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DATA TO THE KNOWLEDGE ON THE LEPIDOPTERA FAUNA AT BODROGZUG

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Abstract

Author presents data to the knowledge on the lepidoptera fauna at Bodrgzug, collected at the Bodrog delta in the Summer aspects. For the evaluation, as a base for comparison, a review is given in respect to the more important dominance values of two light-traps alongside the Tisza river, and a list is presented of the collected 108 species, their classification according to foster-plant types, as well as a picture of the *Hypenodes orientalis* STAUDINGER.

Bodrogzug is one of the most beautiful and most manifold parts of the Tokaj Environment Protection Area, the state of which is inordinately influenced by the frequently changing water output of the Tisza and Bodrog rivers. The area's exploration in respect to its flora and fauna is still in progress nowadays. With his data of collections and observations, author wishes to contribute to one of the partial objectives of this collective work; to the knowledge on the lepidoptera fauna at Bodrogzug.

It is well known that several years' continuous work is necessitated for the complete exploration of an area's lepidoptera fauna, which is firstly performed with the help of lighttraps and other complementary collections. Since there were no possibilities for this, only occasional collections and a total of seventeen studies were performed between the period June 19 and August 28, 1983. With the help of H. lamp functioning with generator, during the course of the collections performed with hand-net, 733 individuals of 108 species were collected and one further species was observed only. For the relative surveying of the mass ratios every individual which flew on the cloth on the effect of light and those which could be caught at day-time, resp., were collected.

Evaluation could not be prepared regarding classification according to aspects, as well as seasonal changes because the number of collections were few and could not at all be considered as continuous. The seventeen days were only 8% of the vegetation period, thus these could only be mentioned as sampling from the associations of the Summer and late Summer aspects.

Vegetation

The Bodrogzug, together with the Szatmár—Beregi-plain and the Rétköz, belongs to the Northern—Lowland district of the Lowlands floristic region. The continental elements are still retraceable amidst the remnant vegetation of the sand

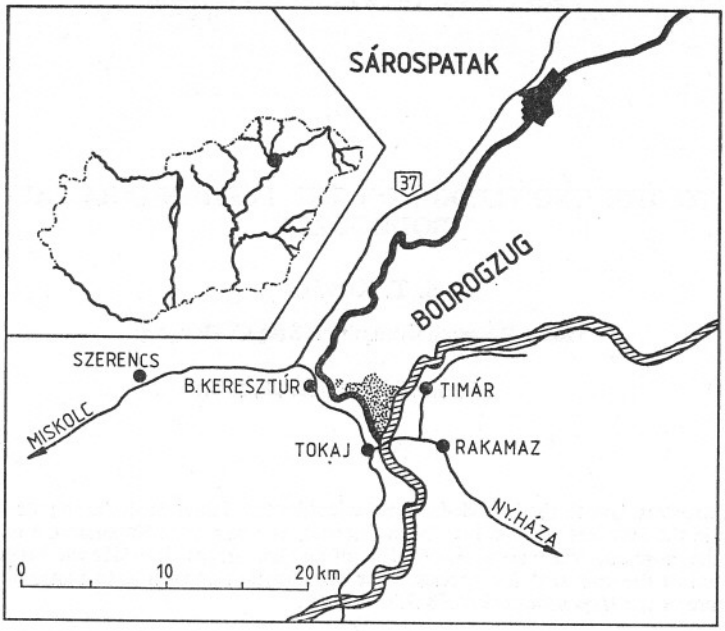

Fig. 1

patches (*Erysimum diffusum, Helichrysum arenarium, Gypsophila paniculata,* etc.). Cirkumpolar heath-fern, buck-bean, featherfoil *(Hottonia palustris)* and Eurasian cicuta *(Cicuta virosa)* can be found at the diminished marsh-remains. Willow gallery forests are found contiguously at the Tisza flood-plain and in reduced or eradicated form along the Bodrog. The tree stand is made up of silver willow, brittle willow with many black and trembling poplars, and common alder at places. Sweet-grass *(Glyceria maxima)* and bulrush *(Typha latifolia)* grow in relatively scant reeds. Dewberry is abundant at the shrub stratum. Furthermore, great patches of common nettle are found diversified with rice-grass.

Study results

On the basis of the data obtained at Bodrogzug, South from Bodrogkeresztur and Timár, at seventeen sites (from flood-plain to tide land plant community types found at the described area) with the help of lamplight and day-time catches by net, the classification according to foster-plant types developed as follows: 49 (45.3%) from species living on soft-stalked and water-plants, 25 (24%) from species feeding on willow and poplar leaves, 7 species (6.4%) from animals living on high dry stalks, 5 species (4.6%) from those living on shrubs, 3 (2.7%) from species consuming leaf-litter and 2 (1.8%) from those feeding on pine elements. The foster-plant of further two species is unknown in science; and one of each had been caught (*Pyrgus armoricanus* OBTH and *Hypenodes orientalis* STAUDINGER, det. RONKAY L.).

