40	10	12		5	10	3	5	5
Euglena spp.		20	3	3		5			5	
Strombomonas spp.		10	2	3						
Trachelomonas spp.		10		5	20	10	2,5		5	
Dinobryon spp.	1,5		3	10	10					
Mallomonas spp.	3		3	5		3		5		
Chlamydomonas spp.		20	8	10		5	2,5		10	5
Eudorina elegans					8	15		8		
Gonium pectorale		30	12	10					15	
Pandorina morum									5	
Closterium acutum		10					10		10	
Cosmarium obtusatum	7		5	5		5				
Staurastrum paradoxum			6		5	5			5	
other algae	2	10		8	9	15				5
total phytoplankton 1000 ind/lit.	266	18 950	7370	10 560	18 590	3540	575	1150	635	765

mos water rich in algae. (I am deeply indebted to him for this valuable completion). In the present series of our investigations we have observed a similar case that I want to report on with fuller particulars.

In the course of sampling we could observe that at Tiszacsécs the Tisza has the character of upper reaches, its flowing is swift, its bed is gritty, its water is clear, of transparent bluish-green colour. The rather swift water detaches algae from the diatom-grass living, fixed on, sticked to the stones of the bed. In the phytoseston we have found many a rheon organism (*Diatoma vulgare* BORY, *Ceratoneis arcus* KÜTZ., *Gomphonema olivaceum* (LYNGB.) KÜTZ., *Rhoicosphenia curvata* (KÜTZ.) GRUN., *Cosmarium obtusatum* Schmidle), besides these, however, as a characteristic plankton-element, the *Cyclotella* species, *Nitzschia acicularis* W. SMITH are constituting already 65 per cent of the total population (cf.: Table). The rather swift water, however, does not make possible any more considerable multiplication of plankton-organisms. Till the inflow of the Szamos this picture does hardly change.

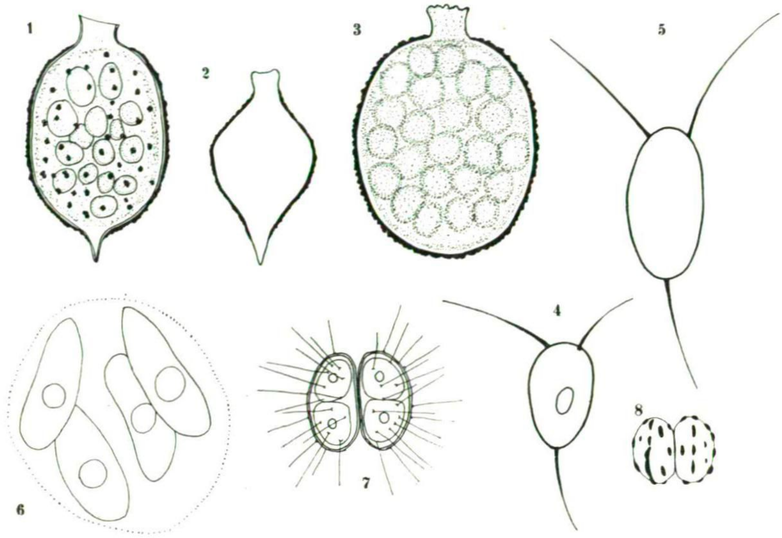
A considerable qualitative change in the Tisza was caused by the water of Szamos. The greenish, brownish Szamos, abounding in water and flowing into the Tisza at Vásárosnamény, brought into it a very rich algal association. The water of Szamos is characterised by the dominance of plankton-elements. The individual number of *Cyclotella* species (10560 thousand ind./l) ,*Nitzschia acicularis* W. SMITH (5880 thousand ind./l) is prominently high. Apart from them, the characteristic components of the alga population are *Attheya zachariasi* J. BRUN., *Rhisosolenia eriensis* H. L. SMITH, and the Chlorococcales-group, rich in specious.

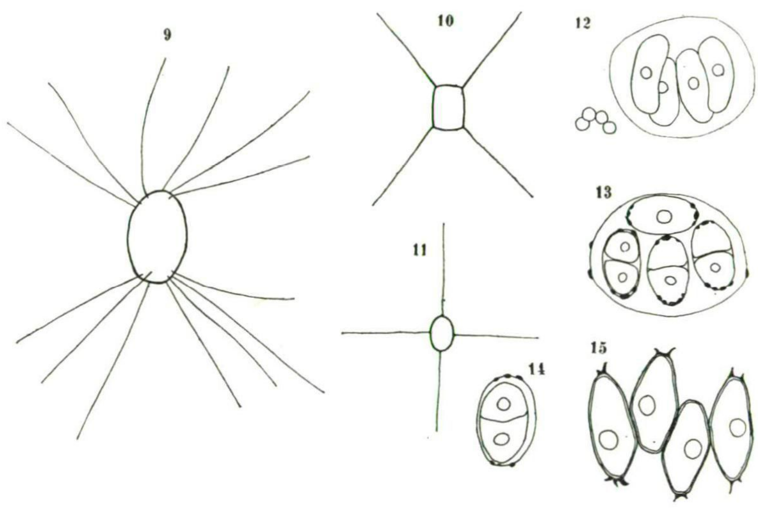
The water of Szamos was considerably diluted in the Tisza, exerting a decisive influence on its quality. The difference between the two waters could be seen well even on their colours. The Tisza was above Vásárosnamény bluish green, the Szamos however greenish brown. It was interesting to observe that the two kinds of water were not mixed entirely with each other even for two km below flowing together.

The algae getting from the Szamos to the Tisza, found favourable conditions, began to multiply quickly and reached the maximum individual number between Záhony and Dombrád. The dominance of *Nitzschia acicularis* W. SMITH fell more and more into the background, on the other hand, the species *Cyclotella* became predominant, forming 76—83 per cent of the total population. It is obvious how rich in species the order Chlorococcales is from among which the species *Actinastrum hantzschii* LAGERH., *Ankistrodesmus angustus* BERN., *Crucigenia tetrapedia* (KIRCH.) W. et G. S. WEST, *Kirchneriella lunaris* (KIRCH.)MOEB., and *Scenedesmus* are to be emphasised. An interesting dash of colour in the population is *Attheya zachariasi* J. BRUN. (300 thousand ind./l) and *Rhisosolenia eriensis* H. L. SMITH (240 thousand ind./l), found in an unusually high number. These planktonic silica algae of an extremely fine silica skeleton can only multiplied in the Tisza in quiet, silent periods with small water.

Between Dombrád and Tokaj, first of all owing to the decrease in the individual number of *Nitzschia acicularis* W. SMITH and *Cyclotella* species, the phytoplankton population was reduced to a quarter. The Bodrog flowing into the Tisza at Tokaj gets on with diluting its water and the algal association at Tiszalök as well as in the Eastern Main Canal can already be called poor, first of all as regards the individual number. As new elements from the Bodrog, the species *Melosira granulata* var. *angustissima* MÜLL., *Merismopedia tenuissima* LEMM., *Gomphosphearia naegeliana* (UNGER) LEMM. are to be emphasised.

In order to reduce the extent of Tab. 1, we have not published there the species found in a lesser individual number. Therewere left out of the Table for similar reasons





List of taxonomical figures

1. *Strombomonas deflandrei* var. *szolnokiensis*
2. *Strombomonas fluviatilis*
3. *Trachelomonas scabra*

4—5. *Chodatella balatonica*

6. *Coenocystis reniformis* var. *tiszae*
7. *Dicellula planctonica*
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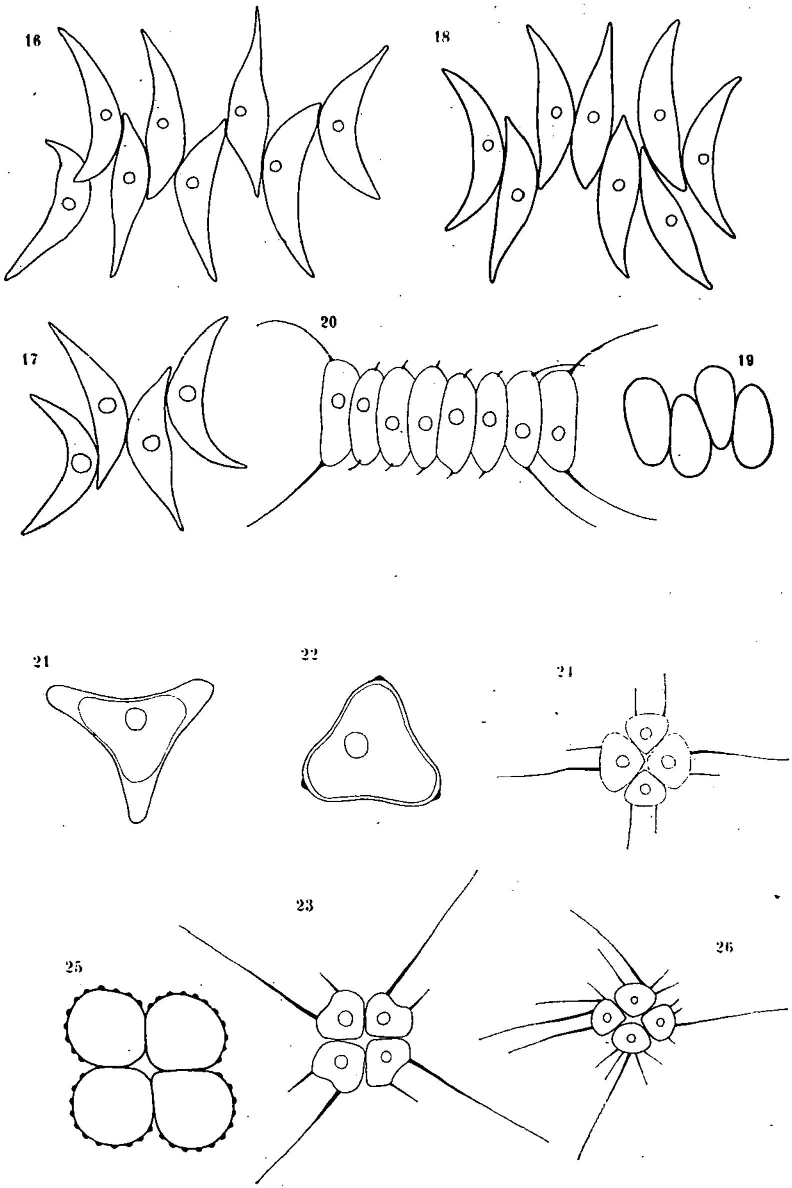
9. *Lagerheimia longiseta*
10. *Lagerheimia quadriseta*
11. *Lagerheimia wratislaviensis*
12. *Nephrocytium agardhianum* var. *szolnokiense*

13—14. *Oocystis pseudocoronata*

15. *Scenedesmus aculeolatus*



16—18. *Scenedesmus acuminatus* var. *bernardii*
19. *Scenedesmus intermedius* var. *acadutus*
20. *Scenedesmus quadricauda* var. *setosus*
21. *Tetraedron muticum*
22. *Tetraedron triangulare*

23—24. *Tetrastrum heteracanthum*
25. *Tetrastrum punctatum*
26. *Tetrastrum triacanthum* var. *abundans*

10 μ
1—3.
10 μ
4—26.

the "sub-special" categories, varieties and forms (i. e., those inside a species); these are enumerated as follows. As some of the taxons published here constitute new data of presence in the water system of Tisza, we are publishing their sampling points, as well. (*Tf:* Upper Tisza Region: Tiszabecs—Vásársonamény; *Tkf:* Upper part of the Medium Tisza Region: Vásárosnamény—Tiszalök; *Sz:* Szamos; *B* Bodrog; *EMC:* Eastern Main Canal; these abbreviations are given on the basis of Uherkovich's paper, 1971).

Aphanisomenon flos-aquae (L.) RALFS—B, *Gomphosphaeria naegeliana* (UNGER) Lemm.—B, *Merismopedia glauca* (EHRBG.) NAEG.—EMC, *Microcytis flos-aquae* (WITTR.) KIRCH.—*Sz*, *Euglena proxima* DANG.—*Tkf*, *Strombomonas deflandrei* var. *szolnokiensis* UHERKOV.—*Tkf*, *S. fluviatilis* (LEMM.) DEFL.—*Sz*, *Trachelomonas scabra* PLAYFAIR—*EMC*, *T. stokesiana* PALMER—*Tkf*, *Dinobryon divergens*, IMHOF—*Tkf*, *D. sertularia* EHRBG.—*Tf*, *D. sociale* EHRBG.—*Tf*, *Mallomonas caudata* IWA NOFF—*Tf*, *Tkf*, *M. tonsurata* TEIL.—*Tf*, *Centritractus belenophorus* LEMM.—*Tkf EMC*, *Achnantes minutissima* (KÜTZ.) GRUN. — *Tf*, *Cyclotella comta* (EHRBG.) KÜTZ.—*Tkf*, *EMC*, *C. kützingiana*)THWAIT.) CHAUVIN—*Tkf*, *EMC*, *C. meneghiniana* KÜTZ.—*Tf*, *Tkf*, *EMC*, *Diatoma vulgare* var. *breve* GRUN.—*Tf*, *D. vulgare* var. *capitulatum* GRUN.—*Tf*, *D. vulgare* var. *productum* GRUN.—*Tf*, *Tkf*, *Gyrosigma kützingii* (GRUN.) CLEVE—*Tkf*, *Nitzschia sigmoidea* (EHRBG.) W. SMITH—*Tkf*, *Stephanodiscus astraea* (EHRBG.) GRUN—*Tkf*, *Sz*, *EMC*, *S. tenuis* HUST.—*Tkf*, *Surirella ovata* KÜTZ.—*Tf*, *Synedra acus* var. *radians* (KÜTZ.) HUST.—*Tkf*, *S. ulna* var. *oxarhynchus* (KÜTZ.) van HEURCK—*Tf*, *Tkf*, *Sz*, *EMC*, *Chodatella balatonica* SCHERF—*Tkf*, *Coenocystis reniformis* var. *tiszae* UHERKOV.—*Tkf*. *Dicellula planctonica* SWIR.—*Tkf*, *Didymocystis inconspicua* KORSCHIK.—*B*, *Franceia tenuispina* KORSCHIK.—*Tkf*, *Lagerheimia quadriseta* (LEMM.) G. M. SMITH—*B*, *L. wratislaviensis* SCHROED.—*Sz*, *Nephrocytium agardhianum* var. *szolnokiense* UHERKOV.—*EMC*, *Oocystis pseudocoronata* KORSCHIK—*Tkf*, *EMC*, *Scenedesmus aculeolatus* REINSCH.—*Tkf*, *S. acuminatus* var. *bernardii* (G. M. SMITH) DESSUS.—*Tkf*, *B*, *S. acuminatus* f. *tortuosus* (SKUJA) UHERKOV.—*Tkf*, *S. acutus* f. *alternans* HORTOB.—*Tkf*, *Sz*, *S. acutus* f. *costulatus* (CHOD.) UHERKOV.—*Tkf*, *S. ecornis var. disciformis* CHOD.—*Tf*, *Tkf*, *Sz*, *S. intermedius* var. *bacaudatus* HORTOB.—*Tkf*, *EMC*, *S. intermedius* var. *bicaudatus* HORTOB.—*Tkf*, *B*, *EMC*, *S. quadricauda* var. *maximus* W. et G. S. WEST—*Tkf*, *Sz*, *EMC*, *S. quadricauda* var. *setosus* KIRCH.—*Sz*, *Tetraedron caudatum* var. *incisum* LAGERH.—*Tkf*, *B*, *T. minimum* var. *apiculato-scrobiculatum* (REINSCH, LAGERH.) SKUJA—*Tkf*, *EMC*, *Tetrastrum heteracanthum* (NORDST.) CHOD.—*EMC*, *T. punctatum* (SCHMIDLE) AHLSTR. et TIFF.—*Tkf*, *T. triacanthum* var. *abundans* KORSCHIK—*Tkf*, *EMC*, *Closterium acutum* var. *variabile* (LEMM.) KRIEG.—*B*, *EMC*, *C. leibleinii* KÜTZ.—*Tf*, *Staurastrum punctulatum* BRÉB.—*Tkf*.

Searching into the causes of the quantitative and qualitative changes in the algal population, we may emphasise the following points of view.

In the reaches between Tiszacsécse and Vásársonamény the cause of the low number of algae may be the higher water speed. Here is the phytoseston of rheoplankton-character. In the reaches at Vásárosnamény and lower the water speed is no more a high one in the time of the low waters in Autumn, then there is an opportunity for the multiplication of planktonic forms.

The development of the rich algal association in the Tisza was unequivocally released by the inflow of the Szamos. It is to be supposed that vegetable nutritive materials were transported by the Szamos into the Tisza where the plankton-algae coming from the Szamos began to multiply quickly. This quick multiplying was promoted by that these suspended loads could depose from the slowly flowing water of the Tisza, the light climate of water was therefore, favourable. The transparence of water ($T_{K\ 0,2-1,2\ m}$) is great, its value is corresponding to the clear water of the Balaton (FELFÖLDY and KALKÓ 1958, ENTZ and FILLINGER 1961). Parallel with the quick multiplication of algae, the dissolved-oxygen content became, of course, higher, as well (Tab. 2).

Table 2. *Some data of water quality in the Tisza and in Eastern Main Canal (24—29 August 1973)*

Sampling points	River length in km	Sampling date	Water temp. C°	O_2 mg	O_2 in p. c.	TK p. c. 0,2—1,2 m	Secchi-s disc transparency in/cm	Total number of algae 1000 ind/
1	732	Aug. 24.	20	12,5	136	71	140	266
2	710	24	20	11,9	130	69	136	259
3	696	25	20	12,1	132	70	130	277
4	684	25	22	11,0	125	64	85	8 370
5	657	26	20	12,9	140	65	70	10 560
6	630	26	20	13,7	150	58	75	17 780
7	605	27	20	12,0	132	63	78	18 350
8	580	27	20	13,7	150	65	80	18 590
9	550	28	20	12,0	132	62	70	3 540
10	535	28	23	10,4	120	58	65	1 150
11	5	29	20,5	8,3	90	52	62	635
12	25	29	21,5	8,3	92	50	56	580
13	45	29	22	8,9	100	52	60	765

The cause of the impoverishment in the periphery of Tokaj may be partly the depletion of nutritive materials, partly the decrease in water transparence and partly the diluting effect of the Bodrog water, poor in algae. It wants more investigations to decide this problem in a more precise way.

On the basis of the data of UHERKOVICH (1968b, 1971) and of the results of our own investigations it may be established, to sum up, that in the upper regions of the Tisza, below the inflow of the Szamos, in case of low water, at the end of Summer, in Autumn, rich phytoplankton associations may develop. We can observe some cases when this rich population goes on with growing, in the reaches between Záhony and Dombrád it achieves the maximum value of individual number, in the lower bed regions, however, it becomes poorer. The causes of this change could not be duly cleared up, as yet, it is however doubtless that the small water speed, the degree of supply with nutritive material and light take a part in it.

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TAXONOMISCH-ÖKOLOGISCHE ÜBERSICHT DER CHLORPHYTEN-, RHODOPHYTEN-, SCHIZOMYCOPHYTEN- UND MYCOPHYTEN-ORGANISMEN DER TEIß (TISZA) UND IHRER NEBENGEWÄSSER

G. UHERKOVICH

Hydrobiologisches Laboratorium der Akademischen Zentrale der UAW, Pécs

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Auszug

Der Verfasser hat die limnologisch-algologischen Verhältnisse der Theiß (Tisza), des größten Nebenflusses der Donau, zwischen den Jahren 1957 und 1968 untersucht. Diese Untersuchung wollte den vor der Anlegung des Theiß-II Reservoirs vorhandenen limnologisch-algologischen Zustand der Gesamtlänge des Flusses in Ungarn ausführlich festsetzen. Dies geschah zunächst in der Form von Längenprofiluntersuchungen und die Wasserproben wurden außer der qualitativ-taxonomischen Analyse auch quantitativ bearbeitet. Das Letztere geschah mit der UTERMÖHLischen Methodik.

Der Hauptzweck der Zönosenanalysen war, die Planktonalgen-Assoziationen der Theiß, ihren Dynamismus, ihre räumlichen und zeitlichen Veränderungen und den Indikator-Charakter dieser Veränderungen aufzudecken.

Die Vorkommensangaben und die ökologischen Umstände der im Laufe dieser Forschungsarbeit beobachteten Algen werden in einer Schriftenreihe veröffentlicht, nach deren bisher erschienenen Teilen (UHERKOVICH 1969, 1971, 1972) diese Reihe mit der gegenwärtigen Abhandlung geschlossen wird.

Diese Abhandlung gewährt eine Übersicht über in der Theiß gefundene und ihren Vorkommensverhältnissen gemäß detailliert analysierte 287 Chlorophyten-Organismen. In dieser Übersicht finden wir bei den Taxons Angaben von der Vorkommensstätte (bezeichnet mit den einzelnen Flußstrecken), der Häufigkeit und dem biotopischen Charakter des Vorkommens, dem eventuellen saprobiologischen und halobitischen—salinitischen Indikationswerte des Taxons, in der Form entsprechender Abkürzungen. In derselben Form gibt die Abhandlung die Übersicht der vom Verfasser in der Theiß gefundenen 6 Rhodophyten-, 4 Schizomycophyten- und 15 Mycophyten-Organismen.

Einleitung

Neben den in den Algenassoziationen der Flüsse der gemäßigten Zone in der Mehrzahl der Fälle dominierenden Kieselalgen ragen die zum Stamm der Grünalgen (Chlorophyten) und innerhalb jenes zur Klasse der Grünalgen (Chlorophyceae) gehörenden Organismen in erster Reihe mit ihren Gattungs- und Individuenzahlen hervor. Diese Organismen erbringen in der Mehrzahl der bearbeiteten Wasserproben gut verwendbare Angaben für die Beurteilung des Saprobitäts- und Trophitätsniv für den aktuellen Flußzustand.

Gegenüber den Tropenflüssen, in denen die Klasse der Jochalgen (Conjugato—phyceae) am meisten sehr abwechslungsreich vertreten ist, ist diese Klasse in den Flüssen der gemäßigten Zone nur in einer kleineren Gattungs- und Individuenzahl anwesend. Die Rotalgen (Rhodophyten) kommen in unseren Flüssen in der Form fixierter oder abgerissener Lager (Thalli), Thallus-Stücke selten vor. Von den Organismen der Schizomycophyten- und Mycophytenstämme pflegen wir im allgemeinen nur die im Laufe der üblichen Planktonverarbeitungsmethoden beobachteten Organismen als die Mitglieder der Mikrophytenassoziationen der Flüsse anzuführen. Dies geschieht so auch in der anwesendnen Bearbeitung.

Ich führe die gefundenen Taxons innerhalb der größeren systematischen Gruppen in alphabetischer Reihe an. Der Vorkommensort wird unmittelbar nach dem Namen mit den folgenden Abkürzungen bezeichnet:

Oberlauf der Theiß in Ungarn (Tiszabecs—Vásárosnamény)	*Tf*
Oberer Teil des Mittellaufs der Theiß (Vásárosnamény—Tiszalök)	*Tkf*
Unterer Teil des Mittellaufs der Theiß (Tiszalök—Szolnok)	*Tka*
Unterlauf der Theiß (Szolnok—Szeged)	*Ta*
Östlicher Hauptkanal	*Ke*
Laborc (Laborec)	*L*
Ondava	*O*
Tapoly (Topl'a)	*To*
Bodrog	*B*
Hernád	*H*
Tarca (Torysa)	*Tr*
Sajó (Slana)	*S*
Zagyva	*Z*
Szamos	*Sz*
Kőrös	*K*
Maros	*M*

Nach dem Vorkommensort (nach den Orten) bezeichne ich die Häufigkeit des Vorkommens auf folgende Weise: Selten, sporadisch I, häufig genug II, häufig III, sehr häufig IV, häufig genug, manchmal massenweise V, häufig, manchmal massenweise VI. Die letzteren beiden Bezeichnungen wende ich auf die auch Massenproduktionen bildende Organismen an.

Bezüglich des ökologischen Spektrums der Organismen wird der biotopische Ursprung durch die folgenden Abkürzungen gegeben: schwebend, planktonisch *pl*, benthisch (als eine allgemeine Bezeichnung), *b*, lithophil (steinansässig)*lph*, plakophil (kiesansässig) *pk*, psammophil (sandansässig) *ps*, pelophil (schlammansässig) *ps*, periphytisch (belegbildend) *pr*, epibiontisch (Lebewesen-ansässig) *ep*. Die Abkürzung in Klammern: *(pl)* bedeutet, daß dieser Organismus sekundär auch im Plankton vorkommt, ein tychoplanktonisches Element ist.

Die saprobiologischen Indikationswerte — wo diese mit geeigneter Sicherheit gegeben werden können — werden durch die folgenden Abkürzungen bezeichnet: Oligosaprobiont *o*, beta—mesosaprobiont *β—m*, alpha—mesosaprobiont *α—m*, polysaprobiont *p*.

Die Bezeichnung der Halobitätsindikation (Salinitätsindikation, Salztoleranz, Salzanspruch) ist: Lebend nur in Süßwasser, limnisch *l*, lebend in Süßwasser und in mäßigem Salzwasser, euryhalin-limnisch *ehl*, lebend sowohl in Süßwasser als auch in mäßigem und kozertrierterem Salzwasser, limnisch-euryhalin-lebend in Brackwasser *ehl-br*, lebend nur in Gewässern höheren Salzgehalts, in Brackwasser *br*.

CHLOROPHYTA

Chlorophyceae

Ich basiere die taxonomische und ökologische Bearbeitung der Klasse in erster Reihe auf die angeführten Werke der folgenden Verfasser: BOURRELLY (1966), FOTT (1971), KOMÁRKOVÁ—LEGNEROVÁ (1969), HEERING (Süßwasserflora 6,7), HOEK (1963), HORTOBÁGYI (1962, 1963, 1967), HUBER—PESTALOZZI (1961), FOTT—NOVÁKOVÁ (1969), KORSCHIKOW (1953), LEMMERMANN—BRUNNTHALER—PASCHER (Süßwasserflora 5,) PASCHER (Süßwasserflora 4), PRESCOTT (1962), SKUJA (1946, 1956, 1964), REHÁKOVÁ (1969), SMITH (1920, 1924), SULEK (1969), TEILING (1946), UHERKOVICH (1959, 1961a, 1961b, 1966a, 1966b, 1966c, 1971).

Einige andere Werke konnte ich erst nach der Abfassung des Manuskripts und nur in einigen Beziehungen in Betracht nehmen: HINDÁK (1962, 1970), PHILIPOSE (1967), RINO (1972), SODOMKOVÁ (1972).

Actinastrum LAGERHEIM 1888

A. hantzschii LAGERH. Tf, Tkf, Tka, Ta, Ke, Sz, M. B, — IV — pl—o—β—m—1
A. hantzschii var *fluviatile* SCHROEDER Tka, Ta, Ke — I—pl—o—β—m — 1
A hatzschii var. *gracile* ROLL Ke — I — pl.— o — β—m — 1
A. rhaphidioides (REINSCH) BRUNNTH. K—I — pl — 1

Ankistrodesmus CORDA 1838

A. acicularis (A. BR.) KORSCHIK. (=A. falcatus (CORDA) RALFS. var. acicularis (A. BR.) G. S. WEST) Tf, Tkf, Tka, Ta, Ke, B, K — IV, — pl — —β—m — 1
A. acicularis var. *mirablis* (W. et G. S. WEST) KORSCHIK. (=A. falcatus (CORDA) RALFS var. mirabilis W. et G. S. WEST) Tf — I—pl — 1
A. angustus BERN. Tf, Tkf, Tka, Ta, Ke, Sz, B, M — IV —bpr, pl — β—m — 1
A. arcuatus KORSCHIK. Tf, Tkf, Tka, Ta, Ke — II— b, pr, pl — 1
A. braunii (NAEG.) BRUNNTH. Tka, Ta — I — b, pr, pl — 1.
A. falcatus (CORDA) RALFS Tf, Tkf, Tka, Ta, Ke, Sz, M, K — III — b, pl — β—α—m — 1.
A. fusiformis CORDA (=A. falcatus (CORDA) RALFS var, radiatus (CHOD.) LEMM.) Ta — I — pl — 1
A. longissimus (LEMM.) WILLE var. *acicularis* (CHOD.) BRUNNTH. (incl. A. falcatus (CORDA) RALFS var. tumidus (W. et G. S. WEST) G. S. WEST) Tt, Tkf, Tka, Ta, Ke, Sz, B — II — pl — β—m ? — 1
Ankistrodesmus sp. Tf, Tkf, Tka, Ta, Ke, M — II — pl

Botryococcus KÜTZING 1849

B. braunii KÜTZ. Ta — I — b, pr, pl — o — β—m — ehl
B. micromorus W. et G. S. WEST Ta — I — b, pl — ehl?

Carteria DIESING 1866

C. ellipsoidalis BOLD Ta — I — pl — β—m ? — 1
Carteria sp. Tf, Tka, Ta — I — pl

Chlamydomonas Ehrenberg 1833

Ch. conferta Korschik. Ta — I — pl. — 1
Ch. dangeardii Chimel. B — I — pl—α—m ? — 1
Ch. intermedia Chod. Ke — I — pr, pl — 1
Ch. praecox Pascher Tkf — I — pl — α—m ? — 1
Ch. reinhardii Dang. Tkf, Tka, Ta, Ke, B — II — pl. —α—m — 1
Ch. simplex Pascher Tkf, — I — pl — α—m — p — 1
Ch. snowiae Printz (= Ch. communis Snow) Ta — I — pl — β—m ? — 1
Ch. subcylindracea Korschik. Tka — I — pl
Ch. umbonata Pascher Tkf — I — pl
Chlamydomonas sp. Tf, Tkf, Tka, Ta, Ke, B, S, L, M — III —pl

Chlorococcum Meneghini 1842

Ch. humicolum (Naeg.) Rabenh. Ta — I — b, pe, ps (pl) — β—m — 1

Chlorogonium Ehrenberg 1835

Ch. elongatum Dang. Tkf, Ta, — II — pl. — α—m — 1

Chodatella Lemmermann 1898

Ch ciliata Lemm. (= Lagerheimia ciliata (Lemm.) Printz.) Ta — I — pl — β—m — 1
Ch. citriformis Snow (= Lagerheimia citriformis (Snow) G. M. Smith) Ke, Tka, Ta — I — b, pl — 1
Ch. longiseta Lemm. (= Lagerheimia longiseta (Lemm.) Printz) Tkf, Tka, — I — pl —1

Cladophora Kützing 1843

C. glomerata Kütz. Tf, Tkf, Tka, Ta, S, Z, O, Tr, — II — b, lph, pr (pl) — o —β—m — 1

Coelastrum Naegeli 1849

C. cambricum Arch. (= C. pulchrum Schmidle) Tka, Ta — II — pl — 1
C. cubicum Neag. Tkf, Tka, Ta, Ke — V — b, pr, pl — β—m —1
C. microporum Naeg. Tf, Tkf, Tka, Ta, Ke, Sz, K, B — IV — b, pr, pl — β—m — 1
C. retuculatum (Dang.) Senn Tkf, Ke — I — b, pl — 1
C. scabrum Reinsch. var. *torbolense* Kirchner Ta — I — pl — 1
C. speciosum (Wolle) Brunnth. (= C. microporum (Wolle) Brunnth. var. speciosum Wolle) Tf — I — b (pl) — 1
C. sphaericum Naeg. Tkf, Tka, Ta, Ke, M — III — b, pr, pl — o — β—m?—1

Coleochaete Brébisson 1844

C. divergens Pringsh. Tf, Tkf, — I — b, pr (pl) — o — β—m ? — 1

Coenocystis KORSCHIKOV 1953

C. obtusa KORSCHIK. Tkf, Ke ,— I — pl —
C. planctonica KORSCHIK Ta — I — pl — 1
C. reniformis KORSCHIK. var. *tiszae* UHERKOV. Tka, Ta — I — pl — 1

Crucigenia MORREN 1903

C. apiculata SCHMIDLE (= Tetrastrum apiculatum (LEMM.) SCHMIDLE; Staurogenia apiculata LEMM.) Tf, Tkf, Tka, Ta, Ke, Sz, K — IV — pl — β—m — 1
C. quadrata Morren Tkf, Ka, Ta, Ke, B, K — IV — pl — β—m — 1
C. rectangularis Gay Tka, Ta, Ke, K, B, — I — pl — 1
C. tetrapedia (KIRCHNER) W. et. G. S. WEST Tkf, Tka, Ta, Ke, K — IV — pl — β—m — 1

Dictyosphaerium NAEGELI 1849

D. ehrenbergianum Naeg. Tka, Ta, K — I — pl — 1
D. pulchellum WOOD Tkf, Tka, Ta, Ke, Sz, B, K — IV — pl — β—m — 1
D. reniforme BULNHEIM Tka, Ta — I — pl — 1

Didymocystis KORSCHIKOV 1953

D. inconspicua KORSCHIK. Tka, Ta — I — pl — 1
D. planctonica KORSCHIK. Tka, Ta — I — pl — 1
D. tuberculata KORSCHIK. Tka, Ta — I — pl — 1

Draparnaldia BORY 1808

D. glomerata (VAUCH.) AGH. Tf, Tkf, Ta — I — lph, pk, pr (pl) — o —1

Dimorphococcus A. BRAUN 1855

D. lunatus Wolle Ke — I — pl — 1

Elakothrix WILLE 1898

E. acuta PASCHER Tka — I — pl — 1

Errerella CONRAD 1913

E. bornhemiense CONRAD (= *Micractinium bornhemiense* (CONRAD) KORSCHIK.) Tkf, Tka, Ta, Ke, B, K — II — pl — 1

Eudorina EHRENBERG 1831

E. charkowiensis PASCHER Tkf, Tka, Ta, Ke, B, Z, M — IV — pl — β—m — 1
E. cylindrica KORSCHIK. Tka, Ta — I — pl
E. elegans EHRBG. Tf, Tkf, Tka, Ta, Ke, Sz, B, Z, M, O — IV — pl — β—m — 1
E. illinoisensis (KOFOID) PASCHER (=Pleodorina illinoisensis KOFOID) Tkf, Tka, Ta, Ke, K, Z — III — pl — 1
E. unicocca G. M. SMITH Tkf, Ta — I — pl — 1

Eutetramorus WALTON 1918 (=Coenococcus KORSCHIKOV 1953)

E. planctonicus (KORSCHIK.) BOURR. (=Coenococcus planctonicus KORSCHIK.) Sz — I — b, pr, pl — 1

Franceia LEMMERMANN 1898

F. tenuispina KORSCHIK Tkf, Tka, Ke — I — pl — 1

Gloeocystis NAEGELI 1849

G. ampla KÜTZ. Tkf, Ta — I — b, lph, pr (pl) — 1

Golenkiniopsis KORSCHIKOV 1953

G. solitaria KORSCHIK. M — I — pl — 1

Gonatoblaste HUBER 1892

G. rostrata HUBER Tkf — I — pr, ep (pl) — 1

Gonium MÜLLER 1773

G. pectorale MÜLLER Tkf, Tka, Ta, Ke, Sz, B, Z — II — pl — β—α—m — 1

Hofmania CHODAT 1900

H. lauterbornii (SCHMIDLE) WILLE (=Crucigenia lauterbornei (SCHMIDLE) KORSCHIKOV; Staurogenia lauterbornei SCHMIDLE) Tkf, Tka, Ta, Ke — I — pl — 1

Hormidium KÜTZING 1845 (=Chlorohormidium FOTT 1960)

H. flaccidum A. BRAUN (=Chlorohormidium flaccidum (A. BRAUN) FOTT) Tf — I — b, lph, pk, pr, (pl) — 1
H. rivulare KÜTZ. (=Chlorohormidium rivulare (KÜTZ.) FOTT) Tf, Ta — I — b, lph, pk, pr (pl) — 1

Hyalorhaphidium PASCHER et KORSCHIKOV 1931

H. contortum PASCHER et KORSCHIK. Ke — I — pl — 1

Hyalogonium PASCHER 1927

H. klebsii PASCHER Ta — I — pl — 1

Hydrodictyon ROTH 1800

H. reticulatum (L.) LAGERH. Tf, Tkf, Z — I — b, pl — o — β—m — 1

Juranyiella HORTOBÁGYI 1962

J. javorkae HORTOB. Tka, Ta, — I — b, pl

Kirchneriella SCHMIDLE 1893

K. lunaris (KIRCHNER) MOEBIUS Tf, Tkf, Tka, Ta, Ke, K — II — pl — — β—m — 1
K. obesa (W. WEST) SCHMIDLE (= Selenastrum obesum W. WEST) Tf, Tkf, Tka, Ta, Ke, Sz, K — II — pl — β—m — 1
K. subsolitaria G. S. WEST Tka, Ta — I — b, pl

Lagerheimia CHODAT 1895

L. genevensis CHOD. Tka, Ta — I — pl
L. guadriseta (LEMM.) G. M. SMITH Ta, Ke — I — pl — 1
L. wratislaviensis SCHROED. Tkf, Tka, Ta, Ke — II — pl — 1

Lambertia KORSCHIKOV 1953

L. issajevii (KISSEL.) KORSCHIK. var. *spinosa* KORSCHIK. (= Characium issajevii KISSEL.) Ta — I — pl —
L. ocellata KORSCHIK. (= Characium ocellatum KORSCHIK.) Tka, Ta — I — pl — 1
L. ocellata var. *maxima* UHERKOV. Tka, Ta — I — pl — 1

Micractinium FRESENIUS 1858 (= Richteriella LEMMERMANN 1896)

M. pusillum FRES. (= Richteriella botryoides LEMM.; Golenkinia botryoides SCHMIDLE) Tkf, Tka, Ta, Ke, B, K, — IV — pl — β—m — 1

Microspora THURET 1850

M. tumidula HAZEN Tf, Tkf, — I — b, lph, pr, pl — o — β—m — 1

Microthamnion NAEGELI 1849

M. kützingianum NAEG. Tf, Tkf, — I — b, pr (pl) — β—m — 1
M. strictissimum RABENH. Tf, Tkf — I — b, pr (pl) — 1

Nephrochlamys KORSCHIKOV 1953

N. subsolitaria (G. S. WEST) KORSCHIK. (=Kirchneriella subsolitaria G. S. WEST) Ta — I — pl — 1

Nephrocytium NAEGELI 1849

N. agardhianum SCHROED. Tka, Ta — I — b, pl
N. agardhianum var. *szolnokiense* UHERKOV. Tkf, Tka, — I — b, pr, — pl — 1

Oedogonium LINK 1820

Oedogonium sp. Tf, Tkf, Tka, Ta, Ke, O — II — b (pl) — 1

Oocystis NAEGELI 1855

O. borgei SNOW (=O. gigas ARCHER var. borgei (SNOW) BRUNNTH.) Tf, Tkf, Tka, Ta, Ke, B, K, M — IV — b, pl — β—α—m ? — 1
O. marssonii LEMM. Tkf, Tka, — I — pl — 1
O. novae-semliae WILLE Ta — I — pl — 1
O. submarina LAGERH. B — I — pl — ehl — br
Oocystis sp. Tf, Tkf, Tka, Ta, Ke — II — pl

Palmella LYNGBYE 1819

P. microscopica KORSCHIK. Tkf — I — pl — 1

Pandorina BORY 1824

P. morum (MÜLLER) BORY Tf, Tkf, Tka, Ta, Ke, Sz, B, Z, K, M — IV — pl — β—α—m — 1

Pediastrum MEYEN 1829

P. boryanum (TURP.) MENEGH. Tf, Tkf, Tka, Ta, Ke, Sz, B, S, Z, K, M — IV — b, pl — β—α—m — 1
P. duplex MEYEN Tf, Tkf, Tka, Ta, Ke, B, Sz, Z, L, K — IV — b, pl — β—α—m — 1
P. kawraiskyi SCHMIDLE Ke — I — pl — 1

P. muticum KÜTZ. K — I — b, pl — 1
P. pearsoni G. S. WEST Tka — I — pl
P. simplex (MEYEN) LEMM. Tkf, Tkam Ta, Ke, Z, K — III — b, pl — — β—m — 1
P. tetras (EHRBG.) RALFS Tka, Ta, Ke, Sz, K, M, — III — b, pl — — β—m — 1

Pleodorina SHAW 1894

P. californica SHAW Tkf, Tka — I — pl

Polyedriopsis SCHMIDLE 1898

P. spinulosa SCHMIDLE Ta — I — pl — 1

Polytoma EHRENBERG 1832

P. obtusum PASCHER Tf — I — pl — 1

Prasiola AGARDH 1821

P. crispa (LIGHTF.) MENEGH. Tf, Tkf, Tka, Tr — I — b, lph, pk (pl) — 1
P. muralis (KÜTZ.) WOLLE Tf, — I — b, lph, pk (pl) — 1

Radiofilum SCHMIDLE 1897

R. flavescens G. S. WEST Tf, To — I — b, lph, pk (pl) — 1

Rhaphidonema LAGERHEIM 1892

R. spirotaenia (G. S. WEST) KORSCHIK. Ta — I — pl — 1

Scenedesmus MEYEN 1829

S. acuminatus (LAGERH.) CHOD. (incl. S. falcatus CHOD.) Tf, Tkf, Tka, Ta, Ke, Sz, M — IV — b, pl — β—α—m — 1
S. acuminatus var. *bernardii* (G. M. SMITH) DEDUSS. Tkf, Tka, Ke — I — pl — 1
S. acuminatus var. *elongatus* G. M. Smith Tkf, Tka, Ta, Ke, Sz, — I — pl — 1
S. acuminatus f. *maximus* UHERKOV. Ta — I — pl — 1
S. acuminatus f. *tortuosus* (SKUJA) UHERKOV. Ta — I — pl — 1
S. acutiformis SCHROEDER Tf, — I — b, pl — 1
S. acutus MEYEN Tf, Tkf, Tka, Ta, Ke, Sz, Z, K, M — IV — b, pe, ps, pl — β—α—m — 1
S. acutus f. *alternans* HORTOB. M — I — b, pl — 1

S. acutus f, *costulatus* (CHOD.) UHERKOV. Tkf, Tka, Ta, Sz, M, — II — b, pe, ps, pl — β—α—m — 1
S. anomalus (G. M. SMITH) TIFF. Tkf, Tka, Ta, — I — pl — 1
S. anomalus-var. *acaudatus* HORTOB. Tkf, Tka, Ta, M — I — pl — 1
S. apiculatus (W. et G. S. WEST) CHOD. Ta — I — b, pe, ps, pl — 1
S. arcuatus LEMM. Tkf, Tka, Ta, — I — b, pl — 1
S. armatus CHOD. Tkf, Tka, Ta, Ke, L — II — b, pe, pr, pl — 1
S. armatus var. *bicaudatus* (GUGL.—PRINTZ) CHOD. Tkf, — I — pl — 1
S. armatus var *boglariensis* HORTOB. f. *semicostatus* HORTOB. Tkf — I — pl — 1.
S. bicaudatus (HANSG.) CHOD. Tkf, Tka, Ta, K — I — pl — 1
S. circumfusus HORTOB. forma Ta — I — pl — 1
S. circumfusus var. *bicaudatus* HORTOB. f. *granulatus* HORTOB. Ta, B — I — b, pl — 1
S. denticulatus LAGERH. Tf, Tkf, Tka, Ta, Ke, B, K — III — b, pr, pl — β—m — 1
S. denticulatus var. *linearis* HANSG. Tf, Tkf, Tka, Ta, Ke, B — II — b, pr, pl — β—m — 1
S. dispar BRÉB. Ta, K — I — b, pl — 1
S. ecornis (RALFS) CHOD. Tkf, Tka, Ta, B, K, M — III — b, pe, pr, pl — β—α—m — 1
S. ecornis var. *disciformis* CHOD. Tkf ,Tka, Ta, Ke, Sz — II — b, pe, pr, pl — β—α—m — 1
S. ellipsoideus CHOD. Tkf, Tka, Ta — I — pl — 1
S. ellipsoideus var. *flagellispinosus* UHERKOV. Tka — I — pl
S. granulatus W. et G. S. WEST Tf, Tkf, Tka, Ta, Ke, M — III — b, pe, pr, pl — β—α—m — 1
S. gutwinskii CHOD. Tkf, Ke — I — pl — 1
S. gutwinskii var. *bacsensis* UHERKOV. Tkf, Tka, B — I — pl — 1
S. intermedius CHOD. Tf, Tkf, Tka, Ta, Ke, Sz, B, K, M — IV — b, pe, pr, pl — β—m — 1
S. intermedius var. *acaudatus* HORTOB. Tkf, Tkam Ta — II — pl — 1
S. intermedius var. *balatonicus* HORTOB. Ta — I — pl — 1
S. intermedius var. *bicaudatus* HORTOB. Tkf ,Tka, Ta — II — b, pl — 1
S. microspina CHOD. Tf — I — b, pl — 1
S. opoliensis P. RICHT. Tf, Tkf, Tka, Ta, Ke, Sz, B, Z, L, K, M — IV — pl — β—α—m — 1
S. ovalternus CHOD. var. *graevenitzii* (BERNARD) CHOD. Tf — I — b, pe, pr, pl — 1
S. protuberans FRITSCH Tka,Ta, Ke — III — pl — 1
S. protuberans f. *danubianus* UHERKOV. Ta — I — pl — 1
S. quadricauda (TURP.) BRÉB. Tf, Tkf, Tka, Ta, Ke, L, B, K, M, — IV — b, pl — β—m — 1
S. quadricauda var. *longispina* (CHOD.) G. M. SMITH Tkf, Tka, Ta — I — pl — 1
S. quadricauda var. *longispina* f. *asymmetrica* (HORTOB.) UHERKOV. K — I — pl — 1
S. quadricauda var. *quadrispina* (CHOD.) G. M. SMITH Tkf, Tka, Ta, L, Z — I — pl — 1
S. soói HORTOB. Tf, Tkf, Tka, Ta, Ke, Sz, B — II — pl — 1
S. soói var. *tiszae* UHERKOV. Ta — I — pl — 1
S. speciosus HORTOB. f. *bicaudatus* UHERKOV. Tka, Ta — I — pl — 1
S. spicatus W. et G. S. WEST forma Ta — I — pl — 1
S. spinosus CHOD. (incl. S. tenuispina CHOD.) Tf, Tkf, Tka, Ta, Ke, Sz, B, M — IV — b, pr, pl — o — β—m — 1
S. spinosus var. *bicaudatus* HORTOB. Tkf, Tka, Ta, Ke — II — b, pl — 1
S. tibiscensis UHERKOV. Tf — I — b, ps, pl — o — β—m ? — 1

Schizochlamys A. BRAUN 1849

S. gelatinosa A. BR. Ta — I — b (pl) — 1

Schroederia LEMMERMANN 1898

Sch. robusta KORSCHIK Ta — I — pl — 1
Sch. setigera (SCHROED.) LEMM. Tkf, Tka, Ta, Ke, B — III — pl — 1 — β—m

Selenastrum REINSCH 1867

S. bibraianum REINSCH Tka, Ta, Z, K, — II — b, pl — 1
S. gracile REINSCH Tf, Tkf, Tka, — Ta — II — b, pl — 1
S. minutum (NAEG). COLLINS Tf — I — b, pl — 1

Siderocelis FOTT 1934

S. ornata FOTT Tkf, Tka, Ta, Ke — II — pl — 1

Siderocystopsis SWALE 1964

S. fusca (KORSCHIK) SWALE (= Siderocystis fusca KORSCHIK.) Tak, Ta — I — pl, — 1

Sphaerocystis CHODAT 1897

S. planctonicus (KORSCHIK) BOURR. (= Palmellocystis planctonica KORSCHIK) Tka, Ke — I — pl — 1
S. schroeteri CHOD. (= Gloeococcus schroeteri (CHOD.) LEMM.) Tf, Tkf, Tka, Ta — II — pl — 1
S. sphaerocystiformis (KORSCHIK.) BOURR. (= Planctococcus sphaerocystifomris KORSCHIK.) Ta — I — pl — 1

Stigeoclonium KÜTZING 1843

S. amoenum KÜTZ. Tkf, — I — lph, pk (pl) — 1
S. longipilum KÜTZ. Tf — I — lph, pk (pl) — 1
S. lubricum KÜTZ. Tf, Tkf, Tka, Ke, S, O, Tr, — II — b, lph (pl) — β—m — 1
S. protensum KÜTZ. Tf — I — b, lph, pk, (pl) — 1
S. subsecundum KÜTZ. Tkf, — I — b, lph, pk (pl) — 1
S. subuligerum KÜTZ. Tf — I — b, lph, pk (pl) — 1
S. tenue KÜTZ. Tf, Tkf, Ta, O, L, Tr — II — b, lph, pk (pl) — β—α—m — 1
Stigeoclonium sp. Tf — I — b, lph, pk (pl) — 1

Tetradesmus G. M. SMITH 1913

Tetradesmus sp. Tak, Ta — I — b, pl

Tetraädron KÜTZING 1845

T. caudatum (CORDA) HANSG. Tf — I — b, pr, pl — β—m — 1
T. caudatum var. *incisum* LAGERH. Tkf, Tka, Ta, Ke — II — b, pr, pl — β—m — 1
T. constrictum G. M. SMITH Tkf, — I — b, pl
T. hastatum (RABENH.) HANSG. Tf, Tkf, Tka, — I — pl — 1
T. incus (TEILING) G. M. SMITH (= T. regulare KÜTZ. var. incus TEILING) Tkf, Tka, Ta, K — I — pl — 1
T. longispinum (PERTY) HANSG. Ke — I — pl — 1
T. minimum (A. BR.) HANSG. Tka, Ta, Ke — II — b, pl — β—m — 1
T. muticum (A. BR.) HANSG. Tka, Ta, Ke — I — b, pl — 1

Tetrallantos TEILING 1916

Tetrallantos sp. (T. lagerheimii TEILING forma?) Ta — I — pl — 1

Tetraselmis STEIN 1878 (= Platymonas G. S. WEST 1916)

T. cordiformis STEIN (= Platymonas cordiformis (N. CATER) KORSCHIK) Ke — I — pl — 1

Tetrastrum CHODAT 1895

T. glabrum (ROLL) AHLSTR. et TIFF. (= T. staurogeniaeforme (SCHRÖD.) LEMM. var. glabrum Roll) Tka, Ta, Ke — II — b, pl — β—m ? — 1
T. hastiferum (ARNOLDI) KORSCHIK. (= Crucigenia hastifera ARNOLDI) Tf — I — b, pl — 1
T. heteracanthum (NORDST.) CHOD. forma Ta — I — pl
T. punctatum (SCHMIDLE) AHLSTR. et TIFF. Tka, Ta — I — pl — 1
T. staurogeniaeforme (SCHROED.) LEMM. (= Cohniella staurogeniaeformis SCHROED.) Tf, Tkf, Tka, Ta, Ke, M — III — b, pl — β—m — 1
T. triacanthum KORSCHIK. Ta — I — pl — 1

Ulothrix KÜTZING 1836.

U. aequalis KÜTZ. Tf — I — b, lph, pk, pr (pl) — 1
U. moniliformis KÜTZ. Tf — I — b, lph, pk (pl) — 1
U. oscillarina KÜTZ. Tkf — I — b, lph, pk (pl) — 1
U. subtilissima RABENH. Tf, Tkf, K — II — b, lph, pk, pr (pl) — 1
U. tenerrima KÜTZ. Tf, Tkf, Tka, Ta, Ke, Sz — III — b, lph, pk (pl) — β—m — 1
U. tenuissima KÜTZ. Tf, Tkf, Tka, Ta, Ke, Sz, B, O, T, L, Tr, M — IV — b, lph, pk, pr (pl) — o — β—m — 1

Tabelle 1. *Übersicht der im Phytoseston der Theiß gefundenen saprobiontischen Chlorophyceae-Taxons (Diejenigen mit unterstrichenen Namen sind für die wichtigsten Saprobionten anzusehen)*

	o β−m	α−m	P
1. *Draparnaldia glomerata*	++		
2. Ulothrix zonata	++		
3. Cladophora glomerata	+	++	
4. *Actinastrum hantzschii*	+	++	
5. Actinastrum hantzschii var. fluviatile	+	++	
6. Actinastrum hantzschii var. gracile	+	++	
7. Hydrodictyon reticulatum	+	+	
8. Microspora tumidula	+	+	
9. Botryococcus braunii	+	+	
10. Ulothrix tenuissima	+	+	
11. Volvox aureus	+	++	
12. Volvox globator	+	++	
13. *Scenedesmus spinosus*	+	++	
14. *Eudorina elegans*		++	
15. Kirchneriella obesa		+	
16. Ulothrix tenerrima		+	
17. Tetrastrum staurogeniaeforme		+	
18. Tetraëdron caudatum		+	
19. Tetraëdron caudatum var. incisum		+	
20. *Tetraëdron minimum*	++		
21. Stigeoclonium lurbicum	+		
22. Eudorina charkowiensis	+		
23. Microthamnion kützingianum	+		
24. Kirchneriella lunaris	+		
25. Chlorococcum humicolum	+		
26. Ankistrodesmus angustus	+		
27. Pediastrum tetras	+		
28. *Micractinium pusillum*	++	+	
29. Chodatella ciliata	+		
30. Coelastrum cubicum	+		
31. *Coelastrum microporum*	++	+	
32. Crucigenia apiculata	+	+	
33. Dictyosphaerium pulchellum	+		
34. Pediastrum simplex	+		
35. Crucigenia quadrata	+		
36. *Crucigenia tetrapedia*	++	+	
37. Scenedesmus denticulatus	+		
38. Scenedesmus denticulatus var. linearis	+		
39. Scenedesmus intermedius	+		
40. Scenedesmus quadricauda	++	+	
41. Stigeoclonium tenue	++	+	
42. *Scenedesmus opoliensis*	++	+	
43. Gonium pectorale	+	+	
44. Pandorina morum	++	+	
45. *Scenedesmus acuminatus*	++	+	
46. Scenedesmus acutus	+	+	
47. Scenedesmus acutus f. costulatus	+	+	
48. Ankistrodesmus acicularis	+	+	
49. Ankistrodesmus falcatus	+	+	
50. Pediastrum boryanum	++	+	
51. *Pediastrum duplex*	++	++	
52. Scenedesmus ecornis	+	+	
53. Scenedesmus ecornis var. disciformis	+	+	
54. Scenedesmus granulatus	+	++	
55. *Chlamydomonas reinhardii*		++	
56. Chlorogonium eleongatum		++	+
57. Chlamydomonas simplex		+	++

U. variabilis KÜTZ. Tkf, Sz — I — b, lph (pl) — 1
U. zonata KÜTZ. Tf, Tkf, Tka, Ta, Ke, Sz, L, Tr — III — b, lph (pl) — o — 1

Volvox LINNÉ 1758

V. aureus EHRBG. Tka, Ta, S, K — I — pl — o — β—m — 1
V. globator (L.) EHRBG. K — I — pl — o — β—m — 1

Von den in der Theiß und ihren Nebengewässern gefundenen 209 Chlorophyceae-Taxons können ungefähr 173 für primäre Planktonorganisationen angesehen werden. Halophytisch, halotolerant sind nur zwei: *Botryococcus braunii* und *Oocystis submarina.*

Die meisten Vorkommensangaben sind bei den folgenden Organismen zu finden: *Actinastrum hantzschii* (73 eingehend analysierte Vorkommensangaben), *Ankistrodesmus acicularis* (47), *A. angustus* (58), *Chlamydomonas* sp. (68), *Coelastrum microporum* (42), *Dictyosphaerium pulchellum* (62), *Eudorina charkowiensis* (42), *E. elegans* (112), *Micractinium pusillum* (49), *Oocystis borgei* (43), *Pandorina morum* (98), *Pediastrum boryanum* (117), *P. duplex* (113), *Scenedesmus acuminatus* (95), *S. acutus* (40), *S. intermedius* (41), *S, opoliensis* (86), *S. quadricauda* (74), *Ulothrix tenuissima* (41).

Von den 209 Taxons erweisen sich 57 als saprobiontisch. Die Anführung von diesen, sowie ihre Einreihung in das Saprobiontensystem vgl.: auf der beiliegenden Tabelle.

Conjugatophyceae

Bei der taxonomischen und ökologischen Bearbeitung der Klasse habe ich die folgenden Werke als Grundlage verwendet: BOURRELLY (1966), CZURDA (1932; in: Süßwasserflora), FOTT (1971), GRÖNBLAD (1960), KOSINSKAJA (1952, 1960), KRIEGER (1933—1939), LÁZÁR (1960), PRESCOTT (1962), RUZICKA (1953, 1957, 1964), SMITH (1924), THOMASSON (1959, 1965), UHERKOVICH (1966b), WEST—G. S. WEST (1904—1912), WEST—G. S. WEST—CARTER (1923). Nach der Abfassung des Manuskripts, bei dessen Revision, konnte ich noch die folgenden Werke teilweise nutzbar machen: RINO (1971), RUŽIČKA (1972, 1973).