Studies on the composition of the collected data displayed mountain-effect. The highlands near the Bodrog, the regions of which give surprises for lepidopterology

even today, show their effect both in the flora and in the lepidoptera fauna, and even at other areas. Regarding the *Cichorium,* the *Leontodon,* the *Frangula* and *Alnus,* furthermore the *Sambucus* and *Galeopsis* as well as the *Lamium* and *Ballota, Thymus serpyllum,* the *Astragalus* and *Colutea* foster-plants, these are not at all typical flood-plain plants, and do not occur regularly at the Lowlands either; just as the *Cucullia umbratica* L., *Angerona prunaria* L., *Perizoma alchemillata* L., *Celastrina argiolus* L. and the *Cupido minimus* FUESSL. are not of flood-plain origin either. It is noteworthy that during the first days of August such a mass swarm of the *Maculinea arion* L. was detectable, that some individuals even roved in the streets of the city Tokaj. The situation of the *Sphinx pinastri* L. and the *Dendrolimus pini* L. is also unambiguous, since there are no pines at Bodrogzug.

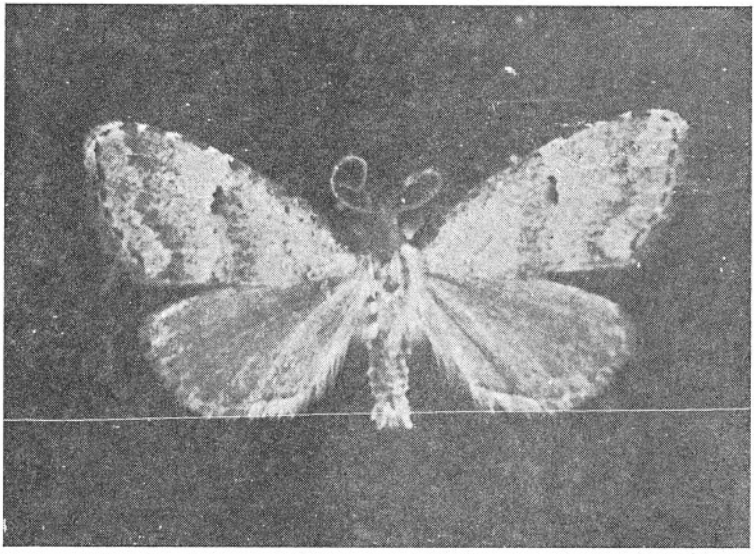

Fig. 2 *Hypenodes orientalis* STAUDINGER, Bodrogzug 1983. 08. 03. leg. S. T. KOVÁCS det. L. RONKAY

The collection reflects the main phytological characteristics of the studied area and its environs well. The species living on willow and poplar leaves form the stock of the fauna, and these are less endangered by floods. The species living on soft-stalked plants and at the herb stratum (grouping here those living on the roots of one year old plants as well as in rhisomes, too) mostly die out from the flood-plain at the time of greater inundations, then get to the flood-plain by way of regular resettlement, meaning at the same time that they find a living place necessary for their maintenance beyond the dams as well. Those species of the flood-plain are in advantageous position which experience the inundation in the imago stage. There was only one flood in 1983, as the consequence of which the number of animals living on soft-stalked plants and various grass types was rather high (59.7%).

Studying the mass ratios of the collection, the following sequence could be determined:

In the list the data of points 5. and 6. are striking. Because of their amount, their hazardous character at this area is out of the question. The phenomenon could rather be explained by the fact that the plants fond of warmth moved down from

the nearby warm hills to the warmer areas at the dams, and with them also certain lepidoptera species. This is probably the cause for the higher incidence of the *Lisandra thersites* cant., too. The data of 10—10 dominant species from the collection of two light-traps alongside the Tisza river may serve for demonstrating how the lepidoptera fauna of the flood-plain is influenced by the animals living at the areas on the protected side.

Mártély (1971: 154 species, 1382 individuals)

Körtvélyes (1979: 134 species, 1300 individuals)

On the basis of these data both communities could correspond to a not waterside, but lowland-stock, since the species bound to (fond of?) the flood-plain or to water fell into the trap in a much smaller number, e.g.: one individual of the Gastropacha populifolia appeared at Mártély and fifteen at Körtvélyes, and such example could also be experienced in other cases.

In any case, the flood-plain stock is made picturesque and at the same time more ordinary by the modulation facility of the protected side. This is also why the mountain-effect of the nearby hills prevails at Bodrogzug.

Further organized investigations are necessary to gain knowledge on the lepidoptera fauna at Bodrogzug. This work would greatly be promoted by the functioning of a few light-traps. Data survey on the basis of individual collections demands several years' work, which is not sufficient in full, either.