Closterium NITZSCH 1817

C. acerosum (SCHRANK) EHRBG. Tf, Tkf, Tka, Ta, Ke, Sz, B, Z, S, Tr, L, O, K, M — IV — b, pr, pl — β—α—m — 1
C. acerosum var. *elongatum* BRÉB. Tkf, Ke, L — I — b, pl — β—α—m? — 1
C. acerosum var. *minus* HANTZSCH Tka, Ta, Z — I — n, pl — 1
C. acerosum var. *striatum* HILSE Ke — II — b, pl — β—α—m ? — 1
C. acerosum var. *tumidum* BORGE Tka, Ta — I — b, pl — 1
C. aciculare T. WEST Tkf, Tka, Ke, B — I — b, pl — o — β—m — 1
C. acutum BRÉB. Tf, Tkf, Tka, Ta, Ke — II — b, pr, pl — 1
C. acutum var. *ceratium* (PERTY) KRIEGER Ta — I — b, pl — 1
C. acutum var. *variabile* (LEMM.) KRIEGER Tkf, Tka, Ta — I — b, pl — 1

C. attenuatum EHRBG. Tf, Tkf, — I — b, pl
C. braunii REINSCH Tkf — I — b, pl — 1
C. dianae EHRBG. Tf, K — I — b, pl — 1
C. dianae var. *minus* (WILLE) SCHROED. Tkf, Tka — I — b, pr, pl — 1
C. ehrenbergii MENEGH. Tkf, Tka, Ke, K — II — b, pr, pl — β—m — 1
C. gracile BRÉB. Ta, Ke, B — I — b, pr, pl — 1
C. kützingii BRÉB. Tf — I — b, pr (pl) — 1
C. lanceolatum KÜTZ. Tkf, Tka, Ke — I — b, pl — 1
C. leibleinii KÜTZ. Tkf, Tka, Tr, K — I — b, pl — β—m—α — 1
C. limneticum LEMM. Tkf, Tka, Ta, Ke — II — pl — 1
C. lineatum EHRBG. Tkf, K — I — b, pr, pl — 1
C. littorale GAY Tkf, Tka, Ta — I — b, pr (pl) — 1
C. lunula (MÜLL.) NITZSCH. var *minus* W. et G. S. West Tf, Tkf, — I — b, pr (pl) — 1
C. macilentum BRÉB, Tkf, Tka, Ta, Ke — I — b, pr, pl — 1
C. moniliferum (BORY) EHRBG. Tf, Tkf, Tka, Ta, Ke, Sz, B, O, Tr, K — IV — b, pr, pl — β—m — ehl
C. moniliferum var. *concavum* KLEBS Tkf, Tka — I — b, pr, pl — 1
C. parvulum NAEG. Tf, Tkf, Tka, Ta, Ke, Sz, K — II — b, pr, pl — β—α—m — 1
C. pritchardiánum ARCHER Tf, Tkf, Tkam Ta, Ke, Sz, B, Z, K — II — b, pr, pl — 1
C. pritchardianum var. *maximum* NORDST. Tkf — I — b, pr, pl — 1
C. pritchardianum var. *oligo-punctatum* ROLL f. *maximum* UHERKOV. Ke — I — b, pr, pl — 1
C. pronum BRÉB. Tkf, Tka, Ta — I — b, pr, pl — 1
C. pseudolunula BORGE Tkf, Tka, Ta — I — u (pl) — 1
C. setaceum EHRBG. Tkf, Tka, Ta — I — b, pr, pl — 1
C. setaceum var. *elongatum* W. et G. S. WEST Tka, Ta — I — b, pr, pl — 1
C. strigosum BRÉB. (= C. peracerosum GAY) Tf, Tkf, Tka, Ta, Ke, L, K — III — b, pr, pl — β—α—m — 1
C. subulatum (KÜTZ.) BRÉB. Ta — I — b, pl — 1
C. tumidulum GAY Tf, Tkf, — I — b (pl) — 1
C. turgidum EHRBG. var. *giganteum* NORDST. Tkf, Ke — I — b, pr (pl) — 1

Cosmarium CORDA 1834

C. botrytis MENEGH Tf, Tkf, Sz — I — b, pr (pl) — β—m — 1
C. formosulum HOFFM. Tf — I — b (pl) — o (o — β—m ?) — 1
C. granatum BRÉB. Tf, Tkf, — I — b (pl) — 1
C. inconspicuum W. et G. S. WEST Tf — I — b (pl) — 1
C. obtusatum SCHMIDLE Tf, Tkf, Tka, Ke, Sz, B, M — III — b (pl) — β—m — 1
C. pygmaeum ARCH. Tf — I — b (pl) — 1
C. punctulatum BRÉB. Tf — I — b (pl) — 1
C. subcrenatum HANTZSCH Tkf, Tka, Ta, Ke, B — II — b (pl) — β—m ? — 1
C. subprotumidum NORDST. Tf, Tkf, Sz — I — b (pl) — 1
C. subtumidum NORDST. T — I — b (pl) — 1
C. turpini BRÉB. Tf, Tkf, Ke, B — II — b (pl) — o — β—m — 1
C. turpini var. *podolicum* GUTW. Tka — I — b (pl) — 1
C. umbilicatum LÜTKEM. Tf — I — b (pl) — 1
C. undulatum CORDA var. *crenulatum* (NAEG.) WITTR. Tf — I — b (pl) — 1

Desmidium AGARDH 1824

D. swatzii AGH. Tf — I — b, pl — 1

Gonatozygon DE BARY 1856

G. kinahanii (ARCH.) RABENH. Tf, Tkf, Ke — II — b, pl — o — β—m — 1
G. pilosum WOLLE Tf — I — b, pr, pl — o — β—m — 1

Genicularia DE BARY 1858

G. spirotaenia DE BARY Tf, Ke — I — b, pl — 1

Hyalotheca EHRENBERG 1840

H. dissiliens (SMITH) BRÉB. Tf, Tkf, Tka, Ta, K — II — b, pl — 1

Miscasterias AGARDH 1827

M. rotata (GREV,) *Ralfs* Tf — I — b, pl — 1
M. sol (EHRBG.) KÜTZ. Tf — I — b, pl — 1

Mougeotia AGARDH 1824

M. angustata HASSAL Ta — I — b (pl) — 1
M. scalaris HASSAL Tkf, — I — b (pl) — 1
M. sphaerocarpa WOLLE Z — I — b (pl) — 1
Mougeotia sp. Tkf, Tka, Ta, Ke — II — b (pl) 1

Spirogyra LINK 1820

Spirogyra sp. Tf, Tkf, Tka, Ta, Ke, Tr, To, O, L, s — III — b, pl — 1

Staurastrum MEYEN 1829

S. anatinum COOKE et WILLE forma Tka — I — b, pl
S. anatinum COOKE et WILLE var. *pelagicum* W. et G. S. West Tka, Ta — I — b, pl — 1
S. dencitulatum (NAEG.) ARCH. Ke — I — b, pl — 1
S. furcigerum BRÉB. Tf, Tkf, Ke — I — b, pl — 1
S. gracile RALFS B — I — pl — 1
S. granulosum (EHRBG.)RALFS Tf, Tkf, — I — b, pl — 1
S. longipes (NORDST.) TEILING (= S. paradoxum MEYEN var. longipes NORDST.) Tkf — I — pl — 1

S. lunatum RALFS var. *planctonicum* W. et G. S. WEST Tf — I — b, pl — 1
S. manfeldtii DELP. Ke — I — b, pl — 1
S. paradoxum MEYEN Tf, Tkf, Tka, Ta, Ke, Sz, B, S, K — IV — pl — β—m — 1
S. polymorphum BRÉB. Ta — I — pl — 1
S. polytrichum (PERTY) RABENH. Tkf — 1 — b, pl — 1
S. punctulatum BRÉB. Tf, Tkf, Tka, Ke, L — II — b (pl) — 1
S. teliferum RALFS Tkf, Tka — I — b, pl
S. tetracerum (KÜTZ.) RALFS Tkf, Tka, Ta — I — b, pl — 1

Von den in der Theiß und ihren Nebengewässern gefundenen 78 Conjugatophyceae-Taxons haben sich nur wenige mit einer größeren Häufigkeit ausgezeichnet. Die Folgenden waren verhältnismäßig häufig: *Closterium acerosum* (mit 61 eingehend analysierten Vorkommensangaben), *Closterium acutum* (16), *Closterium moniliferum* (34), *Closterium strigosum* (19), *Cosmarium obtusatum* (19), *Gonatozygon kinahani* (18), *Staurastrum paradoxum* (27).

Von den 78 Taxons erweisen sich 50 als primäre Planktonorganismen. Die Anzahl der Saprobiontenorganismen ist hier 14. Ihre Einreihung in das Saprobiontensystem wird in der beiliegenden Tabelle gegeben.

Tabelle 2. *Die Einreihung im Phytoseston der Theiß gefundenen Conjugatophyceae-Organismen in das Saprobiontensystem*

	o β−m	α−m
1. Cosmarium formosulum	++	
2. Gonatozygon pilosum	++	+
3. *Gonatozygon kinahani*	++	+
4. *Closterium aciculare*	++	+
5. Cosmarium turpini	+	++
6. Cosmarium obtusatum		+
7. *Closterium moniliferum*		++
8. Closterium ehrenbergii		+
9. *Staurastrum paradoxum*	++	
10. Closterium strigosum	+	+
11. Cosmarium botrytis	++	+
12. Closterium leibleinii	++	+
13. Closterium parvulum	++	+
14. *Closterium acerosum*	+	++

Rhodophyta

Bei der taxonomischen und ökologischen Bearbeitung des Algenstammes der Rotalgen habe ich die folgenden Werke benutzt: BOURRELLY (1970), ISRAELSON (1942), KYLIN (1956), PASCHER—SCHILLER (1925, in: Süßwasserflora), UHERKOVICH (1962b).

Audouinella BORY 1823

A. chalybea (LYNGB.) KYLIN (= Chantransia chalybea (LYNGB.) FRIES; Pseudochantransia chalybea (FRIES) BRAND) Tf, Tkf, Tka, O, Tr — II — b, lph, pk, pr, ep (pl) — o — 1

A. violacea (KÜTZ.)-HAMEL (= Chantransia violacea KÜTZ.) Tf, Tkf, — I — b, lph, pk (pl) — 1
Audouinella sp. Tf, Tr, S — I — b (pl)

Batrachospermum ROTH 1807

B. gallaei SIROD. Tf, Tkf, — I — b, lph, pk (pl) — o — 1
B. moniliforme ROTH Tf — I — b, lph, pk, ps (pl) — o — 1

Thorea BORY 1808

T. ramosissima BORY Ta — I — b, pr, lph (pl) — o — β— m — 1

Von den von mir in der Theiß und ihren Nebengewässern beobachteten sechs Rotalgenorganismen sind vier Saprobionten. Keine von ihnen sind primäre Planktonorganismen.

Schizomycophyta

Innerhalb des Stammes der Spaltpilze (Schizomycophyten) beschränkte ich mich auf die Identifizierung der thallusähnlich kohärenten, im Phytoseston auffällig erscheinenden Arten. Zur Taxonomie und Ökologie der bearbeiteten Arten habe ich meine Angaben aus den angeführten Werken der folgenden Verfasser genommen: FJERDINGSTAD (1965), HUBER—PESTALOZZI (1938, Phytoplankton 1), VAN NIEL und STANIER (1965, in: WARD—WHIPLE), SLÁDECEK (1963).

Cladothrix COHN 1875

C. dichotoma COHN Tf, Tkf, Tka, Ta, Ke, B, O, L, Tr, S, K — III — b, pr (pl) — β—m — 1

Crenothrix COHN 1875

C. polyspora COHN Tkf, — I — b, pr (pl) — o — 1

Sphaeotilus KÜTZING

S. natans KÜTZ. Tkf, Tka, Ta, B, Z, — II — b, pr (pl) — α—m — p — 1

Zoogloea ITZIGSOHN

Z. ramigera ITZIGSOHN emend. BLOCH Tkf, Tka, Ta, Tr, Z, K — II — b, pr (pl) — α—m — p — 1

Alle die vier Taxons sind Saprobionten, keines von ihnen ist ein primärer Planktonorganismus.

Mycophyta

Innerhalb des Stammes der Pilze (Mycophyten) beschränkte ich mich nur auf die Identifizierung der im Seston am häufigsten vorkommenden Arten. Ich habe die taxonomische und ökologische Bearbeitung der zum Stamm gehörenden Arten in erster Reihe aufgrund der angeführten Werke der folgenden Verfasser ausgeführt: BÁNHEGYI (1962), COOKE (1963), HUBER—PESTALOZZI (1938, Phytoplankton 1), NILSSON (1964), SPARROW (1965, in: WARD—WHIPPLE), VÁVRA (1969, in: KOMÁREK—VÁVRA).

Alatospora INGOLD 1942

A. acuminata INGOLD Tf, Tkf, Tka, Ta, L, Tr — II — pl

Aphanomycopsis SCHERFFEL

A. bacillariacearum SCHERFFEL Ta — I ep (parazita) (pl) — 1

Articulospora INGOLD 1942

Articulospora sp. Tak, Ta — I — pl

Clavariopsis DE WILDEMAN 1895

C. aquatica DE WILDEM. Tkf, Tka, Ta, B, M — II — pl — α—m — 1

Gurleya VÁVRA 1968

G. marssoniella VÁVRA (= Marssoniella elegans LEMM.) Ta, M — I — pl — 1

Lemonniera DE WILDEMAN 1894

L. aquatica DE WILDEM. Tkf, Tka, Ta — II — pl — β—α—m — 1

Leptomitus AGARDH

L. lacteus (ROTH) AGH. Z, K — I — b, pr (pl) — β—α—m — 1

Planctomyces GIMESI 1924

P. bekefii GIMESI Tkf, Tka, Ta, Ke, B — II — pl — β—α—m — 1
P. crassus HORTOB. Tkf, Tka, Ke — I — pl — 1

Rhizophydium SCHENK

R. eudorinae HOOD Ke, B, K — I — ep (parazita) (pl) — 1
R. planctonicum CANTER Ta — I — ep (parazita) (pl) — 1

Tetrachaetum INGOLD 1942

T. elegans INGOLD Tkf, Tka, Ta — I — pl — 1

Tetracladium DE WILDEMAN 1893

T. marchalianum DE Wildem. (= Asterothrix rhaphidioides (REINSCH) PRINTZ) Tf, Tkf, Tka, Ta, Sz, Tr, Z, M — IV — pl — β—m — 1

Tricladium INGOLD 1942

Tricladium sp. (T. splendens INGOLD?) Tka, Ta — I — pl

Varicosporium KEGEL 1906.

V. elodeae KEGEL Tkf, Tka, Ta, L — I — pl — —1

Es sind von den in der Theiß und ihren Nebengewässern gefundenen 15 Mycophyten-Taxons die Folgenden, die für Organismen häufigeren Vorkommens angesehen werden können: *Planctomyces bekefii* (21 eingehend analysierte Vorkommensangaben), *Tetracladium marchalianum* (37), *Clavariopsis aquatica* (10). Von den 15 Taxons sind 10 für primäre Organismen und 5 für Saprobionten zu betrachten.

Es sind taxonomisch noch klarzustellende Vorkommen:

Chlorobotrys polychloris PASCHER (Xanthophyceae) Tka, Ta — I — b (pl)
Ochromonas granularis DOFLEIN (Chrysophyceae) Tka, Ta — I — pl
Sorastrum americanum (Bohlin) SCHMIDLE (Chlorophyceae) Tka, Ta — I — b (pl)

Zusammenfassung

Wenn wir die in diesem Werk und in meinem über die Mikrophyton-Taxons der Theiß geschriebenen vorigen Arbeiten (UHERKOVICH 1969, 1971, 1972) veröffentlichten Angaben zahlenmäßig zusammenfassen, gibt uns darüber die folgende Tabelle 3 eine Übersicht:

Tabelle 3

	Zahl der Vorkommensangaben	Zahl der Taxons	Zahl der Planktonorganismen	Zahl der Saprobionten
Cyanophyta	738	124	52	40
Euglenophyta	360	76	62	21
Pyrrophyta	99	21	21	10
Chrysophyta	5322	317	134	90
(Chrysophyceae)	(252)	(19)	(18)	(5)
(Xanthophyceae)	(28)	(14)	(10)	—
(Bacillariophyceae)	(5042)	(284)	(106)	(85)
Chlorophyta	2801	287	223	71
(Chlorophyceae	(2375)	(209)	(173)	(57)
(Conjugatophyceae	(426)	(78)	(50)	(14)
Rhodophyta	45	6	—	4
Schizomycophyta	95	4	—	4
Mycophyta	120	15	10	5
Zusammen:	9580	850	502	245

Es geht auch aus den obigen Angaben hervor, daß in der Zusammensetzung der Mikrotrift der größeren Flüsse in der gemäßigten Zone — im gegenwärtigen Fall in der der Theiß — befindlichen Pflanzenassoziationen, in der des Phytosestons, die bedeutendste Rolle die Kiesalgen (Bacillariophyceae) und außer diesen die Grünalgen (Chlorophyceae) spielen. Die am meisten am Ende des Sommers stattfindenden Massenproduktionen werden von einigen thermophilen, eurythermen Organismen dieser Algengruppen (z. B. *Melosira granulata* var. *angustissima, Synedra actinastroides* (= *Nitzschia actinastroides*), *Cyclotella* spp., *Dicytosphaerium pulchellum*) herbeigeführt. Die den bedeutenderen Abwasserbelastungen folgenden Erhöhungen des Trophitätsniveaus werden am meisten von einer größeren periodischen Vermehrung des *Aphanizomenon flos-aquae* begleitet.

Der Fluß ist saprobiologisch in seinem Oberlauf oligosaprobisch -β-mesosaprob, in den anderen Flußstrecken im allgemeinen β-mesosaprob; streckenweise ist er unter den größeren Industrieabwasserbelastungen noch schlechter. Aber der Fluß hat gegenwärtig noch eine genügende Selbstreinigungsfähigkeit.

Der primäre Zweck dieser Reihe war, die vollständige Aufzählung der vom Verfasser beobachteten Mikrophyten-Taxons der Theiß zu geben. Die zönologische Zusammensetzung der untersuchten Mikrophyten-Assoziationen selber, ihre dem Flusse entlang stattfindenden Veränderungen, sowie die theoretischen und praktischen Schlußfolgerungen, die aus diesen gezogen werden können, werden in unseren anderen Werken erörtert (Uherkovich 1965, 1968, 1970—71, 1971).

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MASS-PRODUCTION OCCURRENCE OF THE BOTRYDIUM SPECIES IN THE INUNDATION AREAS OF THE TISZA AND MAROS IN THE ENVIRONS OF SZEGED

I. KISS

Department of Botany, Gyula Juhász Teacher's Training College, Szeged, Hungary

(Received 12 January 1975)

In the inundation areas of the Tisza and Maros, in a permanently sunny autumn period, the „soil-efflorescendes" of green, bluish-green or brownish-green, engendered by the mass-productions of various algae, are of frequent occurence. Among them, the appearance of *Botrydium* is not an everyday sight but if it appears every now and then, it usually calls the attention to itself with an enormous mass-production. The polyenergidic cells of Botrydium, visible even to the naked eye, take densely place beside one another, and the picture is as if the surface of soil were strewed densely with green poppy-seeds. Walking on a surface like that, one may hear crackling-rattling sounds, as well. These sounds are similar to crackling to be heard on the occassion of treading on salt or granulated sugar strewed on a smooth floor.

The occurrence of *Botrydium* earlier, in the environs of Szeged, was reported on by A. SZABADOS (1933). The occurrence of *Botrydium pachydermum* and *Botrydium granulatum* in mass-production in the confines of Deszk, Újszeged, and Szentmihálytelek was observed by him in the Autumn of 1930. These species induced their mass-production independently of others or associated. He investigated the material of these, originating from four biotops, both from morphological and cytological points of view.

I observed these two *Botrydium* species in the inundation areas of the Tisza and Maros in the environs of Szeged, in the course of the latter nearly four decades, on eight occasions altogether. A short characterization of these mass-productions is as follows:

1. Szeged, Boszorkánysziget, October 19th 1932. It formed smaller or larger mass-production spots in a length of 25—30 m, on crumbling banks. These were formed by *Botrydium granulatum* alone.

2. Újszeged, September 19th 1935. The "soil-efflorescence" of *Botrydium granulatum* appeared in the form of a 30 m long and 1 to 2 m broad greyish-green surface, on a flat bank, opposite to the Bertalan-memorial.

3. On the left bank of Maros, October 10th 1973. About 2 to 3 km above the mouth of the river, on a flat bank, the grass-green "soil-efflorescence" of *Botrydium granulatum* appeared in a length of about 200 m, on the flat bank, with several discontinuities. This phenomenon could be observed for a fortnight or so.

4. On the left bank of Maros, November 7th 1957. About 4 km above the mouth, in a 800—900 m flat riverside sector, the stands of *Botrydium granulatum* and *B. pachydermum* formed 1—2 m broad spots. The changes in that enormous mass production could be followed with attention till the end of the month.

5. "Sárga"-sands at the Tisza, October 27th 1963. At the northern end of the sands, *Botrydium granulatum* appeared in dense masses, on five rather small spots. Its state could be followed with attention for a fortnight.

6. Újszeged, November 2nd 1970. About one km north of the Bertalan-memorial, on the partly ragged, partly flat bank, in a 25 to 30 m stripe, *Botrydium granulatum* and *B. pachydermum* appeared associated.

7. "Sárga"-sands at the Tisza, November 11th 1970. In its southern part, in an about 20 m long and 2 to 3 m broad sloping riverside sector, mass-productions were formed in dark bluish-green spots mainly by *Botrydium pachydermum*. Among them, the lighter spots of *B. granulatum* spread on a minor surface.

8. On the right bank of Tisza, south of the ferry of Tápé, October 31st 1971. On the somewhat flat bank between the ferry of Tápé and the "Sárga"-sands, in an about 100 m length, in spots connected together, *Botrydium granulatum* and *B. pachydermum*, associated with each other, were forming some mass-production spots. Among these there appeared some different shapes, as well, such as not observed earlier. This mass-production series has perished till the middle of November. In the meantime we have investigated it two times. It could be established that the individual number of different forms was increasing continuously.

In the following, both Botrydium species are shortly characterized and we are reporting on the different forms and the ecological investigations.

Botrydium granulatum (L.) GREVILLE

The overground parts of plants seem from above to be globular but observed from the side they seem to be rather elongated, oval or pear-shaped. Their lower part, narrowed more and more, turns into a rhizoid-system with a manifoldly dichotomous ramification. The macroscopical polyenergidic cell is 1 to 1.2, rarely 1.5 mm long and 0.8 to 1 mm broad. Its basal part above the ramification is 35 to 50 μ thick. The young cells have a light green, the older, more developed ones a darker, grass-green hue. On their surface mostly appears a calciferous ($CaCO_3$) incrustation, softening, making rather grey the fresh, green colour.

The rhizoid-system that can be prepared but with difficulty by means of an ejector jet pump, equally surpasses the size of the overground cauloid part both in length and in projective breadth. Its final ramifications are of fourth to fifth grade, their thickness is 5 to 10 μ.

In the overground part the cell-wall is particularly thin, rather rendible, the globules sometimes burst to pieces even if touched slightly. After that the membrane opened, a protoplastic, green, thick mass is pouring out. In the fixed and smeared protoplast the nuclei can be demonstrated by staining well. Its chloroplasts are elliptic or oblongly elliptic, they seem to be of almost homogeneous substance, there couldn't be any pyrenoid demonstrated in them. In the protoplast mass, that in the beginning was pressed out of the carefully perforated green capitulum, there were comparatively more nuclei to be seen than in the plasma-mass getting out later. It is possible that the nuclei are not divided in equal proportion in the plasma-mass. (Close to the vacuolum the energid-system may be rarer?). As to the size of the vacuolum we could not obtain any sure data. We may anyway get some information concerning its presence by the comparative shortness of nuclei in the plasma-mass coming out later.

The multiplication of *Botrydium granulatum* by zoospores could be observed but on a single occasion only, in the material of November 1957. The older mother-cells that are ripening the zoospores burst in their apical or lateral part and the zoospore-mass gets outside. We could not observe the motion of the oblong ovoid zoospores, only their weak metabolizing change in shape could be noticed. Their length is 15 to 20 μ. At sampling point 4, in the second half of November 1957 there were already to be found overwhelmingly only burst plants. It was shown by the stem of their majority that the cell-wall can burst not simply in the apical part alone but in the lower part, as well, respectively the upper larger part of the globule can be torn into pieces all at once, dispersing in pieces in the vicinity. In a case like that, the cell-wall-remains of the part of stem are turning out. At the end of November, in the rhizoid parts of second and third grades also the formation of persistent spores or cysts (Dauersporen, Hypnosporen) could be observed. These formulae are a little condensed, containing more nuclei. In the laboratory material their further development could not be observed either on the soil surface or in agar culture medium.

Botrydium pachydermum MILLER

In the eight occurrences discussed, this species had a part only on four occasions, associated with *B. granulatum*. In occurrence 7 (November the 12th 1970), *Botrydium pachydermum* played a dominant part opposite to *Botrydium granulatum*. In the other occurrences, *B. granulatum* appeared in larger masses.

This species significantly differs from *B. granulatum* in morphological respect. Its overground, cephalic part is completely globular or sometimes a little appressed, in the direction of its longitudinal axis and it is only 0.4 to 0.7 mm in diameter, as well. Its cephalic part is quite protruding from the soil, below it becomes quickly comparatively narrow, continued in a relatively long and thin cervical part. And sometimes this cervical partis, apart from being thin, strikingly short, as well. The cephalic part of *Botrydium pachydermum* mostly of bluish-green or dark bluish-green colour, considerably paled by the excretion of $CaCO_3$ granules, also selected on its surface.

The rhizoid-system is dichotomic but it is not at all as rich in ramifications as *B. granulatum* is. Even after preparing it the most carefully, there was to be observed only its third grade ramification. And it does not penetrate as deep into the soil as seen in case of the former species. The thickness of its branches of third grade varies between 5 to 12 μ. These final branches are not so easily torn, either, as in case of the former species.

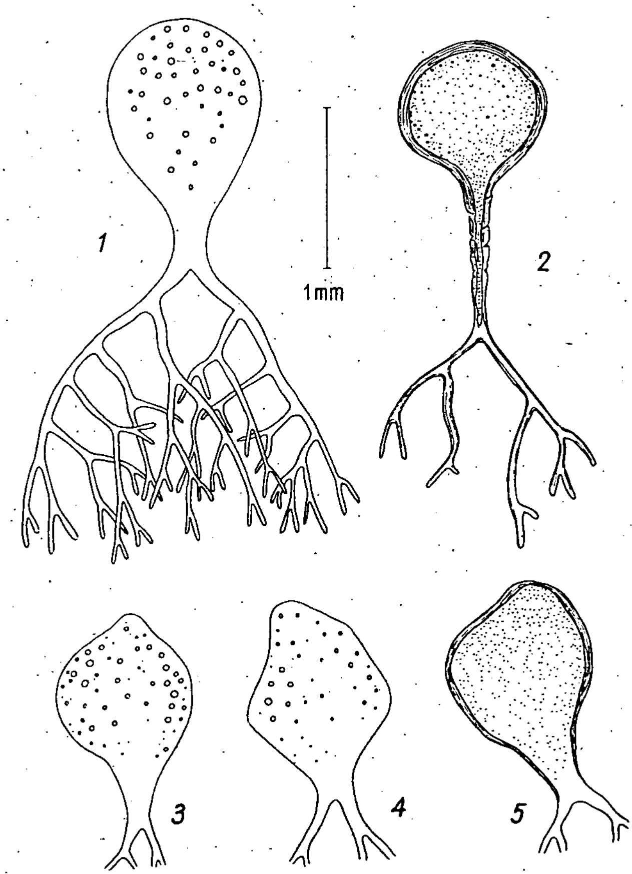
The cephalic part of *Botrydium pachydermum* does generally not tear by being touched and even it is able to bear a slighter pressure, as well. The whole overground part of the small plant is comparatively tough, hardy since its cell-wall is thick enough and multilayered. The whole membrane is thick, not only in its cervical part but also in the cervical continuation. The membrane of the cervical part often suffers deep notchings, ruptures; owing to that, the cervical part has the character of constriction. That, however, can never be observed in case of Botrydium granulatum. In the final ramifications the membrane is comparatively thick. But it is questionable if it does not continue in thinner and more rendible ramifications.

We have not observed the zoospore formation of Botrydium pachydermum on any occasion. The cyst formation could, however, be observed on two occasions: in the second half of November 1957, as well as in November 1970 (occurrences 4 and 7). Its cysts are dark bluish-green. On their surface we did not notice any calcium carbonate selection. They always contain several cell nuclei but the number of these is varying.

Botrydium-forms unnoted earlier

They could only be observed on one occasion, at the very end of October 1971 and at the beginning of November (occurrence 8), after extraordinary circumstances, in the year following the Great Inundation Defence in the Lower Tisza Region. It is known that in Spring 1970 an emergency situation was lived through in the Lower Tisza Region. The water level of the flooded Tisza and Maros was reaching such a height as never before since carrying out recordings and even from time immemorial.

It is a common characteristic of the different forms that their overground part is not globular or ovoid, like in case of Botrydium pachydermum and *Botrydium granulatum*, but it is irregularly deformed, their apical part being mostly slightly protruding. On the basis of the thickness of the cell-wall, however, in case of these, too, there were two types to be distinguished: the forms of thin cell-wall (Figs. 3, 4) and those of thicker cell-wall (Fig. 5).



The overground part of the type with *thin* cell-wall did generally not reach the length of 1 mm. The shape of its cephalic part reminds us a little of the shape of *Botrydius tuberosum* IYENGAR. Its size agrees with that of the latter one by and large. Its rhizoid-system was, however, in decay, in crumbling. In its final ramifications it did not show, in traces either, the features of the species, described by IYENGAR, the ending in globules. The slight protrusion of the apical part is a little similar to the pointed form of *Botrydium cordiforme* VODENICHAROV, being anyway not at all horn-shaped but rather definitely stocky. In this form-group, the individual shown in Figure 4 proved to be the most slender and acute. The rather acute forms like this appeared in the second week of November when even the number of these forms was considerably increasing. It could be observed that the overground part of it is not too rendible, being not completely turgescent. This cephalic part seemed to be a little wilted.

The membrane of the type with *thicker* cell-wall has mostly only two to three layers and that cannot be compared with the membrane of *Botrydium pachydermum* having as many as five to six layers. The number of these was higher, as well, in the cultivation in the secnod week of November than on the first occasion, on October the 31st 1971. Its form is similar to the former type of thin wall. The rhizoid-system of this type, as well, was in the state of disintegration.

The problem of the types of thicker and thinner cell-walls of different shapes cannot be decided, therefore, quite definitely. The fact that the rhizoid-system is easily torn in both cases and that the cephalic part is not quite turgescent, either, makes us think that from among the cells of different shapes those with thin walls are the forms of *Botrydium granulatum* and those with thick walls the forms of *Botrydium pachydermum* only that they are modified for certain reasons and have partly lost their turgescence. All this could only have been decided with physiological and genetic investigations founded on cultivation. The physiological and genetic investigations of the distortedly differing forms like these are justified by the fact, too, that their presence proved rare in the mass production found on October 31st 1971; later on, however, in the second week of November they occurred more and more frequently. That is to say: this *character of distortion was decidedly growing*, raising the reasonable thought of a kind of virus-effect, as well.

Ecological investigation of Botrydium mass productions

The mass multiplication of both *Botrydium* species fell, at all the eight occurrences, on the autumn period. That corresponds to Szabados's earlier results concerning similarly the environs of Szeged. It is not impossible that this seasonal uniformity is cloaking deeper demandable physiological connections. Concerning the two species, the following comparative ecological (partly phisiological) observations, as well, are to be mentioned:

a) The granular calcium-carbonate coating of the membrane is an excretory product. In case of *Botrydium pachydermum* the excretion is of major degree than at the cells of *B. granulatum.* In addition, the excretory coating is often strengthened by the condensation of clay-colloids, too, from the soil surface. These can be wiped away, together with the possible fine grains of sand, without the danger of ripping up the cephalic part.

b) The rhizoid-system of *Botrydium granulatum* is more developed than that of the individuals of *B. pachydermum*, and it penetrates, too, deeper into the soil. Their preparation can mostly be carried out only with the method of water-jet maceration. As a result of water, however, the cephalic parts of *B. granulatum* often bursted, while *B. pachydermum* could endure, without any visible lesion, the macerating or mechanical effect of water.

c) At all the eight occurrences, we carried living material, as well, from the mass productions for being observed in the laboratory. The transportation with the 1.5 cm thick soil layer of the habitat, and the covering in Petri dishes, provided the transport without damage. We have observed that the capitula of *B. granulatum* in the covered Petri dishes mostly burst till next day, *B. pachydermatum*, on the other hand, could endure well the laboratory conditions, as well.

d) The formation of cysts or persistent spores fell on the late autumn period in the culture of both species. Their development may have been in connection with the effects of cold, resp. of a slight frost. That was observed both by SZABADOS (1933). and by us. On the other hand, in case of the individuals brought into the laboratory and accomodated to the conditions there we have learned that, after being dried or illuminated with a rather strong light, the protoplast or at least a part of that migrates into the rhizoids, beginning to be transformed there into cyst-like formations. A further development of these formations could, however, not be observed under laboratory conditions, even in some weeks or months. The further development of these multiplying formations must probably claim a certain period of rest and more suitable conditions of environment.

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DATA TO THE HORIZONTAL AND VERTICAL DISTRIBUTION OF THE ZOOBENTHIC FAUNA OF THE TISZA REGION AT SZEGED

MÁRIA CSOKNYA and MAGDOLNA FERENCZ
Department of Zoology Attila József University, Szeged, Hungary
(Received 10 May 1974)

Abstract

Authors have studied the horizontal and vertical distribution of zoobenthos, with particular regard to Oligochaetes and Ephemeroptera, in definite reaches of the Tisza (at km-mark 165), referred to by them as "Palingenial" biotope.

Introduction

We know by reason of the so-called mosaic principle of the freshwater zoobenthic associations that water motion and substratum-type play a decisive part in the formation of the freshwater zoocoenoses (DORRIS *et al.* 1962, STEFFAN 1965, WACHS 1968). The differentiating effect of these two main abiotic factors involves, of course, a change in other abiotic factors, as well. (LEHMKUHL 1972, LEHMKUHL *et al.* 1972). The mosaics formed in the rivers are comparatively homogeneous parts of the biotopes, they may be called dynamic units. As to their size, in the upper region of the river they are generally smaller than in the lower one.

The biotope-type investigated by us averages, in respect of its maximum dimension, up to 700 to 1000 sq.m, being a characteristic, steep riverside sector, of clayey soil. We named that area after its typical species. — *Palingenia longicauda* — "Palingenial" biotope (CSOKNYA *et al.* 1972).

Considering from among the primary determinative factors (substratum-type and water motion) the first one, the substratum-type as identical in forming the associations of the area, our aim was to investigate the modifying effect of the other factor. To be sure, due to the water motion, the washing away of the upper sediment layer of the river bed is permanent, as well; the changes resulting from that are, however, not so radical that they would induce a change in the substratum-type.

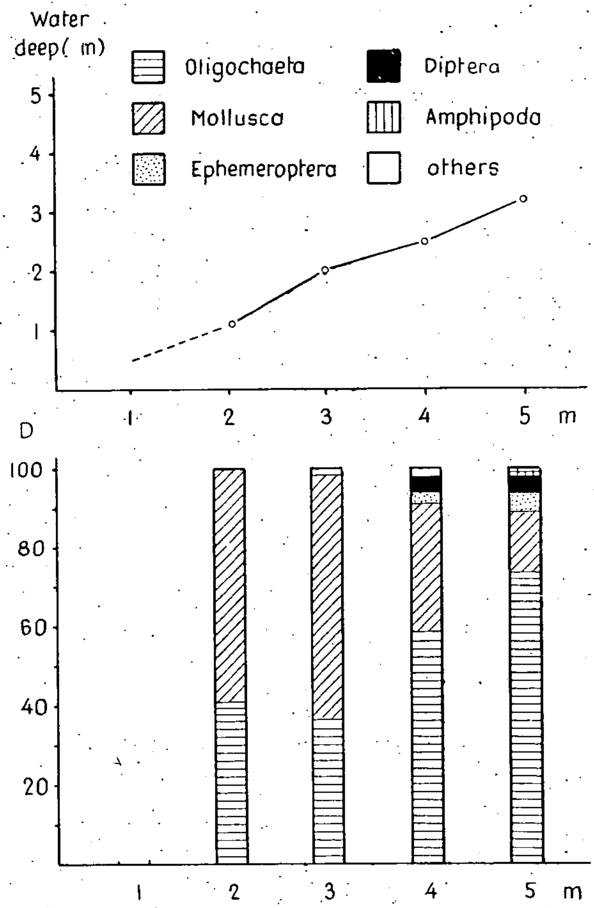
Material and method

The material for our investigations was collected in Autumn 1971, 1972, and 1973 at different water-levels, at km-mark 165. The samples were taken in every metre, from the bank towards the river-bed, with a cylindrical gripper of 16 cm diameter (CSOKNYA *et al.* 1972). We cut them in 10 cm pieces and washed them through 0.5 mm mesh sieves. The animals found in the samples were arranged according to taxonomical groups and fixed in 10 per cent formalin.

Results and their discussion

Our observations were mainly directed towards recognizing the ecology of may-fly nymphs, therefore we considered necessary to know the species, resp. taxonomical groups, as well, living together with them. It is to be established from the data of our collections that in the "Palingenial" biotope the taxonomical groups occurring the most frequently are: Oligochaetes, Mollusca, Ephemeroptera, Diptera, Amphipoda. Apart from these, Polychaetes, Odonata, Trichoptera, Nematoda, too, could be observed in low percentage. We found these taxonomical groups also in the course of other collections carried out in places of similar substratum-type (CSOKNYA *et al.* 1973, FERENCZ *et al*, 1973).

Polychaetes are represented by a single species, *Hypania invalida* (FERENCZ 1969), Oligochaetes by the species *Limnodrilus hoffmeisteri, L. udekemianus, L. claparedeanus, Psammoryctes moravicus, Tubifex tubifex, Branchiura sowerbyi;* while



Graph 1: Horizontal distribution of the ground-fauna after a quick recession (1971).

Ephemeroptera by the species *Palingenia longicauda.* At the other taxonomical groups we have not performed any species determination.

In the cousre of our comparative investigations, we first studied the horizontal distribution and later on the vertical distribution of the zoobenthos at various water-levels; namely immediately after a strong recession (1971), then similarly a few days after a considerable recession (1972), and at a rather long-stagnating water-level (1973).

The data of the first two collections (1971, 1972) are showing a considerable parallelism, enabling us to establish as follows.

To quick changes in water-level the Ephemeroptera (FORBER *et al.* 1970) and Amphipoda respond the most sensitively. These taxonomical groups are namely missing from the samples taken at the metres next to the bank (one or two, and even three metres) (Graphs 1, 2). The groups less responding to changes are the Oligochaetes and Molluscs, as they are to be found in a high enough individual number, resp. percentage even in the most unfavourable places, respectively in those becoming unfavourable. Rather far from the bank (beyond three metres) all the taxonomical groups occurring in this biotope-type are already represented in a growing percentage.

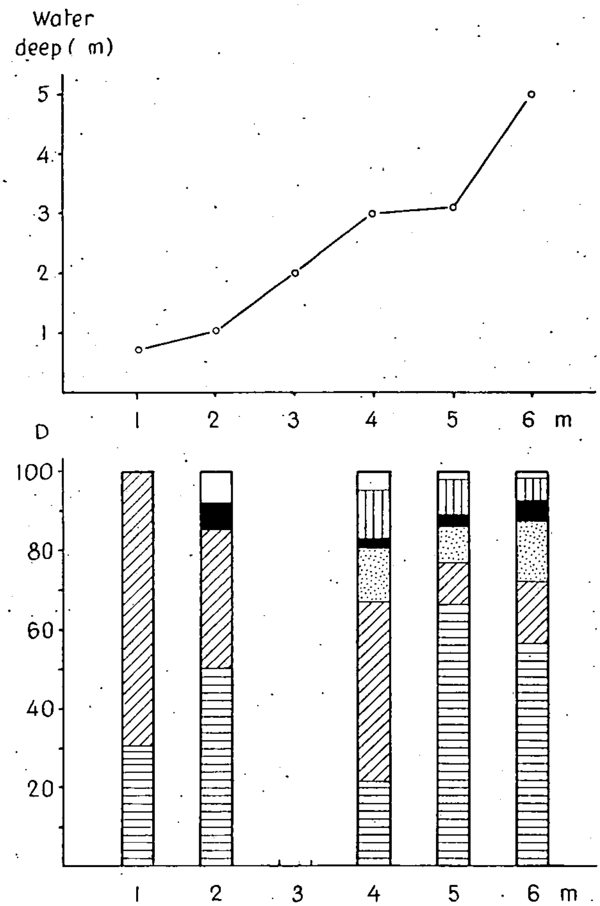
A collection in 1973 — carried out at a water-level stagnating long enough — is differring from the above mentioned ones (Graph 3). It appears from the Graph that close to the bank (two metres) every taxonomical group can already be found in a considerable individual number, even the groups responding in the most sensitive way (Ephemeroptera, Amphipoda).

If we compare the three Graphs, taking into consideration also the heights of water-columns measured above the sampling points, then we may establish that e. g., the nymphs of mayflies occur at lower water-columns, too, in case of stagnating water-levels while in case of falling water-levels they cannot be found in deeper water, either. The motion of these nymphs may, perhaps, be influenced not so much by the height of water-column above them but rather by the change in (speed of?) water motion induced by the recession or flood. These are, of course, for the time being, not more than partly empirical observations, partly suppositions. We want to give an exact reply to these questions in the course of our later observations.

We have connected the investigations of horizontal distribution with studying the vertical distribution of the taxonomical groups, as well. It can be established that the zoobenthos is the richest in a 4 to 5 m distance from the bank (subripal one). There, namely, the species are contained in a very high individual number in the whole depth of silt-samples while till 4 to 5 m from the bank only the lower layer (40—60 cm) and beyond 5 m the upper layer (30 cm) are the richest ones (CSOKNYA *et all.* in print, FERENCZ *et all.* in print).

Our investigations in detail about the vertical distribution have already not comprised but Oligochaetes and Ephemeroptera. The distribution of mayfly nymphs was studied in connection with their stage of development. We have observed that the more developed nymphs (in their last year) occur farther from the riverside, in the lower depth of silt-layers, while the young nymphs closer to the riverside, in the whole depth of samples, and in the samples taken from farther places from the riverside, they occur in the upper layers. If we investigate the distribution according to the stade of development resp. its change connected with the decrease in water-level, then we may establish that the young nymphs change their place the earliest not only in the substratum-regions closer to the bank but in those farther from that, as well. In the latter places, anyway, that is in the deeper layers of samples, the older nymphs continue to be found in the samples.

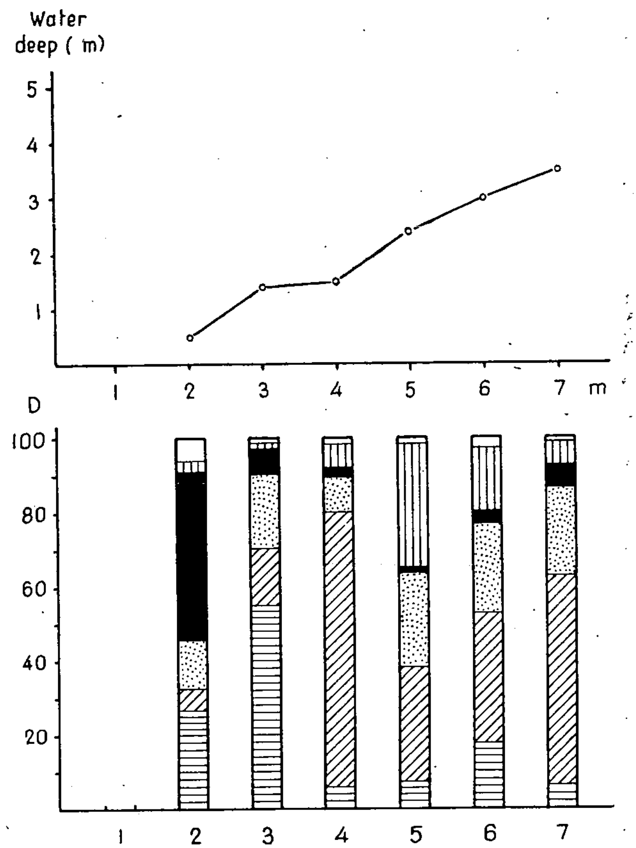
We investigated (1973) the horizontal and vertical distribution of the Oligochaetes, too, as that of the species occurring together with the mayflies the most frequently. The greatest percentage (about 50 per cent) of Oligochaetes preferred the 1 m deep bed sectors 3 m far from the riverside. The species occurring there are almost exclu-



Graph 2: Distribution values after a considerable recession (1972) (Cf. legends in Graph 1).

sively belonging to the genus *Limnodrilus*. *Limnodrilus hoffmeisteri* and *L. claparedeanus* are nearly identical. *L. udekemianus* could only be found in a smaller quantity. These three frequent species, occurring together, are living in a higher individual number in the Tisza, too, as well as in the other European rivers, as established on the basis of our other collections, as well. Ecologically they are euryoek species, with an extensive tolerance. There was just the *Limnodrilus hoffmeisteri* that was found in the comparatively highest individual number even in the deepest bed-sector farthest from the riverside.

Oligochaetes are dominant in the upper 20 cm layers of the sediment but they occurred 40 to 50 cm deep, as well. Here we could only find *Psammoryctes moravicus*, anyway in the comparatively highest individual number. *Branchiura sowerbyi* came to light from the deepest places (3 m), although according to our investigations so far, the dominant species in the clayey-silty substratum was the species Oligochaetes. This difference can be explained with the population dynamics of the species, as well. At the end of Summer, namely, after laying cocoons, the individuals perish.



Graph 3: Zoobenthic distribution appearing at a stagnating water-level (1973) (Cf. lengeds in Graph 1):

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EXPERIMENTS FOR DETERMINING THE OXYGEN CONSUMPTION OF NYMPS OF PALIGENIA LONGICAUDA (EPHEMEROPTERA)

MÁRIA CSOKNYA and KATALIN HALASY
Department of Zoology, Attila József University, Szeged, Hungary
(Received 25 November 1975)

Abstract

On a closed-system apparatus suitable for measuring the oxygen consumption of burrowing Ephemeroptera, supplied with respiratory water in continuous circulation. The change in the oxygen concentration is measured in electrochemical way.

Introduction

The distribution of benthos organisms is influenced considerably by the quality of the substrate and the dissolved oxygen content of water. Several works are known that are regarding the effects of these two factors as independent of each other. But the establishments that prove a close connection between these two parameters become more and more conspicuous (ERIKSEN 1963, 1964, 1968, LINDUSKA 1942, LYMAN 1965, OLSON *et al.* 1968). This refers particularly to the burrowing water organisms and nymphs, respectively.

The presence of species is influenced by the oxygen concentration. The quantity of the dissolved oxygen is namely reduced by pollution in several cases that changes the fauna-composition in the area. Some species — bio-indicators — respond to this change, sensitively, therefore it is of no small interest to recognize their oxygen requirement.

At the bio-energetic researches, practised of late years, it is indispensable, as well, to know the oxygen requirement characteristic of the organisms investigated. It became necessary to elaborate some methods for investigating the respiration, in case of which a primary point of view is to adapt themselves to the natural circumstances as well as possible (KAMLER 1969, KLEKOWSKY *et al.* 1968, NAGELL 1963). Our experiments carried out with nymphs of *Palingenia longicauda* — and taking into consideration the above principle — to construct an apparatus for measuring oxygen consumption, its essence being: (1) to keep the respiratory water in continuous flowing; (2) to contain a substrate that is ideal both to the animal and in respect of measuring, as well.

Description of the measuring system

The most important part of our closed-system apparatus is control electrode Argox-M-ZnDO$_2$ whose functioning is based upon measuring the dissolved oxygen in electrochemical way. A signal current proportionate to the quantity of the dissolved oxygen is supplied by the voltametric sensingdivices and, after calibrating satisfactorily, the changes in the oxygen content of the water dissolved can be concluded from the changes in the intensity of the signal current (electrode description by the Central Research Laboratory).

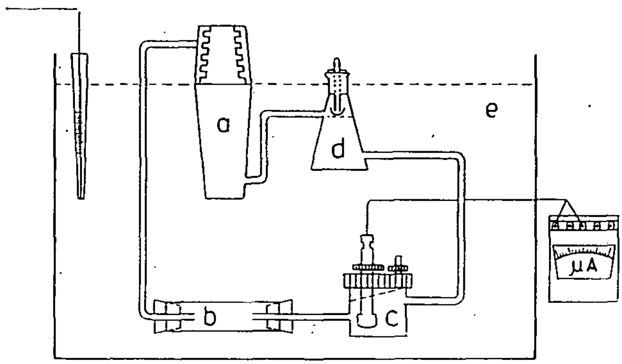

Fig. 1. Schematical representation of the apparatus measuring the flowing-water oxygen consumption. (a: water-circulator, b: respiartory chamber, c: measuring chamber, d: carbon dioxide adsorber, e: water bath).

Measuring Technique.

The most important parts of the apparatus are (Fig. 1):

1. WATER-CIRCULATOR AND TANK (I/a): Motorized plexiglass-tank capable of piping 4.000 ml/min water. It is fundamentally necessary to maintain the continuous waterflow for both the control electrode and animals, as well.
2. RESPIRATORY CHAMBER (1/b): 20 cm×5 cm glass pipe connected to the other parts of the system with connecting pipes. On the occasion of measuring, the experimental animal is placed there.
3. MEASURING CELL (1/c): A plexiglass-tank equipped with a detachable deck, with an incorporated control electrode. The cathode and anode of the electrode are silver, the anode is covered with a zink case, both of them taking place in a gel tank of special formation.
4. CARBON DIOXIDE ABSORBER(1/d): Glass vessel in which, in a small bowl stretching into the air-space over the circulating water, a filter-paper was placed, impregnated with 0.2 ml 20 per cent KOH, for binding the carbon dioxide- released in the course of respiration, and diffusible from the water.
5. WATER BATH (1/e): The system described so far is immersed in a water bath the water of which can be kept, by means of an ultra-thermostat mixing motor and a fine thermo-regulator at a temperature given, with an accuracy of 0.1—0.2 °C.

The system fit together of the enumerated parts was filled in with 3,000 ml river water. We have chosen the quantity and oxygen content of the water so that plenty of oxygen remained even at the end of measuring and we could eliminate the inhibiting effect of its shortage.

In order to destroy the living micro-organisms, we have added chloramphenicol and streptomycin to the water, in 20 mg/l concentration. In this way, we could exclusively measure the oxygen quantity consumed by the experimental animals. On the basis of our investigations this antibiotic quantity is not pernicious to the larvae.

In order to get a reference also to the part played by the substrate in the respiration, we have carried out two series of measurings: in the first series, we have measured the oxygen consumption of nymphs without substrate, in the second one in the presence of a substrate. The intervering effect of light was eliminated by the respiratory chamber being made dark. Further on, we have set the water bath, together with the complete respiratory system and animals, for the temperature wished and then, about 30 minutes later, we began our measuring. We regarded this time as satisfying bacause the animals had already been kept at the experimental temperature for 24 hours. We have performed measuring for two hours and recorded the current drop every fifteen minutes. The values measured can be reckoned over, by means of a calibrating curve, into µg/l oxygen concentration. The calibration curve was drawn at every temperature on the basis of current intensity values measured in 0 per cent (5 p. c. Na_2SO_3) and 100 per cent oxigen-saturated solutions after ventilating, mixing, and bubbling air through them for two hours.

Results and their discussion

We could compare the results of the two measuring series to the data obtained by means of the traditional and mostly-used Warburg-method (Csoknya 1973). As it is known, the essence of Warburg's method is that the vessels of the manometer are to be vibrated with a definite speed. This vibration and the fact that the animals take place in a "closed-bottle" water of small quantity, are in our opinion factors considerably different from the natural conditions of larvae. The effect of these facts can be demonstrated in the form of a larger oxygen consumption.

Have we measured without any substrate but in flowing water then the larvae performed, contrary to the natural circumstances, an intensive movement changing their places in full length of the respiratory chamber, accompanied with the lively movement of branchiae. The respiratory values measured by us in this way — in case of animals of identical weight-class that means the same stage of development, as well — were higher as compared to the data measured with Warburg's apparatus (Fig. 2). We attribute the increase in respiratory values to taking place of a stronger excitement than before.

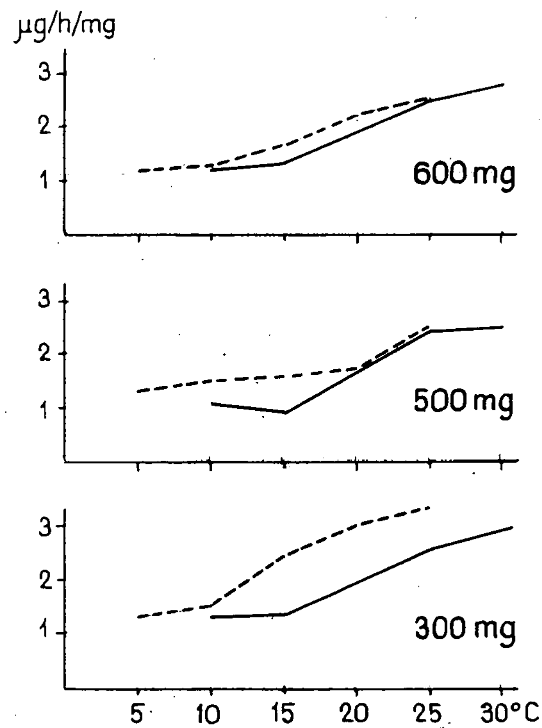

Fig. 2. Comparison of the values of oxygen consumption of the mayfly nymphs (of 300, 500, and 600 mg weight) by means of various methods)———Warburg's method, — — — flowing-water procedure).

In order to decrease this excitement, we put the artificial substrate in the respiratory chamber. A natural substrate is not suitable for that purpose because of its own consumption. And after being burned out or treated in another way (*e. g.*, with chemical agents), the animals perished for in the course of the procedure the substrate had lost its proper concentration, consistence. After trying repeatedly, we found most suitable for this purpose the common plasticine because its composition (clay powder, kaolin, zink oxide) and particularly its consistence are similar to those of the silt which the animals are living in, but which has no own oxygen consumption. We made from the placticine some ducts similar to those of mayfly nymphs but being straight. They often took place in these voluntarily and got in that way into the measuring cell.

The values of oxygen consumption obtained by us were generally lower than the results of either of both former methods. For instance:

body weight	Oxygen consumption at 25° C µg/h/mg	
mg	without substrate	with substrate
200	4.51	2.95
500	2.45	0.91

We find the explanation of the lower values nearly unambiguously in that the larvae were in the „ducts" of the substrate under similar conditions to those in natural circumstances, therefore the irritated movement that looked for place ceased to be continued. The quieter state, characterized by the more regular gill-movement, as well, manifested itself in lower values of oxygen consumption.

The water-circulating oxygen-measuring apparatus, in which the mayfly nymphs can be placed in a substrate, is most ideal for them showing the respiration under natural conditions perhaps in the most real way.

Later on, we want to complete the data obtained by means of the latter method by investigating the effects of the development of nymphs and other environmental factors.

We should like to express our thanks to research-technician A. Horváth for preparing and calibrating the control electrode.

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THE APOIDEA (HYMENOPTERA) OF THE TISZA-DAM

L. TANÁCS
Department of Zoology Attila József University, Szeged, Hungary
(Received 15 April 1975)

Abstract

I collected 72 species from the Tisza-dam, in 1973—1974. At Tiszasziget, *Eucera nigrifacies* LEP. counts among rare species, while at Körtvélyes, the species *Halictus fulvipes* KLUG., *Osmia tridentata* DUF. et PERR., *Epeolus tristis* SCHMIDT., *Camtopoeum Friesei* MOCS., *Bombus argillaceus* SCOP. In the biotope investigated, the dominance of the species Halictus proved to be the greatest.

Introduction

The Tisza-dam (in rather dry years: the flood area) and the ruderal areas of smaller or larger breadth bordering it from the external side provide good feeding and nesting possibilities for the superfamily Apoidea (order Hymenoptera). The pollination of the most important papilionaceous fodder-plants (lucerne, red-clover) is carried out prevailingly by the Apoidea. In the course of my investigations my aim was to establish the Apoidea fauna, dominance conditions of the dam sectors at Mártély, Körtvélyes, Tiszasziget. I performed regular flower-visiting observations and analysed when the single meadow-plants, weeds, possibly cultivated plants mean pollen and nectar source, and for which Apoidea species.

Investigation areas and method

I carried on observations and collections in the sectors Mártély-Körtvélyes (between river-km 200—206) and Tiszasziget (river-km 155—156.5) (Fig. 1), in the flood area, on the dam, and in the zone bordering the dams. I carried out investigations at Mártély-Körtvélyes between June 18 and September 4, 1974, on ten occasions, at Tiszasziget between May 15 and September 11, 1973 on four occasions, May 17 and September 19, 1974, on six occasions, altogether on twenty occasions. From June 17, 1974 on, owing to the long-lasting high-water of the Tisza, I could carry out collections only on the dam and its weed ecotone. During collecting I was complying with the aspects of flowering. Going on evenly in the sectors investigated. I collected the Apoidea from the flower-level of meadow, plants and weeds. For establishing their species composition, I performed two-times-two-hour time-collections with butterfly-net, between 9 to 15 o' clock on the investigation-days. Except Apis mellifera L., I could collect every Apoidea specimen.

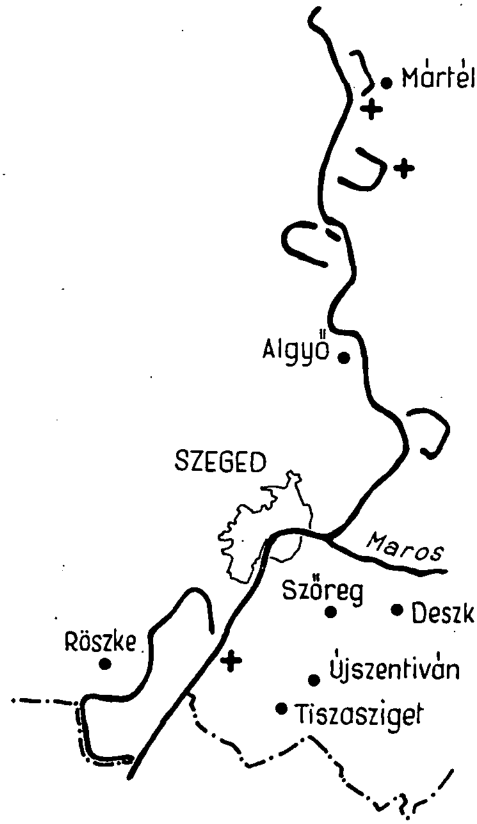

Fig. 1. Map of collecting sites.

Results

Fauna evaluation

In 1974 at Mártély 12, at Körvélyes 56 while in 1973—1974 at Tiszasziget 39, in the course of the investigations altogether 72 species were collected(Table 1). The honeybee occurs in all the three biotopes but I have not collected it. Analysing the list of species, the considerable species-representation of the genera Halictidae, Megachilidae, Eucera, and Bombuses is remarkable. Some species of the Halictus, Megachile, and Eucera genera showed to be considerable pollinators of lucerne (MÓCZÁR 1961b) and Bombuses first of all those of red clover in Hungary (BENEDEK 1970). The species-nümber of genus *Andrena* (Andrenidae) is strinkingly small. According to M. MÓCZÁR, in national relation (1957, 1958, 1960, 1967), *Prosopis cornuta* SM., *Halictus morbillosus* KRIECHB., *Megachile leucomalla* GERST. are rare species, and *Halictus fulvipes* KLUG., *Osmia tridentata* DUF. et PERR., *Eucera nigrifacies* LEP., *Epeolus tristis* SMITH., *Bombus argillaceus* SCOP. are very rare ones. In the course of my regular collections in the county Csongrád, I have learned in case of *Halictus morbillosus* KRIECHB. that it was found at several collecting sites, with a compara-

Table 1. *List of collected Apoidea species by collecting sites and sexes*

Species	Tisza-sziget		Körtvélyes		Mártély	
	♀	♂	♀	♂	♀	♂
Prosopis euryscapa FÖRST.			+	+		
P. cornuta SM.			+			
Andrena carbonaria L.	+					
A. flavipes PZ.	+	+	+	+	+	
A. labialis K.	+	+	+	+		
A. limata SM.	+	+				
A. ovatula K.	+	+	+		+	
Camptopoeum Friesei MOCS.				+		
C. frontale F.				+		
Melitta leporina PZ.	+	+		+	+	+
M. tricincta K.			+			
Systropha curvicornis SCOP.	+		+			
S. planidens GIR.	+					
Dasypoda plumipes PZ.			+			
Halictus 4-cinctus F.	+	+	+	+	+	
H. 6-cinctus F.			+	+		
H. fulvipes KLUG.			+	+		
H. eurygnathus BLÜTHG.	+		+		+	
H. laticeps SCHCK.	+					
H. morbillosus KRIECHB.	+	+	+	+		
H. Kessleri BRAMS.			+			
H. maculatus SM.			+			
H. malachurus K.	+	+	+	+	+	
H. marginatus BR	+		+			
H. nigripes LEP.		+	+	+		
H. simplex BLÜTHG.		+				
H. intermedius SCHCK.			+			
H. politus SCHCK.			+			
H. veneticus EBMER	+		+			
Megachile argentata F.	+		+	+	+	
M. centuncularis L.			+	+	+	
M. ericetorum LEP.			+	+		
M. pilidens ALFK.			+			
M. rotundata F.			+		+	+
M. Willoughbiella K.			+	+	+	
M. leucomalla GERST.			+			
Osmia acuticornis DUF. & PERR.	+					
O. atrocoerulea SCHILL.			+			
O. aurulenta PZ.	+		+			
O. spinulosa K.			+			
O. tridentata DUF. & PERR.			+			
Anthidium oblongatum LATR.			+			
Tetralonia macroglossa f. xanthopyga ALFK.			+			
T. armeniaca MOR	+	+	+			
T. salicariae LEP.		+	+			
T. scabiosae MOCS.					+	+
Eucera clypeata EV.		+	+	+		
E. interrupta BAER			+	+		
E. longicornis L.	+					
E. nigrifacies LEP.	+	+				
E. nitidiventris MOCS.	+	+				
E. pollinosa SMITH.		+	+			
E. seminuda BR.		+	+			
E. tuberculata F.	+	+				
Anthophora acervorum var. Sgualens DOURS	+	+				

A. crinipes SMITH.		+		
A. parietina F.		+		
Epeolus tristis SMITH.				+
Xylocopa violacea L.			+	
Ceratina cyanea K.			+	
Bombus argillaceus SCOP.				+
B. derhamellus K.	+	+	+	
B. helferanus SEIDL.			+	
B. hortorum L.			+	
B. agrorum F.			+	
B. muscorum F.	+			
B. lapidarius L.	+	+		
B. terrestris L.	+	+	+	+
B. silvarum distinctus VOGT.	+	+	+	+
Psithyrus barbutellus K.	+			
P. rupestris F.		+		+
P. vestalis GEOFFR. & FOURCR.				+

tively high individual number, while in case of the other species mentioned the result of my collections is supporting M. Móczár's opinion. At Mártély the endemic species *Tetralonia scabiosae* MOCS. was collected. A o* specimen of the thermophilous species (PITTIONI—SCHMIDT 1943) *Camptopoeum friesei* MOCS. was found at Körtvélyes, having in an irregular way three cubital cells in the first pair of wings. In the Zoological Department of the Museum of Natural Sciences I haven't found any similar specimen in the course of comparison.

Table 2. *Dominancy values of the Apoidea species*

Species	Tiszasziget		Körtvélyes		Mártély		Sum	
	ind.	p. c.	ind.	p. c.	ind.	p. c.	ind.	p. c.
Halictus eurygnathus BLÜTHG.	46	25,55	26	9,12	6	12,50	78	15,20
Halictus malachurus K.	4	2,22	42	14,74	10	20,84	56	10,92
Bombus lapidarius L.	17	9,44	11	3,86	—	—	28	5,46
Tetralonia salicariae LEP.	1	0,55	21	7,37	—	—	22	4,29
Halictus fulvipes KLUG.	—	—	15	5,26	—	—	15	2,92
Halictus nigripes LEP.	2	1,10	13	4,56	—	—	15	2,92
Eucera tuberculata F.	12	6,65	—	—	—	—	12	2,34
Halictus marginatus BL.	1	0,55	9	3,16	—	—	10	1,95
Andrena limata SM.	11	6,11	—	—	—	—	11	2,15
Tetralonia scabiosae MOCS.	—	—	—	—	7	14,58	7	1,36
Other species	86	47,83	148	51,93	25	52,08	259	50,49

Dominance relations

On the basis of the results (Table 2), the species and individual numbers of the genus *Halictus* were the most considerable. In the sector investigated of the Tisza-dam, the dominance of *Halictus eurygnathus* BLÜTHG. (15.2 p. c.) and *Halictus* *malachurus* K. (10,92 p. c.) proved to be the most considerable. From among the Halictidae, the lucerne is visited resp. pollinated by *Halictus eurygnathus* BLÜTHG. with the most considerable individual number in national relation (MÓCZÁR 1961a). In the county Csongrád, apart from the above-mentioned *Halictus eurygnathus* BLÜTHG., *H. malachurus* K. is one of the main visiting wild bees of the lucerne fields of hard soil. (TANÁCS 1975). The species *Tetralonia* and *Eucera* were collected in comparatively large species and individual numbers. From the species *Bombus*, the dominance of *Bombus lapidarius* L. was the most considerable (5.46 p. c.). Their flower-visiting activity and flying distance are large, they display therefore a serious activity in pollinating the papilionaceous agricultures lying close to the dam. From the Andrenidae only the dominance of *Andrena limata* SM. was considerable. It is remarkable that the dominance of wild bees, as *Andrena ovatula* K., *A. labialis* K., *A. flavipes* PZ,, that are so frequent in our fauna-area, proved very small.

Summing up the results, it may be established that, in the course of the collections carried on at the Tisza-dams, the dominance of several economically important species, as the species *Halictus eurygnathus* BLÜTHG., *Halictus malachurus* K., *Bombus lapidarius* L., and that of the species *Eucera* and *Tetralonia*, was high.

Flower-visiting activity of the Apoidea

On the Tisza-dams, BODROGKÖZY (1966) distinguished three plant associations. At both sides of the dam-crown, the weed-association *Schlerechloo — Polygonetum avicularis,* on the dam-slopes *Cynodonti-Poëtum angustifoliae alopecuretosum*, while on the dam-feet the *Agrosti — alopecuretum poëtosum angustifoliae,* including several weedplants, are forming the plant-associations of the dam. The components of the stand of phytocoenoses are, to a smaller or larger extent, the phanerogamous weeds, meadow-plants and (sporadically) the cultivated plants. According to my observations at Tiszasziget in 1973—1974, in April, the Anthophora, mainly the male Eucera individuals, *Bombus derhamellus* K., *Andrena limata* Sm. visited the flowers of *Symphitum officinale* L., *Lamium purpureum* L., and *Glechoma hederacea* L., flowering at the feet of dams, towards the flood area. The flowers of *Taraxacum officinale* L. were visited by the first generation of the bivoltinous genus *Andrena* and *Halictus. Salvia nemorosa* L. and *Brassica napus* L. are flowering in large numbers from the second half of May, visited by the species of the genera *Eucera* and *Osmia.* In June, the main nectar-source of the Apoidea is the papilionaceous meadow-plants and weeds. *Lathyrus tuberosus* L. is first of all the main food plant of *Eucera*, while *Lotus corniculatus* L. that of Megachilidae. Summing up the flower-visiting results, it is to be established that the other species of the Apoidea swarming in June sporadically visit the flowers of the species *Vicia, Trifolium, Coronilla varia* L., *Consolida regalis* GRAY., *Echium vulgare* L., *Lathyrus tuberosus* L., *Lotus corniculatus* L. From the flower of *Convolvulus arvensis* L. I. have collected the species of genera *Systropha* and *Camtopoeum.* From the middle of the Summer, the flowers of the plant family Compositae, first of all those of *Carduus acanthoides* L. were visited by large numbers of Halictidae. I have collected the individuals of *Halictus eurygnathus* BLÜTHG., *H. malachurus* K., *H. 4-cinctus* F., *H. marginatus* BR., *H. morbillosus* KRIECHB., *H. nigripes* LEP., *H. 6-cinctus* F., *H. fulvipes* KLUG., mostly from the flowers of *Carduus acanthoides* L. In the second half of August, after the *Carduuses* ceasing flowering in large numbers, the flowers of *Centaurea pannonica* HEUFF., *Inula britannica* L., *Cicorium intybus* L., still flowering, are visited by the wild bees. At Körtvélyes, I have collected the individuals of *Tetralonia salicariae* LEP. from the flowers of *Althaea officinalis* L. and *Lythrum salicaria* L., found frequently in the burrows dried near the dam. At Körtvélyes, the individuals of *Tetralonia scabiosae* MOCS. occurred on the flowers of *Dipsacus silvestris* HUDO. The flower-visiting distance of Bombuses is long. The Andrenidae, with the exception of *Andrena limata* SM., can only be found comparatively rarely and with low species number on the flowers of dams. At Mártély and Tiszasziget, in a lucerne field lying directly close to the dam, in the time of its flowering, I did not collect any Andrenidae, except one *Andrena flavipes* PZ. It is probable that *A. ovatula* K., *A. labilais* K. visited the flowers of the near-by lucerne field. In September, the Apoidea visited the flowers of *Lythrum salicaria* L., *Cichorium intybus* L., and of the *Melilotus officinalis* L. occurring sporadically, and all flowering still.

As analysing the results, it may be established that during the flying-time of the Apoidea, a continuous pollen and nectar source is provided for them by the miscellaneous meadow and weed flora of the dam. That is important first of all at the end of June and in the first part of July when a periodical lack of nourishment occurs and, in case of the species *Eucera* and *Tetralonia*, that has a strong influence upon the nesting and offspring-educating activity of females (BENEDEK 1972).

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FACTORS STABILIZING THE ANT POPULATIONS (HYMENOPTERA: FORMICIDAE) IN THE GRASS ASSOCIATIONS OF THE TISZA BASIN

L. GALLÉ JR.
Department of Zoology Attila József University, Szeged, Hungary
(Received 20 December 1975)

Abstract

1. It could be demonstrated in the course of the ecological investigations carried out in the grass associations along the Tisza that the most important factors regulating the ant populations were climatic factors that, as density independent factors, fundamentally determined the in populations.
2. In case of a high population density, the competition within the elementary form of life plays a stabilizing part. A suitable indicator of that is the dispersion index.

Introduction

The previous monographs dealing with the Formicoidea fauna of the Tisza basin were discussing the density conditions of the ant fauna of grass associations (GALLÉ 1967, 1969, 1972a, GALLÉ and GAUSZ 1968), as well as the most important microclimatic factors regulating those (GALLÉ 1972a, b). The aim of the present paper is to create a comprehensing model about the factors regulating the ant populations of grass associations along the Tisza.

In an homogeneous or approximately homogeneous environment the ecological factors regulating the animal populations can be classified into two groups:

1. External factors, having an effect only on density (density independent factors);
2. Factors within the population, having an effect both on density and on dispersion (density depednent factors).

Density independent factors

At investigating the environmental factors regulating the ant populations, it is advisable to apply the correlation analysis between the climatic factors and the density of populations. In Table 1 we have displayed the correlation coefficients between the most important microclimatic factors and the density of ant populations obtained on the basis of the investigations at Tiszafüred (1970), Mártély (1971), and Labodár (1973). As it appears form these, the signs of coefficients are mostly

Table 1. *Correlation coefficients between the most important microclimatic factors and the density of ant populations. 1) Herb-layer temperature, 2) soil temperature, 3) Humidity, 4) ground water content. In the upper line there are given the results obtained at Tiszafüred (1970), in the middle those obtained at Mártély (1971), and below those obtained at Labodár (1973)*

species	1.	2.	3.	4.
Myrmica specioides BONDR.	0,132	−0,409	0,276	−0,605
	0,525	−0,125	0,194	0,801
	−0,692	−0,862	0,964	0,744
Solenopsis fugax LATR.	0,090	0,230	−0,488	−0,986
	0,373	−0,006	0,189	−0,144
	0,328	0,461	0,185	−0,257
Tetramorium caespitum LATR.	0,895	0,868	−0,785	0,129
	0,908	0,643	−0,708	−0,531
	0,454	0,300	−0,137	−0,463
Plagiolepis vindobonensis LOMN.	0,056	0,197	−0,510	−0,687
	0,463	0,447	−0,985	−0,033
	0,993	0,947	−0,941	−0,999
Lasius alienus FÖRST.	0,092	0,234	−0,498	−0,987
	—	—	—	—
	0,237	0,303	−0,269	−0,254
Lasius niger L.	−0,645	−0,280	0,908	0,681
	−0,908	−0,486	0,764	0,529
	−0,405	−0,177	−0,001	0,989

Table 2. *The linear correlation coefficients reckoned between the values of the microclimatic factors and the density of ant populations (upper line), and the correlation coefficients indicating the close non-linear connection (lower line), on the basis of measurings at Labodár (1973). The single factors are marked as in Table 1.*

species	1	2	3	4
Myrmica specioides BONDR.	−0,692	−0,862	0,964	0,744
	−0,805	−0,910	0,997	0,857
Solenopsis fugax LATR.	0,328	0,469	0,185	−0,257
	0,629	0,581	0,591	−0,627
Tetramorium caespitum LATR.	0,454	0,300	−0,137	−0,463
	0,896	0,870	−0,816	−0,509
Plagiolepis vindobonensis LOMN.	0,993	0,947	−0,941	−0,999
	0,997	0,963	−0,946	−0,999
Lasius alienus FÖRST.	0,327	0,303	−0,269	−0,257
	0,989	0,998	−0,892	−0,997
Lasius niger L.	−0,405	−0,177	−0,001	0,948
	−0,867	−0,908	0,997	0,998

conform in all the three areas. The use of these coefficients, however, supposes a linear connection between the climatic factors and the density of populations. If we indicate apart from the linear coefficients also the correlation coefficients that are suitable to characterize the close non-linear stochastic connections (Table 2), then it is shown by the higher numerical value of the latter ones and the significant character of those at the given degrees of liberty that the character of the connection is different from the linear one. At graphic plotting, it changes along the curve of saturation. From that, besides the density independent factors, the effect of density dependent factors may be concluded.

Density dependent factors

It would be a highly simple solution, to hold responsible the exhaustion of the available source of food, as a limiting factor, for such an „ant saturation" of the ecosystems of favourable environmental effect. Undoubtedly, it is true that ants have a large food requirement. But they are euryphages, not attached to a single source of food whose shortage would become a limiting factor of the density of population. Apart from certain special cases, therefore — e. g., from coenoses of extremely low primary production — we should not indicate the lack of nourishment as the most important limiting factor in the grass associations of the Tisza basin. In the abovementioned ecosystems of low primary production where, usually as a result of some anthropogeneous influence, the enrichment of vegetation is restrained, e. g. on pastured dam-slopes, in weed associations *Schlerochloo-Polygonetum avicularis, Messor structor* LATR. and *Tetramorium caespitum* LATR. are living. These two species consume vegetable grains, as well. In their nourishment, therefore, they are at least partly independent of the far too poor primary consument way of life of a degraded environmental systems like this. In these sites, therefore, owing to the functioning of Messor and partly of *Tetramorium,* the food chain reaching from plants till ants is quasi "short-circuited" by utilizing the vegetable source of energy. In most cases, however, the production of the grass coenoses along the Tisza is rich enough both at vegetable and at primary consument level to satisfy the food requirement even of the ants being present with a high population density.

We consider the intra- and inter-specific competition, anyway, as a considerable density dependent factor. At ants, particularly in case of the so-called agressive species, this manifests itself in the territorial behaviour (PISARSKI 1972). In a homogeneous or nearly homogeneous environment, a very suitable characteristic of the intraspecific competition is the dispersion of ants' nests. In case of a strong intraspecific competition the dispersion is of uniform type, the dispersion index ($V = \frac{s^2}{\bar{x}}$ being smaller than one. There are several literary data known concerning the dispersion of ants nests .BRIAN (1956) observed on the populations of *Myrmica rubra* and associated ants' that in case of a high density they show a random or uniform dispersion. He sees the cause of that in the intraspecific competition. BARONI—URBANI (1969) studied the dispersion of *Lasius alienus* and *Tetramorium caespitum* with the Morisita index and x^2 testing and found it, on the basis of the x^2 testing, being random. PETAL (1972) established, on the basis of 25 sq. m samples, some clumping dispersion on the populations of *Myrmica laevinodis* (V=2,28) while, in case of a smaller sample size, he noticed a random and uniform diespersion. He regards these as dispersion types inside the clumps.

If the dispersion index is plotted against the population density ($\bar{x}$) of the various grass associations (Figs. 1 and 2), we are learning that the dispersion index is

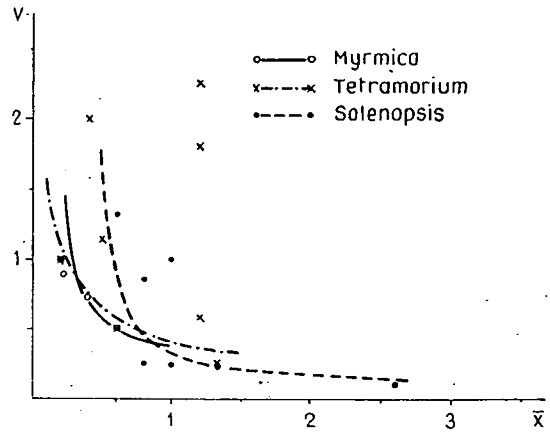

Fig. 1. Depending of the dispersion index (V) on the average density ($\bar{x}$). The peculiar situation of the points concerning *Tetramorium* (1.2; 1.8) and (1.2; 2.25) is probably explained by that, in the ecosystem given, several nests lying close to one another belong to the same colony and were counted separately

inversely proportional to population density. In case of a few species, present with the highest nest density, the equality between them has the following form:

Myrmica specioides BONDR.:

$$V = 0.3 + \frac{1}{12.574\bar{x} - 2.275}$$

Tetramorium caespitum LATR.:

$$V = 0.1 + \frac{1}{0.3883 + 2.822\bar{x}}$$

Solenopsis fugax LATR.:

$$V = 0.1 + \frac{1}{8{,}478\bar{x} - 3.854}$$

Lasius niger L.:

$$V = 0.4 + \frac{1}{10.31\bar{x} - 0.366}$$

Plagiolepsis spp.:

$$V = 0.2 + \frac{1}{0.137 + 3.031\bar{x}}$$

Together with the increase in density the dispersion becomes, therefore, more uniform, in sites of a higher population density, owing to the competitive relation between the nests, the "reciprocal repelling effect" of nests grows stronger. The mosaic-like arrangement off the territories and nests is a result just of that fact.

In a part of ants, on the other hand, the intraspecific competition is exceeded

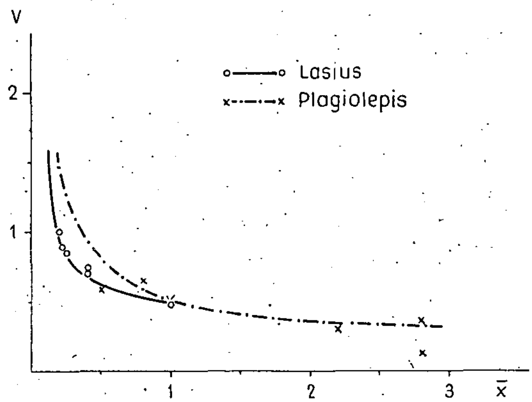

Fig. 2. Depending of the dispersion index (V) on the average density (x) in case of *Lasius niger* and *Plagiolepis* spp.

by the interspecific one, as seen in the laboratory model experiments, as well (MOLNÁR 1975), e. g. concenring the species *Lasius affinis* SCHENCK. The workers — coming from different colonies of Lasius affinis that are very frequent in the grass associations along the Tisza — did not show any aggressive behaviour at all facing one another; at the same time, they attacked the individuals of other species in a very aggressive way.

According to the above, when we speak of competition as a population-stabilizing factor, in case of ants that may refer not only to the intraspecific form or to the interspecific one but to both of them. It is decided by the ethological character of the population given, which of these will play a more considerable part. As to the competition, in the literature there were several papers published so far (BRIAN 1956, 1965, PONTIN 1961, 1963, REZNIKOVA 1974, STEBAEV and REZNIKOVA 1972, BARONI URBANI 1969. 1974).

Interaction of density and of regulating factors

For summarizing the above, we may illustrate in a simple model the interaction of density and the factors regulating the ant populations (Fig. 3). Advancing from a habitat that is unfavourable to an at population towards another that is favourable, the density independent factors (DNDF) become more and more of preconditioning character. At the same time, as already mentioned, the density of population (D) is changing along the saturation curve, as density is stabilized at a permanent level by density dependent factors (DDF), manifesting themselves with the increased population density. The effect of the density dependent factors is, therefore, strengthened by the increase in density. Then, just as a result of that these factors stabilize the population in a favourable environment, too, at a permanent level, the tempo of its increasing becomes slower and later on stops increasing, together with that of density. The effect of these DDF factors is therefore changing, as advancing towards a habitat of a more and more favourable environmental effect, along the longistic curve. The connection between the three variables (DNDF, D, DDF) is shown by the spatial curve seen in Fig. 3. Finally, the dependence of the density dependent factors upon density is given by the projection of the spatial curve at the plane determined by axes D and DDF that is an expoenntial curve.

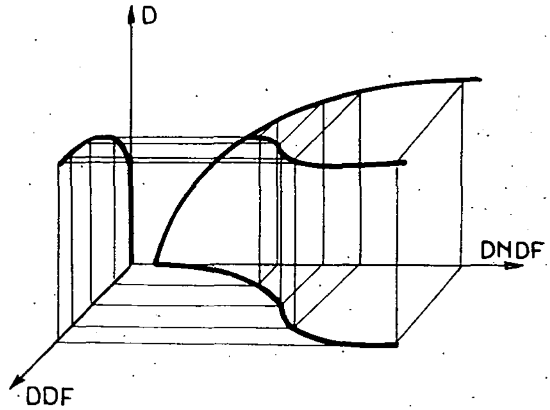

Fig. 3. Interaction of the density independent factors (DNDF), population density (D), and the density dependent factors (DHF).

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TABANIDAE FAUNA IN THE AREA OF THE TISZA II RIVER BARRAGE

S. TÓTH
Museum of Natural Sciences of the Bakony, Zirc, Hungary
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Abstract

The author dealt from 1966 to 1973 with investigating the Tabanidae fauna in the area of the Tisza II river barrage. In addition to the flood area, he extended his activity over the outlined control areas (meadow at Tiszanána, Cserőköz), as well. The half of the about Fifty Tabanidae species, demonstrated from Hungary, could be collected from the area. From among them, the following are worth of being mentioned separately: Heptatoma pelluceus Fabr., *Chrysops rufipes* MEIG., *Tabanus apricus* MEIG., *Tabanus exclusus* PAND., *Haematopota hispanica* Szil.

Introduction

In the area of the Tisza II river barrage, but overwhelmingly between Kisköre and Tiszafüred, I carried out collections of changing intensity from 1966 to 1973. The bulk of that activity was concentrated on the flood area but it was extended over the meadow at Tiszanánás and Cserőköz, as well. (A sketch map of the area is shown in Fig. 1, with the most important sampling points). The latter ones are good Tabanidae sampling sites because the blood-sucking horse-flies are attracted by the grazing and resting animals. We have often managed, therefore, apart from singling with nets, of collecting them from grazing or resting cattle, on rare occasions from horses. Of late, we have achieved good results by collecting with Malaise-traps. The horse-flies have a great propensity for attacking men, too, in order to try blood-sucking. Thus, of course, I netted also the Tabanids attacking me during my collecting. It is due to this collecting method that the rare Heptatoma pellucens Febr. was found in Tiszafüred.

The research after the Tabanidae fauna in Hungary has comparatively been well-organized. In earlier years mainly SZILÁDY (quotation) dealt with them rather intensively. The elaboration of the Tabanidae collection in the zoological department of the Museum of Natural Sciences had been carried out before its combustion in 1956. It is a great luck that the publication of the faunistic data of the material could take place, as well (ARADI 1956). In the publication there are, unfortunately, hardly any data concerning the Tisza basin. Apart from the publication mentioned, there are published only communications concerning smaller areas that contain Tabanidae, too (TÓTH 1964, 1966, 1967, 1968, ZILAHI-S 1961). These are partly referring, in fact, to the Tisza basin (ZILAHI-S, 1961, TÓTH 1966, 1967), nevertheless, they mention not even a single Tabanidae species from the area of the Tisza II river barrage. The metarial collected there furnishes, however, in its entirety new data on the Tabanidae fauna of the area. That is so much the more important as the inundation of the area already began and so in the future a research of the land fauna will not be possible there.

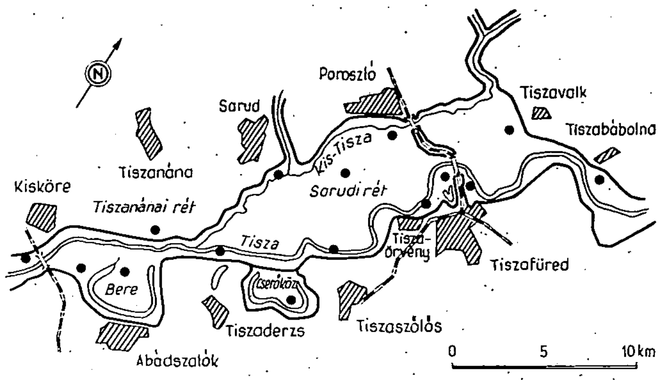

Fig. 1. Sketch map of the area of the Tisza II river barrage with the major Tabenidae sampling points.

In the future, the investigation of the Tabanidae fauna in the area of the Tisza II river barrage will comprise exclusively the outlined control areas of the meadow at Tiszaszána and Cserőköz, with comparative character. In the course of the researches, the presence of 25 Tabanidae species could be demonstrated in the area of the Tisza II river barrage. The Tabanidae fauna of the area cannot be called rich in species count. About the half of the Fifty species demonstrated from Hungary are present in the area of the river barrage. It is, however, to be noticed that the fauna of the hilly and mountainous districts is richer in Tabanids, as well. The great masses of the so-called rare species that are present in this country live in our mountainous districts.

The paper contains the results of the elaboration of 520 Tabanidae individuals belonging to 25 species. The comparatively high number of specimens enable the ma-

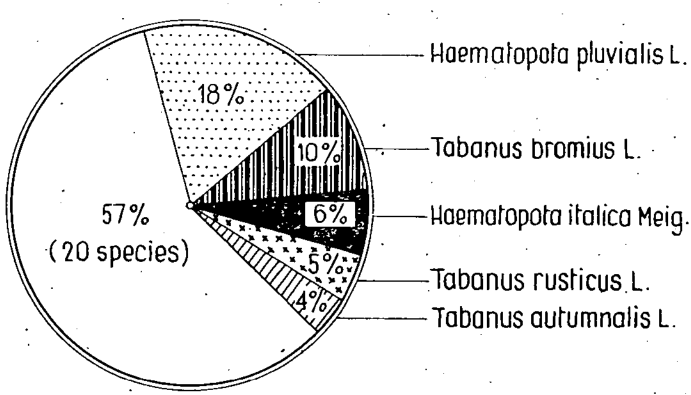

Fig. 2. The Tabanidae species participating in a higher percentage in the material collected in the area of the Tisza II river barrage.

terial to be evaluated, too. From the investigation of quantitative conditions it emerges that in the area *Haematopota plüvialis* L. is predominating, a species highly emerging with its 18 per cent participation in the whole material. This value may have risen above the national average. There is, unforunately, hardly any opportunity to compare the data because concerning the Tabanidae species no investigations of this character have been performed in Hungary. I can, therefore, lean only on my own experiences. The species present in a higher percentage are shown in Fig. 2. The five species shown are 43 per cent of the whole material. The remaining 57 per cent are, therefore, divided into 20 species, in a rather varied ratio. We could collect but a single individual each from the following species: *Chrysops caecutiens* L., *Tabanus fulvus* Meig., *Tabanus acuminatus* Loew., *Tabanus apricus* Meig., *Tabanus quatuornotatus* Meig., *Tabanus exclusus* Pand., *Heptatoma pellucens* Fabr.

Discussion of the species collected

Chrysops rufipes Meig.

A Euro-Siberian species found in Hungary only sporadically. It seemed to be a flatland species by reason of its earlier habitats. In 1973, however, it was found in the Bakony (a wooded hilly district in Western Hungary), as well (fish-pond at Gyulafirátót). It is unfortunate that the exact conditions of its collection, in case of the specimens found by others earlier, are not known. Its habitats recognized by me are exclusively at the banks of the Tisza backwaters and at the shores of larger lakes. The species is an interesting variegated element of the Diptera fauna of the Tisza basin. It was found in the area of the Tisza II river barrage, near the Tisza backwater: on July 25, 1969; July 30, 1971.

Chrysops caecutiens L.

A Euro-Siberian species, frequent in this country, as well. In the Tisza basin, however, so far for unexplainable reasons, it hardly occurs. In the Hungarian part of the Tisza basin we succeeded but in the area at Abádszalók (Bere) to collect a female individual of it, on August 18, 1973.

Chrysops pictus Meig.

It is present in Central and Eastern Europe. In Hungary it is sporadically frequent but that cannot be said of the Tisza region. In the area of the Tisza II river barrage it is rather rare. Its habitats were: Kisköre, September 17, 1972; Tiszafüred, July 25, 1969.

Chrsysops relictus MEIG.

It is present in Europe, Siberia, and Northern Mongolia. In Hungary it is frequent in the flat regions—thus, in the area of the Tisza II river barrage, as well.

Its habitats were: Abádszalók, July 9, 1968, Abádszalók: Bere, August 27, 1972, Cserőköz, July 27, 1970 (from resting cattle), Kisköre, August 25, 1969, meadow at Sarud, August 1, 1968, July 26, 1971, Tiszaderzs, July 23, 1969, Tiszafüred, July 2, 1968, July 15, July 25, 1969, July 26, 1971., Tiszavalk, May 28, 1969 (from graz — ing cattle).

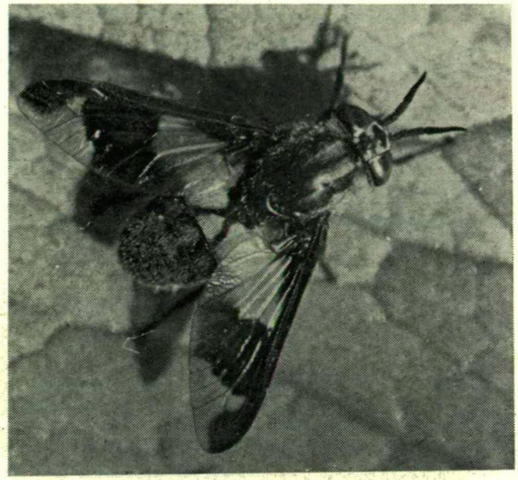

Fig. 3. *Chrysops caecutiens* L.

Fig. 4. Habitat of the larvae of several Tabenidae species at Sarud, along the Small-Tisza.

Chrysops flavipes MEIG.

It lives in Central and South Europe, Asia Minor, and North Africa. In Hungary, it is mainly characteristic of the hilly and mountainous regions. In the Great Hungarian Plain it cannot be called frequent. ARADI (1956) is mentioning it only from Kalocsa. But in the course of the Tisza research it was found at seven points of the Tisza basin till 1964 (TÓTH 1967). It is frequent in the area of the Tisza II river barrage, too. It is such a Tabanida species that can be collected till the latest in Autumn. It has a great propensity for attacking man. Its habitats were: Abádszalók, July 9, 1968, August 26, 1972 (from the flower of Daucus carota L.), Cserőköz, July 27, 1970, August 19, 1973 (from resting cattle), Kisköre, Octóber 16, 1966, Tiszafüred, July 2, 1968, July 31, 1968, October 8, 1973, Tiszavalk, May 28, 1969.

Tabanus fulvus MEIG.

A Euro-Siberian species. In Hungary it is present but sporadically, but in some parts of the Great Hungarian Plain it appears to be more frequent. In the area of the Tisza II river barrage there was only found a single individual of it from the flower of *Angelica silvestris* L.: Tiszafüred, dead Tisza channel, July 26, 1971.

Tabanus rusticus L.

A Euro-Siberian horse-fly. In Hungary it is ubiquitous, too. In some places (e. g., Hejőbába) it can be collected in large numbers from various flowers. It is frequently found in the area of the Tisza II river barrage, as well. It habitats were: Abádszalók, July 9, 1968, Cserőköz, August 19, 1973 (from the flower of *Butomus umbellatus* L.) Kisköre, August 28. 1972. Poroszló, August 1, 1968 (from the flower of *Eryngium planum* L.), Tiszabábolna, June 7, 1968, Tiszafüred, July 31, 1968, July 15, 1969, July 26, 1971 (from the flower of *Butomus umbellatus* L.), Tiszanána, August 21, 1969 (from the flower of *Daucus carota* L.).

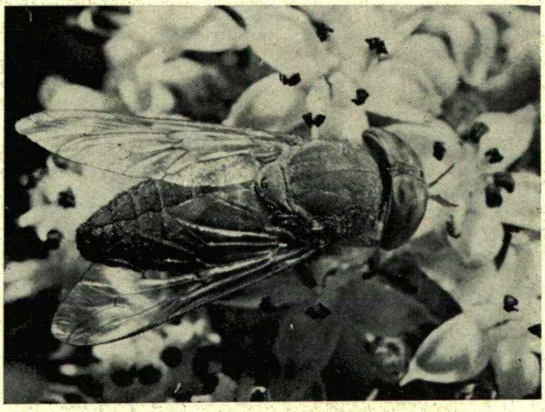

Fig. 5. *Tabanus rusticus* L.

Tabanus distinguendus VERR.

It can be found in Europe, Siberia, and Japan. In Hungary it is not rare, either. In the area of the Tisza II river barrage it is present only sporadically. Its habitats were: Tiszafüred, July 2, 1968, Tiszavalk, May 28, 1969.

Tabanus solstitialis SCHIN.

A European species, it is of frequent occurrence in Hungary, too. It can be found in every part of the Tisza basin, as well. It prefers first of all the bushy, grove-like areas. On the animals of the grazing herd there could be found but a few animals. But at the same time, in the gallery forest lining the pasture, large numbers of them could be netted. This could be observed in the area of the Tisza II river barrage, as well. Its habitats were: Cserőköz, July 27, 1970, Tiszafüred, July 25, 1969, July 30, 1971 (four individuals collected from grazing cattle), meadow at Tiszanána, August 25, 1969, Tiszaörvény, August 24, 1970, Tiszavalk, May 28, 1969.

Tabanus acuminatus LOEW.

It lives in Central and South Europe, Sibiria, and Asia Minor. In Hungary it may be called rare. From the Great Hungarian Plain it is only mentioned from Ágasegyháza by the literature (ARADI 1956). Its being found in the area of the Tisza II river barrage is, therefore, a remarkable datum concerning the distribution of the species. Its habitat was: Tiszaszőlős, July 26, 1970.

Tabanus apricus MEIG.

It lives in Central and South Europe, Caucasus, as well as Hither Asia. In Hungary it was found but sporadically, first of all in hilly and mountainous regions. It was only known from the border of the Great Plain, in the zoogeographical sense of the word (Őrszentmiklós = the present-day Őrbattyán). Its being found in the area of the Tisza II river barrage is, therefore, a valuable datum on the Tabanidae fauna of the Hungarian Great Plain. Its habitat was: Tiszafüred, July 2, 1968.

Tabanus quatuornotatus MEIG.

It can be found in Central and South Europe and South-Eastern Asia. In Hungary it is characteristic rather of the hilly and mountainous regions. In the area fo the river barrage there was only found a single individual of it, from Tiszaörvény (August 23, 1969).

Tabanus bifarius LOEW.

It is a denizen of Central and South Europe, North Africa, and Asia Minor. It is not rare in Hungary, either. In the area of the Tisza II river barrage there were found only two individuals of it. Its habitats were: Abádszalók: Bere, July 9, 1968, Tiszafüred, July 31, 1968.

Tabanus exclusus PAND.

A species found sporadically in the hilly and mountainous regions of Central and South Europe. In Hungary it is rare; earlier it was only known from Bag and

Pápa. From the Tisza basin one female individual was found (Abádszalók, July 9, 1968). The distinguishing characters of the species can be recognized well, it can therefore be identified undisputably. It is imaginable, anyway, that the individual may have emigrated from the not too far away hilly region under the pressure of circumstances (e. g., a strong wind). At any rate, it adds a new datum to the Tabanidae fauna of the Great Hungarian Plain.

Tabanus glaucopis MEIG.

A Euro-Siberian species. In Hungary it is present sporadically, first of all in the mountainous regions, in larger numbers. From the Great Plain there are known but a few habitats of it (Kalocsa, Kecskemét). Our knowledge concerning the distribution of the species in the Hungarian Plain is therefore considerably completed by its being found in the area of the Tisza II river barrage. Its habitats were: Abádszalók; August 27, 1972, meadow at Tiszanána, September 18, 1972.

Tabanus tergestinus EGG.

As a denizen of Central and South Europe, it is ubiquitous in Hungary, as well. In the area of the Tisza II river barrage, however, it was only found sporadically. Its habitats were: Meadow at Sarud, July 26, 1971, Tiszafüred, July 15, 1969, Tiszavalk, May 28, 1969.

Tabanus maculicornis ZETT.

It is a denizen of Europe and Western Siberia. In Hungary, the species is characteristic rather of the hilly and mountainous regions. In the Great Hungarian Plain it is known but from a few habitats. Its presence in the area of the Tisza II river barrage is, therefore, a remarkable datum. Its habitats were: Cserőköz, July 25, 1970, meadow at Sarud, July 26, 1971, Tiszafüred, July 2, 1968.

Tabanus bromius L.

It has been a horse-fly of frequent occurrence in the whole Palaearctic Region, therefore in Hungary, as well. It may be found in the area of the Tisza II river barrage, too, in many places. Its habitats were: Abádszalók: Bere, August 26, 1972, Cserőköz, July 23, 1969 (16 individuals, collected on resting cattle), meadow at Sarud, August 1, 1968 (six individuals, observed on grazing horses), Tiszaderzs, July 23, 1969, Tiszafüred, July 15, 1969, July 25, 1969, July 30, 1971 (12 individuals observed on grazing cattle), meadow at Tiszanána, August 21, 1969, August 25, 1969.

Tabanus autumnalis L.

It is a horse-fly of frequent occurrence in Europe, Western Siberia, Asia Minor, and North Africa. It is ubiquitous everywhere in Hungary, too, but it can rather be collected individually, one by one. It is frequent in the area of the Tisza II river barrage. On grazing or resting animals it can usually be found. Its habitats were: Abádszalók: Bere, August 23, 1969, August 18, 1973, Cserőköz, August 19, 1973 (three individuals collected from resting cattle), Kisköre, August 28, 1972, meadow at Sarud, August 27, 1970)two individuals collected from grazing cattle), Tiszafüred July 30, 1971 (five individuals observed on resting cattle), Tiszafüred, near the dead Tisza channel, July 22, 1969, August 25, 1972, Tiszaörvény, August 24, 1970.

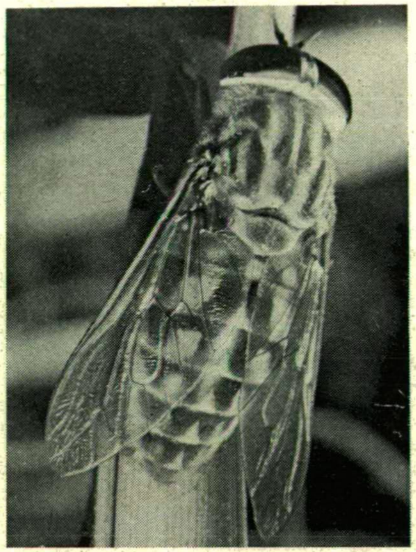

Fig. 6. *Tabanus autumnalis* L.

Tabanus bovinus LOEW.

It is a denizen of Europe, Western Siberia, and North Africa. In Hungary it is not rare, being characteristic mainly of the mountainous region but it is present sporadically in the Great Hungarian Plain, too. In the area of the Tisza II river barrage only two individuals could be collected. Its habitats were: Cserőköz, July 21, 1970. meadow at Sarud August 20, 1973.

Heptatoma pellucens FABR.

It is a denizen of Central and Northern Europe. The turning up of this species, that may be called rare in Hungary, in the area of the Tisza II river barrage is remarkable because earlier it was only known in the Great Plain from Kecskemét, on the basis of an old literary datum. As it could not be collected from the Great Plain since then, it could be considered doubtful if the datum from Kecskemét was not an erroneous one. At Tiszafüred, a female individual was found in a flood-plain grove, from a bushy, marshy area on July 30, 1971.

Haematopota italica MEIG.

It lives in Central and South Europe, as well as in North Africa. In Hungary it seemed to be of frequent occurrence, first of all in the hilly and mountainous regions. From the Great Hungarian Plain only two habitats of it are published by ARADI (1956). I myself collected about 20 individuals of it (Eszlár, Tiszabercel, 1961). It is interesting that in the post-1961 years it could not be found. In 1969, on the other hand, more than 30 individuals were collected at Tiszafüred. In the area of the Tisza II river barrage it is frequent and at times even common. Apart from *H. pluvialis* L. it is the main torturer of horses and cattle. Its habitats were: Abádszalók, August 18, 1973, Cserőköz, July 26, 1970 (18 individuals collected from resting cattle), Kisköre, August 21, 1969, meadow at Sarud, July 26, 1971, Tiszabábolna, June 3, 1969, Tiszafüred, August 2, 1968, July 15, 1969 (15 individuals collected from a grazing horse), July 25, 1969, July 30, 1971, Tiszaörvény, August 25, 1970.

Haematopota grandis MACQ.

It is a Central European species, being not rare in Hungary, either. In the Tisza basin it is present only sporadically. It habitats were: Poroszló, August 1, 1968, meadow at Sarud, July 23, 1969.

Haematopota hispanica SZIL.

It lives in Central and South Europe, as well as in Western Siberia. In Hungary it was only found of late. It was found in the Tisza flood-plain at Tiszafüred in the area of the Tisza II river barrage (July 15, July 25, 1969). Although there are some individuals of the species from several points of the country in the Tabanidae collection of the zoological department of the Museum of Natural Sciences, these have not been published, as yet. The occurrence at Tiszafüred is, therefore, the first datum published concerning the presence of the species in Hungary.

Haematopota pluvialis L.

It can be found in Europe, in the middle regions of Siberia, and in North Africa. It is an ubiquitous, frequent and sporadically very common hosre-fly in Hungary, the most frequent Tabanida species in the area of the Tisza II river barrage. It lives close to waters, in bushy, wooded places, infesting the cattle and horses grazing there (particularly if the animals are alone) often in enormous numbers, and tormenting them with blood-sucking. It occurred in cloudy, stifling, warm seasons before rains that at hay-loading about fifty individuals of them were simultaneously observed on a single horse harnessed to a cart. It may be imagined, of course, that a lesser percentage of the individuals belonged to other Haematopota species (though the individuals collected proved to be all *H. pluvial* L.) Its. habitats were: Abádszalók, August 23, 1969, August 26, 1972, August 27, 1972, Cserőköz, July 27, 1970 (23 individuals collected on garzing cattle), August 19. 1973, Kisköre, August 21, 1969, Poroszló, August 1, 1968, Sarud, August 24, 1969, meadow at Sarud, July

23, 1969, August 27, 1970, August 20, 1973, Tiszabábolna, June 3, 1969, Tiszaderzs, July 20, 1969, Tiszafüred, July 15, 1969, July 25, 1969, July 30, 1971 (17 individuals collected on horses), August 25, 1972, Tiszanána, August 21, 1969, Tiszaörvény, August 19, 1973, Tiszaszőlős, July 26, 1970.

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INVESTIGATION OF THE RELATION BETWEEN BODY LENGTH AND BODY WEIGHT OF THE PIKE-PERCH (LUCIOPERCA LUCIOPERCA L.) IN THE TISZA-STRETCH AT TISZAFÜRED

Á. HARKA
Lajos Kossuth Secondary School, Tiszafüred, Hungary
(Received 9 December 1975)

Abstract

The correlation, reckoned on the basis of the data of 212 fish individuals collected in the years 1973 to 1975, is: $1 g W = -5.6303 + 3.2837.1 g L$, where W is body weight in g, and L is standard length in mm. The correlation is valid to the specimens above 27 cm.

Comparing the parameters of the equation to similar data on the population in Lake Balaton, it can be estalbiched that the average weight of the individuals in the Tisza, at 300 to 500 mm size, is about 2.5 decagram smaller than that of those in the Balaton. Although the tempo of growth of the individuals in the Tisza is faster and, therefore, in case of $L > 561$ mm the situation is already reversed, in practice it isn't of great importance because a larger size than that is achieved at most by 3 per cent of the fish caught.

Introduction

In analysing the populations a consideable part is played by the allometric investigations. The allometries — following Röhrs (BERINKEY 1966) — are usually arranged in four groups: ontogenetic, supergenetic or evolutionary, interspecific and intraspecific allometries.

At investigating populations we strive for establishing the intraspecific allometries. From among these, from the point of view of production-biology — at least in case of the pike-perch populations — it is of the utmost importance to determine the allometric relation between body length and body weight.

Material of investigation

I have used for investigating the weight and length relation of the pike-perch stock in the Tisza the data of 212 pike-perch individuals, collected in the river stretch at Tiszafüred between March 15, 1973 and October 22, 1975. The measures of length were changing between 27 and 77 cm, the body weights between 24 and 642 dkg. The body length of the individuals — from the tip of the nose till the beginning of the tail fin — was measured with 1 cm, and the body weights were determined with 1 decagram precision. I did not consider as justified to measure with 1 g and 1 mm precision, as these measurings could not take place under completely identical conditions. Thus the result of using smaller units of measure would have been but a sham accuracy.

Method

I have reckoned the relation of weight and length on the basis of the formula suggested by Tesch (1968):

$$W = a \cdot L$$

respectively of the logarithmic form of that:

$$\lg W = \lg a + b \cdot \lg L$$

where W is the body weight of fish, L its body length, and "a" and "b" are the constants of equation. I adapted the function to the data with the least square method (Sváb 1973).

I have reckoned the values of the condition factor according to Hile (1936), on the basis of the relation:

$$CF = \frac{W}{L^3}$$

where L is the body length in mm, and W is the body weight in g, as calculated from the allometric connection.

Results

By analysing the relation transformed into a linear equation, I have obtained the following regressive equation:

$$\lg W = -3.3466 + 3.2837 \lg L$$

where W is given in decagram, and 1 in cm.

In Hungary — as I know — we have data of this character only on the pike-perch stock of the Balaton, published by Bíró (1970). Accordiog to his investigations, to the individuals longer than 200 mm the following connection is valid:

$$\lg W = -5.2996 + 3.1634 \lg L$$

where, however, W is given in g, L in mm.

For comparability, I also reduced the connection concerning the stock in the Tisza to g and mm. The relation, shown in Fig. 1 and obtained in that way, is the following:

$$\lg W = -5.6303 + 3.2837 \lg L$$

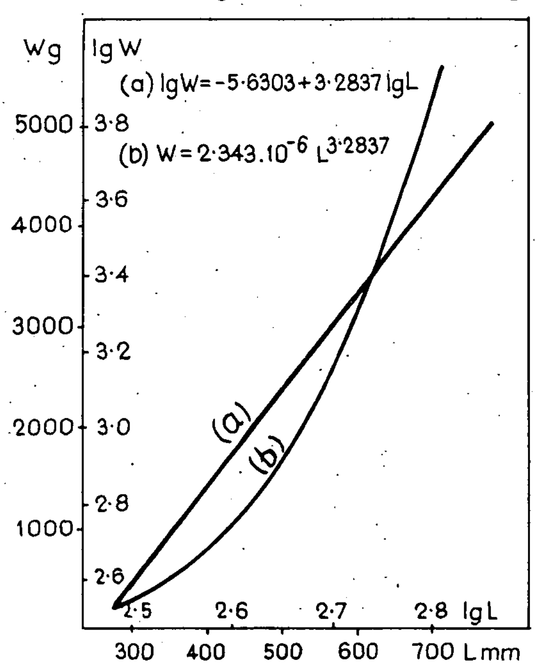

Fig. 1.
Allometric relation of body weight and body length.
W: body weight (in g)
L: body length (in mm).

After comparing the parameters of both equations, there is no essential difference to be seen. And that is natural, talking about groups within an identical species. Nonetheless, there is a little difference in case of both constants. For the sake of clearness, I expressed the average weights belonging to the single body measures out of both equations (Table 1).

It can be seen from the data, and the same is shown by constants "a" of the equations, that the pike-perches in the Tisza start with a smaller weight and are handicapped for a long time.

It appears from the comparison of constans "b", the so-called alometric exponents, that in the Tisza population the tempo of gaining weight is faster. Demonstrating that on an example: while in case of the Balaton pike-perches at a double growth in length their gain in weight was 8.9-fold, the same of the Tisza individuals was 9.7-fold.

Table 1. *Body weight of pike-perches of the Balaton and of the Tisza*

Body length (mm)	Body weight (g)	
	Balaton	Tisza
300	344	319
400	855	821
500	1732	1708
600	3083	3109
700	5019	5154

From the point of view of production the condition of fish, that can be characterized by comparing the condition factors (CF), is important (Table 2). It is apparent from these data that the condition of the pike-perches in the Tisza, that are smaller than 561 mm, is poorer than of those in the Balaton. About 97 per cent of the individual caught were below the size limit mentioned above.

Table 2. *Condition of pike-perches of the Balaton and of the Tisza*

Body length (mm)	$10^5 \cdot CF$	
	Balaton	Tisza
300	1.2740	1.1814
400	1.3359	1.2828
500	1.3856	1.3664
561	1.4153	1.4153
600	1.4273	1.4393
700	1.4632	1.5026

To sum up: The poupulation in the Tisza starts with smaller body weights and that handicap remains for long in spite of the faster tempo of growing. The condition of the large majority of the individuals caught is, therefore, poorer. Their body weight — in about 90 per cent of the cases — is by about 2.5 decagram smaller than the weight of the individuals of the same size caught from the Balaton.

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DATA ON THE COMPARATIVE ECOLOGY OF THE SCRUB WARBLER (HIPPOLAIS PALLIDA ELAEICA (LIND.)) AND ITS SPREADING ALONG THE TISZA IN THE YEARS 1973 TO 1974

A. BANKOVICS

Museum of Natural Sciences of the Bakony, Zirc (Hungary)

(Received 18 November 1975)

Abstract

In 1973, the scrub warbler *(Hippolais pallida)* was found in new habitats along the Tisza. At the river bank opposite to Szajol three pairs, at Tiszasüly four pairs were found. All of them appeared in the Salix triandra L. stand fringing the river bed.

The wide ecological valency of *Hippolais pallida*, as a species extending its range, is shown by that while in Hungary it settles down in the first place to the floodplains of the river, near the water, its habitats in the Balkan peninsula are often in a dry environment far from the waters.

Distribution data

In 1972, I found scrub warblers (*Hippolais pallida elaeica* (LIND.)) at Tiszakürt, a northernmost site at the Tisza. I have not found it in the 8 km floodplain stretch investigated at Szolnok. In the latter area it did not appear in 1973, either, but rather north of it, at the riverside opposite to Szajol, in an about 400 m long stretching *Salicetum triandrae* association, at river-km 343, I found two pairs, and later 1 km south of them 1 pair, on the 14th of June. Next day, on the 15th of June, 40 km above Tiszasüly, at river-km 383, in the right-bank *Salicetum triandrae* zone I observed four singing males, in an about 300 m stretch. These observations are supporting, too, the earlier establishment that the scrub warbler settles down in the Tisza and Danube stretches in Hungary mainly in the Salix triandra L. stands fringing the edge of the river bed (BANKOVICS—MOLNÁR 1970, BANKOVICS 1974). (Fig. 1). The above habitats are new in respect of the distribution of the bird. But there may not be drawn any exact conclusion concerning the tempo of spreading of the species as in the areas mentioned no similar investigation took place in the earlier years. We may not know, theerfore, when they appeared there. In connection with that I may mention that on June 22nd and 23rd, at Kisköre, between river-kms 400 to 403, I could not found them in the *Salix triandra* stocks, either, that ensure the optimum environmental conditions. It may be supposed, therefore, that it has not reached here in its distribution. That can only be proved, anyway, by the research work further on. In 1974, the prolonged flood, having passed in the hatching period, may have destroyed the nests of the population in the Tisza floodplains but, in the same way, it frustrated also the research work taking place with earlier methods. Thus the negative results of the observations carried out from the dam between

Tiszafüred and Tiszacsege on July 12th—13th do not say much. In that time, namely, there was still water standing several km broad, from dam to dam. Its real habitat was unapproachable because of the flood. I have not noticed any scrub warbler on the way. Nevertheless, it may already live, apart from this, in the area.

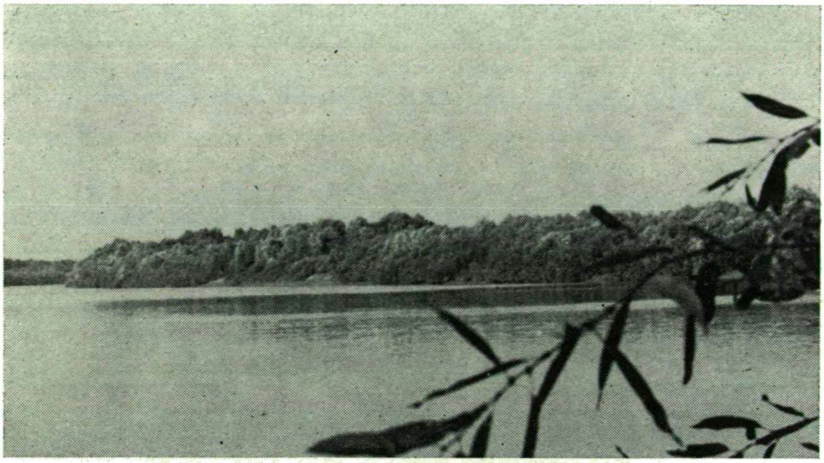

Fig. 1. Habitat of the scrub warbler, the *Salicetum triandrae* plant association at Tápé. (Photograph: Bankovics, A.).

Fig. 2. A male scrub warbler just passing food to a hatching hen-bird. (Photograph: Molnár, Gy.).

In 1974, during the nesting time, I looked for it in vain, besides the Tisza, along the Zagyva, too, at Újszász, as well as between Győr and Kunsziget, at the Moson-Danube arm, too. Both areas are showing some affinity to the Tisza floodplains, the floodplain bird-community is almost the same, as well. But the scrub warbler is lacking in these areas, for the time being. Its favourable habitat, the *Salicetum triandrae* plant association is not formed, either, in the above sites. That, however, would be absolutely important for the settlement of the species.

On the distribution of the urbanized population we have obtained some data from 1973. It was first observed by József Rékási and István Pelle in Bácsalmás, an area under a thorough watching, that year. They could observe the singing-bird for a long time but they did not succeed in proving its nesting (Oral information by J. Rékási).

Ecological comparison

I should like to illustrate the changing ecological demands of the species by discussing my observations in Jugoslavia in 1973 and 1974. As constrasted with the river-floodplain populations in Hungary, I have often met the scrub warbler in Macedonia, Monte Negro, and Dalmatia in a strikingly arid environment. On May 5th, 1973 a male individual kept on singing in the almost unwooded East Macedonia, 5 km north of Lake Dojran, on dry, scrubby mountain-sides, among the scrubs of a valley kept wet by means of a source. The nearest considerable water, a mountain torrent, is 2 km from there. On May 9, 1973, at Ulanci, in the basin of Vardar, 200 m from the river, on a row of scrubs, there sang similarly a male warbler. These may still have been migrating birds. In 1974 I found this species in a still more strikingly arid environment. On May 18, in the shrubberies of a 1 square km coastal flatland situated at Petrovac-Bulgarica along the seaside of Monte Negro, there were three of four singing males 500 m from the sea. The birds spread to the dry shrubberies of the foot of the mountain, as well, and there continued singing and looking for nourishment in the pines. On May 20, at Makarska in Dalmacia, in an about 35 years old pinewood (*Pinus* sp.) covering the talus slope of the Biokovo mountain, I found their smaller population consisting of five to six pairs. Knowing the humid habitat of this bird at the Tisza, I found that extremely surprizing as the nearest water, the Adriatic sea was 1.5 to 2 km far from there. The birds kept on singing within a good earshot of one another in the sparse pinewoods, in the upper part of the talus slope, about 300 m above sea level. As it was May the 20th, these must not have been migrting birds but they were surely individuals hatching there.

After recognizing all these data, we may value the ecological valency of the scrub warbler to be much wider than only forming opinion of a river-floodplain population. That's easy to understand as we are speaking of a spreading species, and there go strong vitality and a considerable adaptability with spreading tendency.

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THE PART OF FLOOD IN THE FORMATION OF THE AVIFAUNA IN THE FLOOD AREA OF THE TISZA

M. MARIÁN

Work-team of the Hungarian Academy of Sciences for Tisza-research, Szeged, Hungary

(Received 20 July 1975

Abstract

The author is dealing with the effect of floods upon the bird-stand in the flood area on the basis of his two-decade experiences obtained in the Mártély-Sasér Nature Conservation Area in the flood area of the river Tisza, about 30 km north of Szeged.

He is showing the biotope-types, formed, resp. transformed owing to the three annual floods of the Tisza repeating themselves regularly (water-surface of the „living" Tisza and backwaters, the pool-system formed in the flood area, the deep-, resp. shallow-water lake filling in the whole flood area, and the woods of the flood area), and the bird-types characteristic of these biotopes.

He sees the cause of the various bird species appearing in the flood area, as well as replacing one another in space and time, in the different ecological demands of bird organism. The species appear in the place of the flood area, in the suitable period and in the highest number proportionate to the sustaining capacity of the area: where, when, and in which degree they can satisfy their ecological demands.

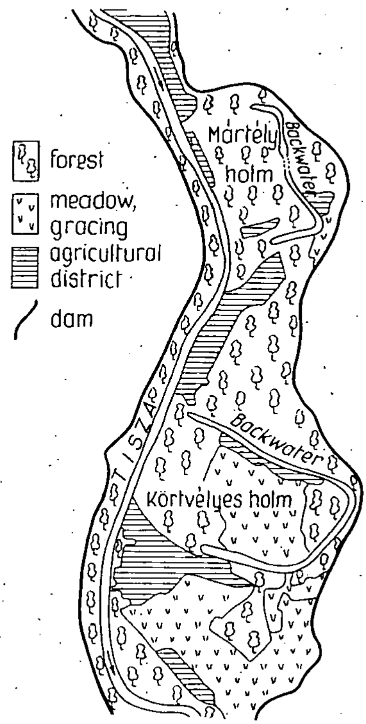
On the basis of my experiences obtained during investigating one of the largest and most beautiful flood-area regions of the Tisza, the so-called Mártély-Sasér Nature Conservation Area for approximately two decades, I should like to refer to the decisive part of floods of this river in forming the avifauna of the flood area.

In this nature conservation area the natural conditions existing before the regularization of riverways can still be found sporadically.

The three Tisza-backwaters: the dead channels at Mártély, Körtvélyes, and Atka, are lending variety to the area. Along the „living" Tisza and the backwaters, and the anti-inundation dams, the area is covered with willow-poplar gallery forests, elsewhere with extensive meadows, pastures, to a lesser extent with agricultural cultures. In patches, there are growing large aspen plantations, as well. Its area is 2760 ha, about 11 km long by 2 to 4 km wide (Sketch map No. 1).

On the basis of the hydrographical conditions taking place here, mainly on the so-called Körtvélyes-island, as a result of the Great inundation of 1970, then of the long drawn-out triple flood-waves, almost connected with one another in 1974, we can form an idea of the primeval conditions having prevailed on the Great Hungarian Plain in the days of old.

We have, of course, no written records of that period. But the hydrographical conditions of the period before the Hungarian conquest of Hungary, i. e., about 1000 years ago, may be concluded well from a note of Tacitus, the great Roman historian. He was writing that, on the then territory of the Hungarian Plain, there were so many marshes, lakes, backwaters that even the Romans living in Pannonia (the present-day part of Hungary that lies between the Danube, the Drava and the western frontier of the country) didn't quite exactly know if they should name that region land or water.



Sketch map No. 1. Mártély-Sasér Nature Conservation Area.

Before the Tisza control, the several waters of small depth gave fish and amphibians excellent places for spawning and feeding. These were, consequently, extremely multiplied, providing plenty of food for water-fowls. In that way came about the bird-life of legendary richness about which the first scientific data are published by MARSIGLI in vol. 5 ("Aves aquaticae circa Danubium et Tibiscum viventes") of his book "Danubius Pannonico-mysicus" in 1726.

Hertelendy was discussing the rich avifauna of the marsh Fehérmocsár in the Lower Tiszà Region in 1866.

JENŐ NAGY was reporting on several hatching *Anser ansers*, as well, in the marsh Fehértó in the same region, in 1914.

In connection with the water motion of the Tisza, from ornithological point of view, two fundamental problems arise: If the flood-waves exert an effect on the avifauna of the flood area? And if they do, will these be of positive or negative effect on the formation of the bird population?

To the first question, by reason of our observations and also on the basis of literary data, we have to reply that *flood-waves are inducing considerable biotope-transformations* and these are exerting a decisive effect upon the formation of the bird population.

On the basis of our regular observations we have established that the number of floods drifting down in the river, the water-mass of the single flood-waves and the length of time of their drift play a main part in the change of progressive or regressive direction in the avifauna of the flood area.

The qualitative and even quantitative change in the population depends upon the biotopes formed as a result of water motion.

1. The most permanent biotope is *the water suface of the "living" Tisza and backwaters.* In Winter, hundreds of *Anas platyrhynchos* and lesser *Bucephala clangula* flocks are staying here, in ice-free places.

On the water surface of the river, overswollen by the late-winter flood as a result of the melting snow, on the occasion of the bird migration in Spring, the flocks of golden-eyes disappeare but the number of mallards is multiplied, completed by *Anas crecca* flooks.

In Autumn, in the time of the so-called autumn flood, the same latter species are similarly predominating although their number is smaller than that observed in the time of the spring bird movement.

2. The *biotopes of the flood* area change according to the water motion of the Tisza and the seasons.

a) In the years of an average water motion, in early Spring, a *periodical pool-system* forms from the accumulated winter precipitation in the flood areas of lower lying. In these places, in the time of the spring migration, thousands of geese *(Anser albifrons, Anser fabalis, Anser anser)* and ducks *(Anas platyrhynchos, Anas crecca, Anas querquedula, Aythia ferina, Anas acuta, Spatula clypeata,* and *Anas penelope)* are staying. At its riversides, the riparian birds *(Vanellus vanellus, Limosa limosa, Tringa totanus, Tringa nebularia, Tringa ochropus, Tringa glareola, Actitis hypoleucos, Philomachus pugnax, Calidris alpina)* relieve one another in flocks of hundreds, some species of thousands, in the resting places for a few days of their way towards north. In that period, several Grallatores *(Nycticorax nycticorax, Ardea cinerea* and *Ardea purpurea, Ardeola ralloides, Egretta garzetta)* are fishing, as well. Above the pools, several individuals of *Larus ridibundus* and few ones of *Sterna hirundo* are flying. These periodical waters are, therefore, excellent transit camps for the birds migrating along the Tisza.

b) In years with plenty of precipitation when the spring-flood fills up the flood area from dam till dam, the region at Mártély-Körtvélyes is transformed into a 9 to 10 km long by 3 to 4 km wide *open-water lake.* The picture of avifauna is changed: the riparian birds mostly disappear, the natatorial birds and mergansers persist in staying. Their number is, however, not multiplying as the water-surface grows, and even it is decreasing, and that is easy to understand as the nutritive conditions deteriorate together with growing of the water-depth and water-stream. The flood has, therefore, in this case a negative effect upon the formation of the avifauna.

c) A development of contrary direction is shown by the particular water biotope *in the years following the great floods or if the spring-flood is persisting for a long time* and drawing back slowly (as it happened in 1974, too). In this case, there is plenty of water in the pool-system of the flood area already mentioned before, all the Summer round. The biotopes of river character, so far, are transformed into *waters similar to the shallow lakes* in the Hungarian Plain. The bird species characteristic of the flood area of the river persist but completed by characteristic lake species (e. g., *Numenius arquata*). Some species that at another water-level only pass through are now building nests *(Podiceps cristatus, Tringa totanus).* Some rare species may appear: the migratory *Egretta alba,* one individual or two of *Plegadis falcinellus*, some considerable flocks of *Platalea leucorodia.*

The biotopes are, therefore, transformed by the flood in positive relation, the consequence of what appears in the increase of the number of species and not only of that of individuals. The mass of many thousand birds of the rich avifauna formed, the heterogeneous composition of its species recall in memory the ancient avifauna mentioned in the introduction.

d) The development of the avifauna living in the biotope of the *woods in the flood area* is influenced by the flood by and large in two relations.

It exerts a negative effect on the species populations leading a terricolous life on the substratum of the gallery forests. By destroying the nests, resp. by stopping the possibility of nesting, it prevents the species from multiplying. And as the soil and low vegetation providing a possibility for nutrition are getting under water, even the survival of the species in the given area becomes impossible. (The species *Luscinia megarhinchos, Troglodytes troglodytes, Phylloscopidae, Turdus merula* are leaving the area).

From the point of view of the arbolicolous species, the flood-wave of normal course is not so much considerable. The crown-level of trees gets namely on with playing the part of a "terrestris" biotope because the water persisting intermittently at the level of the stems of trees is exerting hardly any influence on the feeding and nesting possibilities at crown level *(Turdus philomelos, Hippolais icterina, Muscicapa striata, Fringilla coelebs, Oriolus oriolus).*

Looking, together with Laage, for the cause of the above-presented considerable change in the avifauna of the flood area, we may establish the following: Birds are chained to some ecological factors (feeding possibility, hiding- and hatching-place, etc.). The single species appear in the highest possible individual number where they find these factors and according to the degree of these. (I think here, of course, only on the biotopes of areas free from human intervention).

The biotopes transformed as a result of flood-waves may, therefore, induce the appearance of new bird species or, just on the contrary, the disappearance of those.

Last but not least, I wish to express my thanks to István Bogdán, Lajos Puskás and László Salamon, for having helped my work considerably with their bird observations.

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RESEARCH INTO THE LIFE OF THE TISZA CONFERENCE ON TISZA RESEARCH IN 1974

Compiled by
GY. BODROGKÖZY
Department of Botany, Attila József University, Szeged

The Tisza-Research Conference that has become customary to be held in recent years was again held in 1974, on 19—20 April, in the Assembly Hall of the Club-house of the Academy Committee in Szeged. The lectures of the Conference were attended at, apart from the Tisza-researchers, by several guests, as well, participating in the discussions, too.

1. Prof. I. HORVÁTH:

Chairman's address

Honoured Tisza-Research Conference,
Ladies and Gentlemen,

I am pleased to greet the members of the Tisza-Research Working Committy and our dear guests. Several others have asked to be excused for being absent owing to pressure of their business in other directions.

Of late years, this Conference arranged in the spring months became traditional, giving opportunity to the members of the Tisza-Research Working Committee to inform one another about their results achieved and their plans, being for us all a useful exchange of working methods, promoting a really complex solution of our scientific programme.

It is a welcome change that the number of scientific lectures registered for our Conference have increased as compared with those last year: while in 1973 eleven lectures were delivered at the Conference, at present eighteen researchers will lecture. I am glad, moreover, because approximately half of the lectures will speak about the results of the scientific research work performed in our two basis-areas (in the Kisköre District and in the Region Conservation District at Mártély-Sasér), and even the problems of the other lectures, as well, are connected with these questions.

The Tisza-Research Working Committee and its executive committee have for some years good connections with the Hatchery and Research Institute for Pisciculture, Szarvas, and that is very important for the Tisza research. I am, therefore, particularly greeting the lecture of the Director of that Institute registered for the programme of our Conference.

The lecturers of Department of Zoology of the Lajos Kossuth University, Debrecen, are tankig part first in our Conference, after getting connected actively with the investigations in the Kisköre district last year. This participation is all the more such a welcome news because it means the extension of the Tisza research.

For us it is also very important that a well-equipped laboratory has been organized at the Kisköre river barrage by the Water Management of the Middle—Tisza Region. That is promoting not only the work of researchers working in the laboratory and cooperating with us but also that of our whole working committee.
After mentioning these ideas in advance, I declare the meeting open.

2. M. MARIÁN:
Results of the Tisza Research in 1973 and plans for 1974

3. M. SZALAY:
Activity, results, part of the Hatchery and Research Institute for Pisciculture, Szarvas, in the Tisza research

In our country, owing to a wrong decision, the Research Institute for Pisciculture that since 1906 had performed various duties was dissolved and functioned for ten years but as a Division of Pisciculture connected to the Research Institute for Raising Small Animals, Gödöllő, under unfavourable conditions and with a reduced working force as compared to the earlier state.

The lack in an actual piscicultural research in our country made itself felt after some time on national-economy level, as well. For eliminating that, since January 1st, 1969, Szarvas was assigned to be the centre of the national piscicultural research by our highest authority because it found guaranteed here the conditions necessary for the real research work.

A five-year middle-distance research programme, closed in 1973, was solved by the research workers of the Institute. The results and tasks of this work were reported on and the next major tasks outlined by the lecturer. In respect of Tisza research there are important tasks: region conservation, the investigation of growth rate and migration of the various sorts of fish, as well as the systematic investigation of the zooplankton and benthos in the Tisza reaches above the water barrage and in the reservoir for several years and always embracing the whole of the year. These investigations are necessary to determine with a rough estimate the stock of food needed by fish for a given season. It can only be imagined in this way to plant the Tisza, and the other natural waters, too, with fine young fish in the future.

Contributions to the discussion:

B. SZŐKEFALVI NAGY: Asks whether the dead-arms mean any change in respect of fishing.
The lecturer's reply: At present they still mean but an unexploited, hidden reserve.
Á. HARKA: Can the amur multiply in our country under natural conditions?
Reply: It is imaginable theoretically although their stocking is subject to licence for avoiding problems in case of a faulty introduction of these.

4. J. HAMAR:
The effect of impoundment upon the water quality of the Tisza in the district of the Kisköre river barrage
(Published in Vol. 11 of the Tiscia)

Contributions to the discussion:

I. HORVÁTH: Asks if the suspended-matter content has a part in the minimum heat-difference between the surface and deep water-layers.

The lecturer's reply: At Kisköre there is a lower through-flow; the above fact may be explained by that.

K. BÁBA: What is the quantitative difference in zooplankton as compared to the dead-arms?
Reply: In the Reservoir the amount of zooplankton is much lower.

A. SZITÓ: Asks which Cladocera species is predominant in the plankton of the Reservoir.
Reply: Bosminalongirostris.

I. HORVÁTH: Asks in what a distance the damming up of water is getting on above the Reservoir. He suggests investigating the effect of impoundment in a larger distance above the Reservoir.

K. KISS: Asks what we understand under the effect of damming up.
Reply: It means how the water-quality changed as compared to the earlier state. That isn't effective in respect of every factor, resp. It is only observed in certain reaches.

M. ANDÓ: The effect of damming up the water is modified by the rivers streaming in.

GY. DÉVAI: At Kisköre the problem of impoundment is complicated. The influence of theaffluents should, indeed, not be neglected as the picture can be modified by the passing water-masses.

5. J. SZABÓ:

Some hydrobiological peculiarities of the reservoirs and their part in the complex utilization of the Kisköre Reservoir

The study of water animals, water ecology has some traditions at the Department of Zoology in the Lajos Kossuth University. Since 1962, the education in hydrobiology has also been going on in the Department what has resulted in developing a good cooperation with the organs of water administration, particularly the Water-quality Supervision of OVH VIKÖZ (National Water Office Centre of Water Supply Economy Management and the Water Administration of the Middle-Tisza Region. The cooperation, realized in socialist treaties and agreements of external research and improvement, has brought about good conditions for us to solve the tasks both of the basic and the applied researches. We have started comprehensive investigations to study the theoretical and practical problems of biological water-quality and to examine the water-quality of the Kisköre Reservoir prognostically, in close cooperation with the laboratory there. My co-workers are reporting on the results of researches begun and achieved so far, and I myself am outlining a part of the preliminary conclusions drawn from the investigations performed in the reservoirs at the Volga (at Ivanovo, Uglich, Ribinsk, Gorky, Kuybischev, Saratov, Volgograd), with environmental conditions that are somewhat similar to ours, which conclusions can be utilized for our purposes, as well. The generalized experiences are as follows:

After filling up the above reservoirs with water, there could be distinguished three subsequent periods of the biological succession: (1) The original biocenosis of the river and of the district filled up becomes disintegrated; (2) temporary animal- and plant-communities come into being; (3) the new, dynamic stable biocoenosis is developing.

The process outlined is of different intensity in the various groups of organisms (enabling us to concentrate on certain investigations). The change in plankton is the quickest, its complete transformation may last about three years long. The benthos-transformation is a little slower, about 3 to 4 years. The development of macro-vegetation is the slowest, with an about 10 to 20-year period.

Conclusions for the Kisköre investigations:

(1) Before filling up the reservoir, the quantitative and qualitative composition of the original benthos and plankton of the Tisza is to be measured.

(2) After filling up the reservoir, we have to reckon with a rather long-period succession. Mainly the processes of the first 4 to 5 years are to be supervised. Under

the conditions of our country, we have to reckon with the acceleration of the succesion and a considerable increase in the amplitude of fluctuations.

(3) The processes of succession make progress in the direction of stabilization — if the bed of the reservoir and the water filled in are free of the organic matters and poisoning matters exceeding the „normal extent".

As the development of the processes of succession to be expected under natural conditions may be modified by the latter ones considerably, and as we have to reckon with these:

a) We have to ask for preliminary and continuous informations on the water-quality above the Tisza reservoir; *b)* we have to ascertain by means of model-examinations in advance of how the biological succession is modified by the vegetation formations left behind in the reservoir. These investigations have already begun.

Contributions to the discussion:

I. HORVÁTH: Asks in which degree it is real to draw a parallel between the Volga and the Tisza. The lecturer's reply: The rather shallow Russian reservoirs (at the Volga) are most of all similar to ours as proved so far by literary and local investigations. There are, of course, some differences, too. *E. g.*, the bed of the Volga is poor in vegetation.

GY. DÉVAI: There are to be compared with each other the regions that are less or more similar to one another in respect of the main climatic factors. Between the Kisköre and Volga reservoirs, besides their individual features, a parallel may be drawn in respect of water depth.

M. MARIÁN: The multiplication of Amphibia species is to be expected in the district. He regards, therefore, desirable to measure their present quantity and follow their later development with attention.

6. GY. DÉVAI:

A prognostic investigation of the biological water-quality in the Kisköre reservoir

The lecture is surveying the facts and circumstances that are fundamentally determining, resp. will influence in the highest degree the biological water-quality in the Kisköre reservoir. On the basis of evaluating these and exploring their causal connections, it is establishing that our most important tasks are to be grouped round two points of view.

First it is to be determined, speaking in a general way, what the effect of:

a) the shallow-lake character of the reservoir,
b) the water-quality of the Tisza-reaches above the reservoir,
c) the organic matters left behind in the inundated area,
d) the communal and industrial waste-waters, resp.
e) the water utilizations at the operation of the reservoir,

will be upon the water-quality of the reservoir, and how far they will influence the intended complex utilization of the Kisköre river barrage and reservoir.

At any rate, our work can only be really successful in respect of the protection and regulation of water-quality if the prospective effects and points of attack of the factors enumerated above were previously "scanned" with model-experiments.

The model-investigations are to be started with a double aim:

1. "theme-oriented", *i. e.*, by modelling the "whole" of the Kisköre reservoir, resp.:

2. "problem-oriented", *i. e.*, by modelling a single factor or a factor-system seeming to be the most important in forming the water-quality or by modelling the effect of these.

In addition to clearing the general peculiarities mentioned above, we regard as extremely important to organize the systematic control of water-quality and the collection of facts in the dammed up bed-stretch of the Tisza, giving us exact and evaluable results, and the same in some parts of the watershed-area of the reservoir that are prominently important in respect of protecting and regulating the water-quality. Our aim is to bring about a comparative basis that is absolutely necessary to evaluate the results of later investigations in their causal relation.

Finally, the lecture expresses the confident hope that as a result of the programme, — coordinated and directed by the Water-quality Supervision of the Centre of Water Supply Economy Management of the National Water Office and carried out by the Department of Zoology and Anthropology in an examplary and close cooperation with the Water Administration of the Middle-Tisza Region, — we shall get to a real and right explanation of the particular events taking place in the water system of the Kisköre reservoir and then, as a result of all these, to an active and productive intervention in the course of water processes, contributing in that way to the successful realization of the complex economy of water-supplies of the Kisköre river barrage.

Contributions to the discussion:

M. MARIÁN: Proposes to let known the ideas of the lecturer in wider circles.

I. HORVÁTH: Asks what kind of concrete researches are planned in the future.

The lecturer's reply: After collecting the data up till now, a 5-year plan of research will be elaborated by the operative committee to be established in Kisköre.

GY. BODROGKÖZY: The increase in humus-formation means a great problem, sodification is inevitable. What is done to solve this problem?

Reply: Mainly at the summer low water, unfortunately, water-quality will strongly be vitiated by the heat power station. It is tried to help for it also by measuring the upper polluting factors and respecting in the maximum way the rules of waste-water clearing.

7. KLÁRA HORVÁTH:

The vertical distribution of oxygen content in the Kisköre reach of the Tisza at Kisköre and Tiszacsege

The considerable water-mass of the Kisköre reach of the Tisza cannat be regarded as a real river-water even in the present period of damming up. Taking into consideration the 9 to 10 m water-depth formed immediately above the river barrage, as well, it is justified to raise the question if a stratification in limnologic sense has developed. That can be decided in the simplest way by studying the vertical distribution of water temperature and dissolved oxygen.

On August 16, 1973, at Tiszacsege, at three points of the cross-section of the bed and at Kisköre, above the river barrage, at two points of the drift-line we carried out measurings. On September 8, at Kisköre at the same place we were measuring again, passing towards the bottom with always exactly half a metre distances, and by help of a DELTA M85 type oxygen-meter.

At Tiszacsege, the dissolved oxygen uniformly decreased down-wards from the surface between the values 8.5 and 7.5 mg/l. Oxygen-saturation was everywhere above 90 per cent. At the same point of time, at Kisköre, a change in similar direction of a little lower dissolved oxygen values was observed. The decrease in temperature was inside 2 °C, oxygen-saturation fell 10 per cent from the surface down to the bottom. In case of all the three parameters we got a similar uniform decrease at the measurements on September 8, as well, but inside a still smaller interval than earlier.

On the basis of our results we may establish that in the reach of the Tisza at Kisköre there couldn't be demonstrated any stratification, at least in the places and at the points of time of our investigations.

Contributions to the discussion:

D. GÁL: Asks if there are oxygen- content investigations in the reaches above the reservoir.
The lecturer's reply: In the above place he hasn't carried out any oxygen-content measuring.

7. I. KISS:
Occurrence of Botrydia in the flood-land of the Tisza and the Maros
(Published in Vol. 10 of the Tiscia)

Contributions to the discussion:

GY. BODROGKÖZY: At measuring the flood-land phytomass, we had to follow with attention the larger units, as well, placing Botrydia, too, into the synusia.

I. HORVÁTH: Asks by what environmental conditions the mass-production was released.
The lecturer's reply: The mass-production appeared after the spring-flood had passed and, in short, the lasting, sunny warm weather had come to an end.

9. T. K. KISS
The quantitative relations of phytoplankton in the dammed Tisza reaches at Tiszalök and in the Eastern Main Channel

Contributions to the discussion:

J. SZABÓ: It is praiseworthy that the lecturer is looking for a causal relation. He is drawing the attention to some cooperatives established by several specialists, and to the importance of the interdisciplynary cooperation.

A. SZITÓ: He would approve of carrying out a complex Tisza-investigation and even of increasing it.

I. HORVÁTH: The research bases have been established (Kisköre, Körvélyes), the cooperation of research teams is increasing (the researchers of Debrecen). All these are exerting their effect for expanding the investigations.

10. I. HORVÁTH and GY. BODROGKÖZY:
The effect of mowing on the organic-matter production of the meadows in the flood-area of the Tisza

Contribution to the discussion:

GY. DÉVAI: Asks what an amount of stock the plant communities at Kisköre mean.
The lecturer's reply: At Kisköre, the authors have carried out measurements of other type, they have, therefore, no data in this respect.

11. M. ANDÓ:
Areal ecological conditions of the Region-Conservation District at Mártély-Körtvélyes

The Region-Conservation District is forming in regional sense a part of the Southern Tisza valley where but a lower propertion of the homologous facies groups have remained in their natural state. They have become here, in a larger part of the natural ecotope groups, economic ecotopes under the influence of the anthropogenous activity.

In the geographic environment transformed by the social-economic activity, the natural factors exerted their effect similarly in a changed degree and with a changed speed. Since the turn of the century, the effects of the anthropogenous activity have often fused casually some units differring from one another ecologically, as well, into regions of the same type. The ecological types like these are the flood-land plough-lands, the agriculturally cultivated areas wehre there was already formed an excellent soil-structure to a considerable extent, and the feature of the soil is developing from meadow an alluvial into an open-country soil type.

The effect of human activity is already less considerable at the grassy surfaces (meadow, pasture) of the flood-land. This ecotype is characterized by that the mutual connections of the factors of natural geography are sharply reflected in the single qualitative and quantitative potentialities.

One of the most considerable natural and anthropogenous ecotope groups of the region is the flood-land forest stand. This ecotype is showing considerable heterogeneity in the distribution of species (from plane-tree up to willow) in the flood-area. The ecotope that not always can be brought into correlation with the relief of the terrain and other natural facts, is reflecting a considerable effect of the anthropogenous factor. In the wood-environment formed artificially in the flood-land since the turn of the century, several relict ecotypes have been regenerated, too, where the natural geographic processes have considerably increased and the anthropogenous influences decreased.

12. R. VÁMOS:

Pollution of the Tisza dead-arms and the thermal waters

A part of the Tisza dead-arms are utilized piscatorially, as well. Although the stock of fish is from time to time incraesed by introduction and feeding also takes place, fish-breeding is still risky because, every now and then, fish perish in large numbers. From the cases till now we may draw the conlusion that every factor that promotes the bacterial sulphate reduction, *i. e.* the formation of hydrogen sulphide, is at the same time responsible for the destruction of fish, as well. Fish destructions are frequent in the dead-arms in whose neighbourhood the application of N-fertilizers is increased. Eutrophization is considerably promoted by the vegetable mineral foods washed into. In increasing the degree of nitrogen supply, a part is played by the thermal waters, as well, that are containing a large amount (5—13 mg/l) of ammonium. Ammonium being the only N-source of the sulphate-reducing bacteria, that is also an important factor of sulphate reduction. In order to promote the oxidation of ferrous sulphide accumulated in these lakes, it is right to treat these dead-arms similarly to fish-ponds, emptying them entirely after being fished.

Contributions to the discussion:

Á. HARKA: Asks what preliminary safety measures could prevent fish destruction in the Kisköre reservoir.

The lecturer's reply: The chemical protection is not good as no lethal concentration can be achieved in the deeper parts owing to dilution.

Á. HARKA: Reckoning with 1.5 m fluctuation of the water-level, is or isn't to be expected a negative influence of the partial drying-up?

Reply: A partial drying up won't have any harmful effect.

A. SZITÓ: In case of drawing the dead-arms into fish-breeding, in which phase the fish destruction by hydrogen sulphide may take place?

Reply: The dead-arm must be treated fishpond-like and emptied periodically. For protection he would consider good to spread calcium nitrate into the water, in order to neutralize hydrogen sulphide.

13. J. SZÉPFALUSI:

Influence of the Novi-Becse river barrage on the Tisza stretch in County Csongrád. Protection of water-quality. (Detail of a monograph)

The effect of the river barrage, being under construction at Novi-Becse (Jugoslavia), to be exerted on the water-quality of the river stretch between 158 and 244 river-km above the barrage cannot be "predicted". Even the measuring-series — carried out for several years in the interest of the aim and with fullknowledge of the task since much earlier times — couldn't present any safe basis for solving the task.

The solution of the problem by only qualitative deliberations is made more difficult by that even the effect of the Tisza II river barrage upon the Tisza stretch investigated is not yet known, at present. It may be supposed that the surface, covered with a vegetation owing to being inundated durably by water as a consequence of the raised water-level, willl in the first years influence the quality of water, as a result of decomposition, more intensively than on the average.

The hydrobiological characterization of water is carried out by the aid of its halobity, toxicity, saprobity, and trophity. The significance of these four factors is different in cases of a river and of standing waters. In the Tisza, damming is not inducing any considerable change in its halobity. It is not damming, either, that may cause a possible catastrophe in its toxicity but the admission of toxic matters, *e. g.*, pesticides, poisons of industrial origin, over certain limits. To be sure, it is not certain that the measure of toxicity is independent of the self-purifying power of water connected with its flowing conditions, but an unambiguous correlation cannot be established. At any rate, so much can be ascertained, even previously, that it is justified to preserve the stringency of the practice followed so far here in respect of how to drain the poisoning waste-waters in the future, too. And in respect of preventing removing, systematically the toxic water pollutions induced by the chemicalized agriculture, there are needed further considerable measures, as well.

One of the results of the transportable smaller suspended-matter content, caused by the Novi-Becse barrage-induced diminished water-speed, is that thus a thicker water-layer can be illuminated by sunshine. The decreased suspended-matter content is, at the same time, resulting in reducing the effect of the suspended load on crushing, damaging the micro-organisms. These two factors may be, under given conditions, a hotbed of the regular summer development of algal blooms in the Tisza.

Taking into consideration that the effects outlined are in connection with living result of decomposition, more intensively than on the average.

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One of the results of the transportable smaller suspended-matter content, caused by the Novi-Becse barrage-induced diminished water-speed, is that thus a thicker from those mentioned above, of several environmental factors, in the most various ways. These changes may have an influence through the food-chain upon the macrofauna, as well.

In the mud — in extreme cases — a hydrogen-sulphide accumulation, too, can occur. In the region of some waste-water disposals this may manifest itself in the increase in local toxicity.

Contribution to the discussion:

Gy. Dévai: On the basis of several data to be found at the Centre of Water-Supply Economy Management, we should need a preliminary survey in respect of the future storing conditions. But there was no such preliminary survey in case of Kisköre, either.

14. Mária Csoknya and Magdolna Ferencz:

Data on the horizontal and vertical distribution of the zoobenthos fauna of the Tisza

Lecturers are reporting on some data on the zoobenthos fauna in other substratum-types of the Tisza, resp. the quantitative and qualitative distribution of these.

Contributions to the discussion:

M. Andó: He would favour measuring the stream of river-water. The daily change in sediment-movement is also an important modifying factor.

Á. Harka: Asks what the cause and measurement of the quantitative decrease in may-fly larvae are. The lecturer's reply: She does not know any exact data but it is an empirical fact that the may-flower larvae are perishing in the Tisza. The causes of that may be looked for partly in the regularization of the river-side, partly in the increasing water pollution.

K. Bába: The phenolic pollution measured in the Maros may also have an influence on the decrease in larvae.

15. I. Dostál:

The comparative ecological investigation of sub-ordo Hydrocorisae in the relation of a Tisza dead-arm and some natron lakes

Time of sampling: From May 1970 up to October 1971.

There were pefrormed systematic samplings in the Tisza dead-arms at Szeged. The water depth of the sampling sites did not surpass 70 cm. I generally sampled successfully from free water-surfaces rich in vegetation or surrounded by plants.

The chemical composition of water included: Na—$MgCO_3$, HCO_3, SO_4, Cl,

Annual pH period:	March	July	October
	6.0	8.4	6.3
Water temperature	8.0 °C	24.5 °C	12.2 °C

O_2 household of the water:	June	September	October
O_2-consumption:	43 mg/l	54 mg/l	49 mg/l
Dissolved O_2	9 mg/l	10.5 mg/l	14.2 mg/l
O_2-saturation	101%	107%	131%
BOI_5:	8.7 mg/l	17.4 mg/l	24.7 mg/l

The pH of the isolated marshy waters never exceeded 7.5 but their BOI_5 value is high, O_2-saturation is low, and the temperature of water is extremely fluctuating.

In Lake Fehér-tó and that of Rókus, I carried out samplings in the months August and September, in 1970 and 1971.

The water included chemically Na_2CO_3 and $NaHCO_3$, its pH moved between 9 and 11, its temperature between 27 and 29 °C. The water at Rókus is an alkali marshy tract, that of Lake Fehértó is mixed with Tisza water.

In Lake Fertő (or Lake of Neusiedl, between Hungary and Austria) I collected material from June to August, 1971. The pH of water fluctuated between 7.2 and 8.3, its temperature was between 23 and 25 °C. The water includes chemically Na_2SO_4.

The percentage, appearance, development, and disappearance of the Hydrocorita species occuring the most frequently are summarized in the following Table.

Sampling site, time / Species	Dead Tisza- arm						Percentile occurrence in Lakes Fertő—Fehér—Rókus		
	Annual 1970	total % 1971	Apperance	Imago max.	Larva max.	Imago disappears	Fertő	Fehér	Rókus
Naucoris cymicoides	16	24	M.	M. Sept.	May July	Oct.	44.8	—	—
Plea Leachi (m)	16	18	Feb.	May July	June July	Oct.	2	—	—
Notonecta glauca	1.3	7.5	Feb.	Apr. May Sept.	May June	Oct.	—	0.25	—
Nepa cinerea	2.41	6	Apr.	July	June	Oct.	—	—	—
Sigara lateralis	29	17	Apr.	Aug. Sept.	Aug. Sept.	Nov.	39.3	81	93
Cymatia coleoptrata	27	4.5	M.	June Aug.	June Aug.	Sept.	10.7	—	—
Sigara striata	—	7.9	Feb.	Apr. Aug.	June Aug.	Oct.	—	6	—
Corixidae	56	26.4	Feb.	July Sept.	July Aug.	Nov.	50	93	99

Contributions to the discussion:

M. MARIÁN: Congratulates to the devoted work of the lecturer, asking him to get on with developing his investigations.

A. SZITÓ: The subject is very fruitful because our knowledge of the nourishment and habits of water-bugs is rather defective although the part they have in the fish-ponds is very considerable (*e. g.*, fish-parasites).

M. ANDÓ: Suggests the author to watch primarily their daily living rhythm.

The lecturer's reply: He would like to complete his field-observations with experiments in aquaria, particularly as regards nourishment and individual development.

16. L. GALLÉ, Jr.:

Recent faunistic and ecological data on the myrmecological knowledge of the Tisza valley

Contributions to the discussion:

M. ANDÓ: Asks whith what measuring technique the measuresments of microclimate took place.

The lecturer's reply: He accomplished preferably point-measuring by means of Assmann's psychrometer.

M. MARIÁN: Asks if the degree of parasitism is increasing as a result of the increase in ant-populations.
Reply: It is to be reckoned with parasites and predatory animals, as well.

K. BÁBA: Asks if the bunchy dispersion of nests is characteristic of ants.
Reply: In case of small population density the bunchy dispersion may occur but, as the population becomes denser it grows more and more uniform, as well.

I. HORVÁTH: Asks what in the model from the exponential curve may be concluded.
Reply: There may be concluded the density of population and the connections depending upon that.

M. ANDÓ: Asks what kind of microclimatic mean values are characteristic of a single population, in case of a medium population.
Reply: The limits of extremes are of importance, therefore, the single populations are different.

17. Á. HARKA:

Investigation of informative character on the body weight/body length relation of the pike-perch in the Tisza-stretch at Tiszafüred

The allometric relation between body weight and body length of the fifty pike-perch individuals collected between March 15 and June 27, 1973 is described by the following equation:

$$\lg W = -5.4172 + 3.2075 \ \lg L,$$

where W is body weight in grammes, L is body length in mm. The body length of the individuals serving for the basis of connection was more than 27 cm.

Comparating the constants of equation to the data on the stock in Lake Balaton, it appears that the individuals in the Tisza start with a smaller weight but the rate of their growth in weight is more rapid than that of the individuals in the Balaton.

Contributions to the discussion:

I. HORVÁTH: Asks what the cause of the more rapid growth in weight of the pike-perch in the Tisza is, in contradistinction to the stock in the Balaton.
The lecturer's reply: The state of pike-perch in the Balaton is genetically comparatively impoverished.

A. SZITÓ: In the Tisza there are more white-fish, a food of the pike-perch and there are no concurrents in nourishment. The continuation of investigations is justified at Kisköre by the increase in line-fishing to be expected, necessitating an intensive planting.

K. BÁBA: Says that the pike-perch, mainly in its young age, feeds on Mollusca.

18. A. LEGÁNY:

Some ornithological problems of poplars in the flood-lands of the Tisza

In the flood-area of the Tisza, in intensive introduction and production of poplars is going on. It is unambiguously proved by my systematik stand-takings in that biotope that ornithologically these areas are of low production. From among the wood types, these are the lowest ones. They have an individualized community, characterized by being poor in species and individual numbers that is, in fact, forming no homogeneous nesting community, either. I explain this phenomenon by the biotope-induced insatisfactory nesting possibility. The ornithological production and biological wood-protection of poplars may be increased in two ways. One of these is bird-settling with artificial nest-holes, the other is settling the poplars mixed together with other three species.

19. A. Bankovics:

Further data on the propagation of the olivaceous warbler *(Hippolais pallida)* along the Tisza

The olivaceous warbler *(Hippolais pallida)* that in the Carpathian basin is spreading towards the north the most expressly along the Tisza, occurred already at Tiszasüly on June 15, 1973. The suitable habitats of the 200 km Hungarian Tisza-stretch south of that are populated by them. Comparing the ecological demands of the populations of the olivaceous warbler in the Carpathian basin and the Balkan peninsula, it may be established that the former ones are almost exclusively only the dwellers of the flood-land woods along the river, while the latter ones populate even the dry areas farther from the waters.

Contributions to the discussion:

M. Marián: He would approve of extending the investigations towards north to (*e. g.*, over Slovakia), resp. over other biotopes, as well.

L. Gallé, Sr.: Is interested in the ecological-etiological demands of the olivaceous warbler (migration, flight, singing period, etc.).
The lecturer's reply: The bird arrives late and leaves early. It only sings in incubation period (May—July), its progeny is poor (its nest is not camouflaged, nest-plunderers).

Gy. Csizmazia: Asks with what bird-species the warbler nests together and if it is impeded by these in adapting itself to the environment or in spreading.
Reply: He has not yet carried out investigations on this little aggressive bird, resp. his data are still unelaborated.

20. Gy. Csizmazia:

Mammalian associations in the Region-Conservation District at Mártély-Körtvélyes

It can be established in the course of investigating the sample areas in the flood-lands that in the Tisza valley the mammalian fauna is very dynamic. The research in a single year is but a mosaic of the varying mammocoenosis and in the following year it can often be observed only in another form. The aim is, therefore, to reveal regularities, outline and registrate the mammalian associations.

The development of biocoenoseses under the influence of their distance from the river-water, the breadth of the flood-land, the configurations of the terrain, covering by plants, as well as duration and size of the passing flood-waves.

Dynamism is regulated by biogenous and abiogenous factors that I have tried to fix by formulating them.

On the basis of the identities of the way of life, of the constant identity and dominance it turned out that in the course of the year there are formed some mammatian associations that owing to the different degrees and climatic character of the habitats in the flood-land can be deduced from, and change into, one another. There were only four provisory divisions into groups made known by the lecturer, for lack of a uniform nomenclature of mammocoenoses and expecting further results of the work going on at present. These are the hydrobiontic, hydrophilous, hydrogradic, xerophilous associations. He was reporting on the species inducing the associations, touching also upon the ecological evolution of these.

Contributions to the discussion:

M. Marián: He is pleased to greet the author passing over, after the faunistic investigations, to the ecological-coenological way.

I. HORVÁTH: Asks from where the xerophilous species got to this area.
The lecturer's reply: Migration must have taken place from the protected side, from the monocultures outside the dams. And as the flood-land is no suitable habitat for the xerothermic species, they are going with emigrating from there.
GY. BODROGKÖZY: Proposes to characterize biocoenosis together with botany.
A. BANKOVICS: Draws the attention the the problems of trapping: The differences in activity are distorting the real data.
I. KISS: Deems necessary to investigate the problem of soil, as well, that is a considerable factor *e. g.* in case of the breaks in the embankment by the flood.

21. Prof. I. HORVÁTH:
Chairman's concluding words

Reaching the end of our two-day conference, for concluding I should like to say some words to it. I think we have all got a good survey over the research activity of the Tisza-Research Working Committee in 1973, beginning from the problems of natural geography up to investigating Mammalia. It is a good thing that the lectures were followed by vivid discussions that were sometimes even to be limited for husbanding our time.

I beg the lectures interested not to take offence at that.

The discussion following the lectures was interesting if only because climatologists, hydrobiologists, botanists and zoologists could mutually offer remarks on the lectures of one another and that is a fundamental result because of the complex character of the Tisza research.

This great interest and active discussion mentioned elicited in me the idea that it would be useful in the future to arrange, besides our annual Conferences, on a few occasions some informal "round-table conferences", as well, on one or two concrete problems, without any limitation in time. I think, *e. g.*, on the domain of biocoenosis, the problem of modelling emerging more than once at our present Conference, too, the role of researches on the local and micro-climate, the question of fish-destruction — to mention only a few problems. This problem will be studies by our Executive Committee and we will inform our members on time and subject-matter of such informal conferences.

The success of our Conference is showing the continuous development of our Tisza research. I wish every co-worker of ours a successful activity this year, too. The meeting of our Conference is closed.

After the concluding words of the Chairman, GY. BODROGKÖZY was outlining some questions of general interest (date of handing in MSS), resp. was calling the attention on the use of the increasing library (exchange material).

The Tisza-Research Working Committee:

President: Prof. Dr. I. HORVÁTH
Botanical Vice-President: Dr. GY. BODROGKÖZY
Zoological Vice-President: Prof. Dr. L. MÓCZÁR
Secretary: Dr. M. MARIÁN
Further members of the Committee: Dr. M. ANDÓ, Dr. MAGDOLNA FERENCZ, Prof. Dr. I. KISS

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RESEARCH INTO THE LIFE OF THE TISZA CONFERENCE ON TISZA RESEARCH IN 1975

Complited by
GY. BODROGKÖZY
Department of Botany, Attila József University, Szeged, Hungary

In 1975, the Conference organized annually was held on 25—26 April, in the Assembly Hall of the Club-house of the Academy Committee in Szeged. On this occasion there were delivered 16 lectures in the course of the two days. Most reports were followed by a vivid discussion.

The main aim of the Conference was this year, as well, to enable also the co-workers whose activity takes place far from the basis of the Tisza-Research Working Committee, to meet one another, to become acquainted with the results of the research work in the period past that they can utilize in their own fields of action, too. The aim of the management is in the future, as well, to promote as much as possible an early realization of some investigations of complex character.

The Conference was beginning with the inaugural address of Professor and Head of the Department of Botany, Dr. IMRE HORVÁTH, filling the Chair. He offered a detailed survey of the development of Tisza research traced since 1945. He spoke of the importance and the three main scopes of tasks of the researches of complex character; namely of the research works performed 1. in the district of the Kisköre Reservoir, 2. in the Region-Conservation District at Mártély-Sasér, and 3. in the district of the planned Csongrád Reservoir, as well as of the research works to be performed in the future, and of the importance of all these. —

After that, the lecture series and the discussions connected with these began.

I. Investigations carried out in the Kisköre District

1. P. VÉGVÁRI:
   Water-chemical investigations in the district of the Kisköre Reservoir in 1974
   (Published in Vol. 10 of the Tiscia)

Contributions to the discussion:

I. HORVÁTH: Asks how much the last year's flood approached the definite damming level.
The lecturer's reply: It was approached to 50 cm.
M. ANDÓ: Asks if there was any heat-stratification.
Reply: There was none. But there was a difference between the surface and the 6 m depth mainly in respect of the suspended-matter content, as well as the chemical components in connection with that.

I. BELICZAY: Asks why the mass of water and the content of alluvial deposits are larger at the spring flood than at the autumn one.
Reply: In Spring, the water coming from the Carpathian Mountains transports a larger alluvial deposit mass than the water of the Sajó and Bodrog in Autumn.

M. ANDÓ: The differences shown in the Ca and Mg content of the water may probably be attributed to geographic causes, as well, as the larger or smaller water mass had come from different watershed areas. Owing to the large water surface and water mass, large waves may be formed, and that may mean embankment problems, too.

2. J. HAMAR:

Algological investigations in the district of the Kisköre Water Reservoir
(Published in Vol. 10 of the Tiscia)

3. I. BANCSI:

Rotatoria and Crustacea investigations in the dammed up Tisza-stretch at Kisköre
(Published in Vol. 10 of the Tiscia)

4. A. HARKA:

Exploratory investigation of migration and growth of the carp in the river-stretch at Tiszafüred

On April 11, 1972, we marked 2000 bi-annual mirror carps and introduced them into the Tisza in the stretch at Tiszafüred.

Because of the low number of reports back, for the time being we can only arrive at some establishments of informative character.

The migration of the introduced individuals from there is considerable. But the opinion according to which the overwhelming majority of fish are washed off by water, is not correct. The ratio of fish swimming up-river is considerable and the distance made is also long: the farthest site of observation is Tiszalök, 97 river-km from the place of fish-introduction. For fish swimming down the river, the longest distance of observation is 184 river-km, in the vicinity of the Körös mouth. In spite of the migration, a considerable part of fish have remained in the district of introduction.

The growth of carps is generally favourable in the river-stretch mentioned. From among the carps introduced 7 individuals of 40 decagramme average weigh grew on average to 204 decagrammes in 15 months and a half. (The individual weights changed between 100 and 250 decagrammes).

The chance of the fish introduced in this river-stretch to leave the territory of the country is very low because a large part of the fish swimming down the river swims backwards in the water-courses discharged into the Tisza.

Contributions to the discussion:

M. MARIÁN: Adds to the lecture that from the Lower-Tisza Region there was no report back on the carps indicated. Social cooperation would be needed in order to get systematic reports.

R. VÁMOS: In the plants a large mass of N accumulates. After the destruction of plants, NH_3 and H_2S may increase what is harmful to fish.

I. HORVÁTH: Emphasizes the efficiency of collective work. The results of the investigations in 1974 yielded several valuable data that may be important for later researches.

P. VÉGVÁRI: It would have been advisable to submit the fish caught to gas-chromatographic investigations. In that way, the degree of chemical pollution could have been demonstrated.

MÁRIA VOLEMANN: Says they undertake the gas-chromatographic investigations.
M. MARIÁN: Asks if the fish in the meanders of the holm at Körvélyes were investigated.
The lecturer's reply: No, they were not.

II. Investigations carried out in the Region-Conservation District at Mártély-Sasér

5. Á. FARKAS:
Pisces fauna of the Tisza dead-arm at Körtvélyes

Contributions to the discussion:

J. HAMAR: Asks if the Lower Tisza-reaches could be investigated.
The lecturer's reply: He alone cannot undertake it.
I. LŐRINCZ: Asks if at flood the Tisza gets fish supply from the dead-arms.
Reply: It gets that and it would be very good to ensure a stable water-level in the dead-arms.
K. BÁBA: The pollution of dead-arms is mostly the same as, or stronger than, that of the Tisza. They are, therefore, not suitable for fish-breeding.
M. ANDÓ: Only a part of the dead-arm at Körtvélyes is suitable for spawning as the water at the dam-keeper's house and its surrounding is too muddy. The stable water surface of the dead-arms is not easy to be fixed if only because in case of law water in the Tisza there is waterose from the dead-arms. By means of lockage and canalization it could anyway be solved to use the dead-arms for introduction of young fish, resp. propagation of fish.
P. VÉGVÁRI: In case of increasing the Tisza regulation the stabilization of the water surface in the dead-arms is to be expected.

6. I. HORVÁTH and GY. BODROGKÖZY:
Connection between stock-structure and organic-matter production in the marshy meadows in the Tisza flood-plain at Körtvélyes
(Published in Vol. 10 of the Tiscia)

Contributions to the discussion:

J. HAMAR: Asks if the measuring of vegetable production differs only methodically at samples got from water and land.
Reply: The methodical differences are only decisive.
K. BÁBA: Asks if the plant species have a special effect on the definite formation of N—P content.
Reply: There are some differences in species.

7. I. BELICZAY:
Forestry problems of the holm at Körtvélyes

After the regulation of riverways, the natural flood-land wood-associations, regional sceneries have changed, mostly perished. Due to that, the regional aesthetics has got poorer, the possibility of biological researches narrowed down and that is, in the last analysis, a loss for science.

In Western and Central Europe, the flood-plain biological biocoenosis has survived in the largest continuous area, with the comparatively lowest — but considerabledamage in the Region-Conservation District in the flood-plain of the Tisza at Mártély-Sasér.

Our aim is to preserve and reconstruct the region, the biological biocoenosis that developed owing to the regularization of the river, as an open-air museum. There is to be applied a sylvicultural technique by the help of which the still surviving wood-associations can be preserved and those already changed can be reconstructed.

Contributions to the discussion:

M. ANDÓ: Asks what the natural regeneration of the flood-plain wood vegatation is like.
The lecturer's reply: Assessments like that have not been taken place.

K. BÁBA: After machine-work and planting, the soil-fauna is very poor. In Region-Conservation Districts the hand-operated cultivation would be more practical.
Reply: Some efforts have already taken place in this direction: the parallel application of machine- and hand-operated cultivation.

J. HAMAR: It would be advisable to preserve and breed, resp. cultivate the rare plant and animal species in a conservation area. It would be useful to root out weeds and shrubs by hand.
Reply: The intention is to preserve the rare species by transplanting them into Region-Conservation Districts. In case of deciduous woods, the remains after rooting out are burnt.

M. MARIÁN: Asks why the damage done by game is larger in a cultivated area.
Reply: In non-cultivated areas, the weeds are considerably consumed, as well, by the game.

8. M. MARIÁN:

The part played by floods in the development of the avifauna in the flood-plain of the Tisza

(Published in Vol. 10 of the Tiscia)

Contributions to the discussion:

J. HAMAR: Asks if sea-gull species can be present at the reservoirs.
The lecturer's reply: Yes, they can.

I. SZŐKE: Is interested in the effect of urbanization.
Reply: The holiday home at Mártély must not expand. Körtvélyes is closed from disturbance by an inserted buffer area.

9. I. DOSZTÁL:

Some data on water-bug species of the flood-plains of the Dead-Tisza at Körtvélyes and the Double-Körös

The investigations were performed in 1973. The areal distribution of the investigations was:

Dead Tisza at Körtvélyes,

Double-Körös and its dead-arms.

The aim of the investigations was to establish what degree of similarity is shown by the biotopes of certain water-bug species and the composition of the plant-stand of the biotope, in various sampling areas. I have established that the *Hydrocorita* species of the dead-arm at Körtvélyes are living in four biotopes differing from one another by their plant-stand.

Comparing these results with those of the investigations performed in the region of the Double-Körös, I established a considerable similarity in respect of the plant-stand in the living-space of a few water-bug species. I am dividing the most important ones of these into the following groups:

water-bug species	plant species
Naucoris cimicoides L. PLEA LEACHI MC GREG. KIRK *Hydrometra gracilenta* HORV.	*Ceratophyllum demersum, Myriophyllum verticillatum, Potamogeton* sp.
Micronecta meridionalis COSTA	at the surface of a mud saturated with broken organic fragments, there is no water vegetation max. to ten cm depth

Ranatra linearis L. — *Phragmites communis, Typhya angustifolia, Carex* sp., *Polygonum amphibium*
Nepa cinerea L.

On the basis of the material elaborated so far, at the species

Sigara laterialis LEACH,
Sigara striata L.
Sigara falleni FIEB.
Corixa affinis LEACH

I have not found any special plant association referring to their presence.

Contributions to the discussion:

L. MÓCZÁR: Asks if a quantitative collection was carried out.
The lecturer's reply: There were only collections of informative character.

J. HAMAR: In smaller waters there live several water-bugs. In the traffic in materials they have a considerable part.
He asks: If they have in larger waters a more considerable part. He asks, too, how many species in Hungary are known.
Reply: Bugs avoid the deeper, rippling waters, they have therefore no part in the traffic in materials. They have a more considerable importance in natron lakes. In Hungary, 16 to 24 species of them are known.

K. BÁBA: Asks if there are some species characteristic of water plants and, if there are any, whether their quantity is or is not characteristic.
Reply: He observed some special species in some plant-associations: *Naucoris cimicoides* is a species like this. In some muddy pools, from places rather rich in organic matter, *Micronetta meridionalis* was found.

L. GALLÉ, Sr.: Asks if the lecturer compared the results of his investigations to Zogler's and Csongor's data.
Reply: Mainly Csongor's qualitative data were useful as he collected from similar sites. The species generally agreed.

10. L. TANÁCS:
The Apoideae of the dams of Mártély-Körtvélyes and Tiszasziget
(Published in Vol. 10 of the Tiscia)

Contributions to the discussion:

J. HAMAR: Asks if the pollination of the agricultural plants is connected with the presence of Apoideae He asks further on, if the pesticide-induced destruction of these was osberved, and if they can be brec if necessary.
Reply: Pollination and the presence of Apoideae are connected with each other. Pesticides are often used in dilettantish way, they destroy therefore bees, as well. These plant-protecting insecticides should be applied as depending upon season and the part of the day. The breeding of Apoideae is possible under convenient climatic conditions.

L. MÓCZÁR: Emphasizes the importance and necessity of the hydrobiological researches. He appoves of investigating the flood-plain as a completion. He thinks it proper to carry out in ihe future more exact quantitative investigations, in addition to the surveying investigations carred out so far. The ecological investigation is important, as well. Fewer species but more fundamentally.

III. Preparation of the investigations planned in the district of Csongrád

11. A. BANKOVICS:
Region-Conservation problems of the districts of Tőserdő and the Tisza III river barrage

After the districts of Kisköre and Mártély, that of Tőserdő will be the third complex area of investigation of the Tisza-Research Working Committee. The begining of investigations there as soon as possible is justified by two circumstances. On the one hand, since Janaury 1, 1975, the area has belonged to the National Park of Kiskunság (Little Cumania: a district of South-Centrall Hungary), its investigation is therefore important as that of a nature-conservation area. On the other hand, the area of Alpár, immediately south of Tőserdő, will considerably change in its regional feature, too, after the Tisza III river barrage being built. In the further parts of the lecture, the area of the National Park of Kiskunság at Tőserdő and the present projects of the Tisza III river barrage are outlined.

Contributions to the discussion:

I. HORVÁTH: Is pleased to hear that the suggestions of the Tisza-Research Working Committee, as wall, are taken into consideration at building the Tisza III river barrage. First of all, the research of the future area of the reservoir is to be organized.

P. VÉGVÁRI: Asks if somebody has already dealt with the water-quality to be expected. It is good that the reservoir will not be in a direct connection with the river itself. Thus it won't pollute it back.

K. BÁBA: Tőserdő is already at present full of weekend-houses. The character of being a reservoir is disturbed by that fact. The reservoir will contain Danube-water. He asks if the area of the Kiskunság National Park will not be endangered by that strongly polluted water.

T. KERESZTES: In the future area of the reservoir there is at present no continuous sampling but it has a part in the perspectivistic plan of the Water Administration of the Lower-Tisza Region. He offers the help of the Water Administration in the research work connected with the reservoir, and asks the Tisza-Research Working Committee to include in its plan of work the research of the connection between pesticides and the water ecosystem.

J. HAMAR: The Tisza III. River Barrage will be built at Csongrád. But is possible that the Danube Canal will connect with the Tisza at Szolnok.

A. BANKOVICS: The reservoir will store 400 million cubic metre water mass that is expected to damm back the Tisza up to Kisköre. The reservoir filled up with Danube-water is isolated from the Kiskunság National Park, a negative effect is, therefore, not to be expected. Tőserdő is of grove-wood character, it cannot be sealed off from people.

IV. Investigations carried out in other areas

12. T. K. KISS:
Recent data on the algae of the Tisza Eastern Main Channel

Contribution to the discussion:

J. HAMAR: He congratulates. At evaluating eutrophization, the maximum values are really to be taken into consideration. The norms of water management for eutrophization are to be revalued if the eutrophization induced by human influence can in that way filtered out of it.

L. GALLÉ, Sr.: He saw in the pictures that irregular algae have a part among those originating from eutrophic waters. That may be caused just by the considerable multiplication.

T. K. KISS: No question about it that an anthropogenous effect has been reflected by the rise in algal number since the early 1960.

13. L. GALLÉ, Sr.:
Influence of biotic and abiotic factors upon the change in the lichen vegetation along the Maros

The first lichenological data in the flood-plain of the Maros in Hungary originated from ISTVÁN GYŐRFFY who collected the lichen species *Baeomyces rufus* (HUDS.) REBENT, under the name *Sphyridium byssoides β/carneum*, at Maroslelle, in October 1905. This primarily montanous, terricolous lichen couldn't be found again either in the region of Makó or in that of Szeged. Since Győrffy's find up to 1960 there have not been any lichenological data from these areas. Then GALLÉ reported in the "Acta Botanica", and later, in 1967, in the "Fragmenta Botanica" on 141 species belonging to 39 genera, 66 varieties and 89 forms, classifying these into eleven different licken-econoses. From among these 93 species and several varieties of these lived in the area bordered by the dams of the Maros. Among the 93 species there occurred 12 ones that were rare mountain-species even in the northern regions of the Great Hungarian Plain. From among these species there cannot be found any more in the same area. The causes of the change are, according to the author, that the revetments, consisting mainly of andesite, and together with them the epilithic lichen-species disappeared from the dams, that the old, mainly superannuated oak-forests (Querceta) were cleared along the Maros, that most part of the flood-areas were drawn under agricultural and small-plot cultivation and, in connection with that, under anthropogenous effects, the lichen species that are extremely sensitive to herbicides, disappeared from the area.

14. K. BÁBA:

From where the woods of the Tisza valley are populated by snails

From the Great Hungarian Plain, in the 1940s, 48 land-snail species were known. (On the basis of the works of Soós, ROTARIDES, CZÓGLER). 15 species of these, found at the skirt's of the Plain, were not reckoned to the snail fauna of the Plain in the strict sense of the word. The snail fauna of the Plain was characterized on the basis of not more than 32 species.

From the Great Hungarian Plain, in the 1940s, 48 land-snail species were known. (On the basis of the works of Soós, ROTARIDES, CZÓGLER). 15 species of these, found at the skirts of the Plain, were not reckoned to the snail fauna of the Plain in the strict sense of the word. The snail fauna of the Plain was characterized on the basis of not more than 32 species.

As a result of the older and recent collections, from the Great Plain 82 species are demonstrated. 47 per cent of the 82 species are hydrophilic, sylvicolous. (According to our earlier knowledge, they occurred in the mountains). These species are the constant dominant elemetnts of the woods in the Plain at present, too. The sylvicolous elements are to be found in the natural forests.

In the woods belonging to the same line of succession, the 82 species are distributed so that 41 per cent of them are living in the willow-plantations, 67 per cent in the flood-plain grove-woods as developed from the latter ones, 33 per cent in the hornbeam oak-woods, developing from the grove-woods, and 24 per cent in the oak-woods with lilies-of-the-valley. In the alkali oak-woods isolated from the river, and in the ash-alder bogs developing in organogenous way, only 7, resp. 33 per cent of the total species numbers are living. In the developmental series starting from the sand-grasses and leading into the steppe oak-plantation, 34 per cent of the species occur.

Farther from the river, the species number occurring in the single wood-types, and inside the species number, the number of the sylvicolous elements decrease.

It is proved by the results that the richness of the snail fauna of the Great Plain in hydrophilous, sylvicolous species is a result of the fauna-transporting effect of rivers. And that is showing the stocking of the malacofauna of the Great Hungarian Plain from the mountains.

The animals brought down by water either perish or, getting to a higher relief (the grove-woods), survive for a shorter or longer time, respectively they become acclimatized. The species acclimatized are, owing to the character of grove-woods-moderately oligothermic. (The great masses of the sylvicolous acclimatized animal, are accessory elements showing a 10 to 20 per cent permanence value).

In some places, the lecturer mentions a few examples showing that the snails may spread from one wood-type over another, even in case of mountain- and plain-woods being in a continuous connection with each other. This way of spreading becomes today rarer than before, due to the present sylviculture.

The stocking by river water is general and may be observed in case of other animal categories, as well (*e. g.* the 82 rare mountainous insect species of Bátorliget in Újszentmargita the two montan *Isopoda*-species found by LOKSA). The largest number of the 500 betele-species transported by the flood of the Maros were found by József Erdős to be generally spread in the Great Plain.

Contributions to the discussion:

L. GALLÉ, Jr.: At the fauna-genesis of the Tisza valley, it is to be taken into consideration that not only a mountain-fauna but also a fauna of southern, Mediterranean-steppe character are conveyed through the flood-plain of the river to the Great Hungarian Plain.

J. HAMAR: Asks if water-snails, too, are conveyed through the Tisza valley.

M. MARIÁN: Approves very much of delivering lectures of comprehensive character and making papers like this.

The lecturer's reply: He has not found any southern species in the Tisza valley. In treeless areas he did not experience any sudden advance fo the steppe-elements. Water-species are conveyed by the Tisza, as well.

15. A. LEGÁNY:

Ornithological problems of poplars in the flood-areas of the Tisza

Contributions to the discussion:

B. SZŐKEFALVI-NAGY: Asks where the nestlings, flying out in a wood planted, later settle down

I. BELICZAY: The settling of a mixed stock cannot be solved in the flood-plain.

L. MAGYAR: Asks whether the sylviculture by plantation means or does not mean a ruthless exploitation of woods, as well. He asks if the lecturer observed that the settling of some birds is helped or unfavourably influenced by the branching type of trees.

M. MARIÁN: The lecturer has performed a solid, substantial work. Sparrows settle down in small holes of skort opening, as well.

The lecturer's reply: The yound birds settle in another place after flying out. We should need more artificial holes for maintaining them successfully in the area. In the flood-plain no soil-impoverishment could be observed.

16. GY. CSIZMÁZIA:

Prediction of flood-waves in the Tisza and their connection with the stock of game

The up-to date observation of nature is showing the natural phenomena in a quite new, original perspective. The connection between the stock (and so the economy) of game and the environment must therefore get a new perspective, a new content, in case of the populations living in the Tisza flood-plain, as well. In the lecture mentioned the decisively important ecological conditions that make the game economy possible. There is an organic connection between the soil of the biotope, the size and shape of its vegetation, and the stock of game. The investigations carried out in the Region-Conservation District at Mártély-Körtvélyes have proved the strong destroying effect of the flood-waves on the stock of game in the flood-area. In case of deer, hare, pheasant, partridge, the damage can be proved with statistical data. The theoretical and practical investigation of this very considerable problem that is important from the point of view of the people's economy, as well, seems to to be necessary in the future, too. In can be established that, knowing the predictions of the water-levels of the river, a preliminary plan may be prepared for alarming the game. In 1972, the lecturer, too, carried out a partly successful alarm in the area investigated, on the basis of a plan prepared by the Water Management Department of the Water Administration of the Lower-Tisza Region. It would be impotrant to prepare the exact graphs of flood-prediction for the whole flood-plain of the river, taking into consideration the local geomorphological conditions. On the basis of a graph like this, the alarm of game could be organized by every association of huntsmen.

Contributions to the discussion:

A. BANKOVICS: Asks if any nettings took place for establishing the sex-ratio of the stock of hare.
L. TANÁCS: Asks the rate of deer destruction of as a result of a flood-wave.
D. GÁL: Asks if there were sex-ratio investigations at the autumn-winter huntings.
I. BELICZAY: Game-savers should be created for preventing the flood-induced damages.
J. HAMAR: Asks in what time the game forced out by flood generally returned.
The lecturer's reply: The determination of sex-ratio took place not on morphological but on ethological basis. The flood-induced destruction may be of 90 to 95 per cent. Driving-out before the flood-wave could be successful but it occurred that the game returned in 24 hours.

V. Organizational problems

17. M. MARIÁN:
Results of the Tisza research in 1974, and its tasks for 1975

Contributions to the discussion:

I. HORVÁTH: The main principles of the Tisza-research work are as follows:
(1) Region and nature conservation,
(2) Region reconstruction,
(3) Prognosis of anthropogenous changes.
Our basis-areas are:
(1) Kisköre — here the water-biological researches are ensured by the laboratory works in maximum way. The botanical and zoological researches are, however, to increased.
(2) In case of Mártély-Sasér, on the other hand, the development of the hydrobiological researches is desirable.
(3) Csongrád river barvage: the basis of our activity is to aid the solution of the given practical problems with basic researches.
Partial tasks of investigating the single areas:
Csongrád (Tisza III) river barrage:
(1) The area of the Kiskunság National Park and the future area of the reservoir, as well, are to be explored equally from botanical and zoological points of view.
(2) The schedule of reservoir building is to be procured.
(3) The Water Administration of the Middle-Tisza Region is to be requested for storing the plankton samples.
(4) The researchers of the Kisköre laboratory ought to prepare collaborating projects.
Region-Conservation District at Mártély-Körvélyes:
(1) Basic researches for setting the forest ecosystems,
(2) Research of the underwood.
(3) Research of fish in the dead-arms.
(4) Study of the effect of pasturing.
Kisköre (Tisza II):
(1) The Kisköre laboratory continues its investigations.
(2) The ornithological research of the area at Cserőköz.

M. MARIÁN: Vol. IX. of the Tiscia came out. Closing of MSS: on June 30, every year. The Abstract of the lectures delivered is requested. Two copies of the articles on Tisza research, if published not in the Tiscia, are to be sent to the Tisza-research library.

Tisza-research publications in 1974: 14 papers are published, 21 are in manuscript, 20 lectures were delivered.

Inland schloraships were given to eight co-workers but three of them have not used it. For 1975, schloarships were asked for by eleven persons.

Two colleagues in the educational service have obtained a 500 Ft grant each. The study-tour of a person to Poland was aided by the Tisza-Research Working Committee. Tisza Research has got two premises in the Botanical Gardens.

The Researcher House at Körvélyes is complete. It is at the disposal of the researchers.

Three of the co-workers obtained university doctor's degree, three of them candidate's degree, and one academic doctor's degree last year.

I. HORVÁTH: Wishing the participants further good work, he closes the Conference.

TISCIANA HUNGARICA SERIES 1973—1975

Complited by

M. MARIÁN

A list given below of the publications of members of the Tisza-Research Working Commettee wich appeared between 1973 and 1975, and wich were included by the Tisza-Research Working Committee in the Tisciana Hungarica series.

89. ANDÓ M.—VÁGÁS I. (1973): The flood in the Tisza Valley in 1970. — Studia Geomorphologica Carpato-Balcanica, Karkow 7.
90. BÁBA K. (1974): Mollusca communities in the Tisza bed in the region of Szeged. — Tiscia (Szeged) *9*, 99—104.
91. CSOKNYA M.—FERENCZ M. (1972): A study of Palingenia longicauda Oliv. in the zoobenthos of the Tisza and Maros (Ephemeroptera). — Tiscia (Szeged) *7*, 47—59.
92. FERENCZ M.(1974): Zoobenthos studies on the lower reaches of the Tisza and Maros. — Acta Biol. Szeged. *29*, 143—155.
93. GÁL D. (1972): Rhizopodenfaune de Theißs-strecke über der im Bau begriffenen II. Theißstufe. — Tiscia (Szeged) *7*, 29—35.
94. GALLÉ L. (sen.) (1973): Die Flechtenvegetation der Eschenbaumstamme langs der Theißs. — Tiscia (Szeged) *8*, 42—52.
95. GALLÉ L. (jr.) (1972): Formicidae populations of the ecosystems in the environs of Tiszafüred. — Tiscia (Szeged) *7*, 59—68.
96. HARKA Á. (1974): Study of the fish population in the region of the second series of locks on the Tisza. — Tiscia (Szeged) *9*, 125—143.
97. HORVÁTH A. (1972): Aquatic Mollusca fauna of the flood-area and dead-arms of the Tisza. — Tiscia (Szeged) *7*, 34—46.
98. KISS KEVE, T. (1974): Effect of the turbidity of the water on the development of algal association in the Tisza. — Tiscia (Szeged) *9*, 9—24.
99. LEGÁNY A. (1974): Ornithological observations in some biotopes of the Upper-Tisza inundation area. — Tiscia (Szeged) *9*, 115—124.
100. MARIÁN M.—PUSKÁS L. (1973): Quantitative Untersuchung der Singvogel-Population (Passeriformes) des Überschwemmungsgebeietes der Theißs. — Tiscia (Szeged) *8*, 71—77.
101. SZITÓ A. (1974): Quantitative and qualitative Studies of Chironomidol larvae on the section of the Tisza between Tiszafüred and Kisköre. — Tiscia (Szeged) *9*, 52—58.
102. TÓTH S. (1974): Odonata fauna the area of the second series of locks on the Tisza. — Tiscia (Szeged) *9*, 87—97.