Table 1. *List of the collected species (on the basis of the namings used by* L. KOVÁCS

ZYGAENIDAE	
Zygaena achilleae ESP.	2 ind.
Geometridae	
Clorissa viridata L.	2 ind.
Calorhysanis amata L.	8 ind.
Scopula immorata L.	5 ind.
Scopula immutata L.	4 ind.
Scopula flaccidaria Z.	1 ind.
Sterrha muricata HUNFN.	4 ind.
Sterrha aversata L.	1 ind.
Mysticoptera sexalata RETZ.	30 ind.
Xanthorhoe ferrugata L.	1 ind.
Oerizoma alchemillata L.	4 ind.
Pelurga comitata L.	4 ind.
Eupithecia centaureata SCHIFF.	1 ind.
Lomaspilis marginata Li	7 ind.
Lomographe dilectaria HBN.	5 ind.
Angerona prunaria L.	10 ind.
Epione repandaria HUNF.	11 ind.
Macaria alternaria HBN.	6 ind.
Chiasmia clathrata L.	8 ind.
Tephrina murinaria SCHIFF.	6 ind.
Ascotis selenaria SCHIFF.	14 ind.
Etcropis bistortata GOEZE	8 ind.
Ematurga atomaria L.	5 ind.
Noctuidae	
Hypenodes orientalis STGR.	1 ind.
Rivula sericealis SC.	2 ind.
Catocala elocata ESP.	2 ind.
Macdunnoughia confusa STPH.	5 ind.
Chryaspidia festucae L.	3 ind.
Bena prasinana L.	1 ind.
Nycteola asiatica KRUL.	4 ind.
Emmelia trabealis SC.	8 ind.
Eustrotia bankiana F.	9 ind.
Eustrotia condidula SCHIFF.	15 ind.
Athetis gluteosa HUFN.	2 ind.
Caradrina morpheus HUFN.	1 ind.
Archanara geminipuncta HAW	7 ind.
Archanara sparganii ESP.	17 ind.
Hydraecia micacea ESP.	2 ind.
Ipimorpha retusa L.	3 ind.
Apatele rumicis L.	4 ind.
Derthisa glaucina ESP.	1 ind.
Cucullia umbratica L.	2 ind.
Mythimna albipuncta SCHIFF.	10 ind.
Mythimna pallens	28 ind.
Mythimna conigera SCHIFF.	13 ind.
Mythimna turca L.	11 ind.
Mamestra suasa HBN.	2 ind.
Mamestra oleracea L.	9 ind.
Discestra trifolii HUNF.	2 ind.
Amathes c-nigrum	14 ind.
Diarsia rubi VIEW.	12 ind.
Ochropleura plecta L.	5 ind.
Sctoia exclamatio·is L.	11 ind.
Sctoia segetum SCHIFF.	4 ind.
Nolidae	
Roeselia albula SCHIFF.	2 ind.
Celama centonalis HBN.	2 ind.
Lymantriidae	
Leucoma salicis L.	10 ind.
Lymantria dispar L.	2 ind.

Arctiidae	
Pelosia muscdrda HUNF.	4 ind.
Phragmatobia fuliginosa L.	8 ind.
Spilosoma menthastri ESP.	13 ind.
Spilosoma uritcae ESP.	9 ind.
Diaphora mendica CL.	3 ind.
Diacrisia sannio L.	16 ind.
Notodontidae	
Harpyia furcula CL.	3 ind.
Gluphisia crenata ESP.	6 ind.
Notodonta ziczac L.	12 ind.
Pterostoma palpinum L.	4 ind.
Clostera anastomosis L.	5 ind.
Clostera curtula L.	9 ind.
Clostera anachoreta F.	1 ind.
Sphingidae	
Hyloicus pinastri L.	1 ind.
Smerinthus ocellata L.	4 ind.
Amorpha populi L.	5 ind.
Macroglossa stellatarum L.	(megfigyelt)
Pergesa elpenor L.	6 ind.
Pergesa porcellus L.	14 ind.
Thyatiridae	
Habrosine pyrithoieds HUFN.	28 ind.
Tethea or F.	15 ind.
Lasiocampidae	
Gastropacha populifolia ESP.	24 ind.
Dendrolimus pini L.	1 ind.
Hesperidae	
Pyrgus malvae L.	
Pyrgus armoricanus OBTH.	1 ind.
Ochlodes venatum BREM.	3 ind.
Carcharodus alceae ESP.	4 ind.
Pieridae	
Leptidea sinapis L.	
Pontia daplidice L.	8 ,nd.
Pieris rapae L.	7 ind.
Pieris napi L.	1 ind.
Colias croceus FOURC.	1 ind.
Papilionidae	
Papilio machaon L.	1 ind.
Lycaenidae	
Thersamonia dispar HAW.	2 ind.
Thecla quercus L.	2 ind.
Lycaeides argyrognomon BERGSTR.	3 ind.
Lycaeides idas L.	2 ind.
Plebejus argus L.	2 ind.
Everes argiades PALL.	3 ind.
Cupido minimus FUESSL.	4 ind.
Lysandra thersites CANT.	8 ind.
Polyommatus icarus ROTT.	4 ind.
Celastrina argiolus L.	2 ind.
Lysandra coridon PODA	7 ind.
Maculinea arion L.	20 ind.
Nymphalidae	
Issoria lathonia L.	2 ind.
Clossiana dia L.	1 ind.
Melitaea trivia L.	20 ind.
Satyridae	
Coenonympha pamphilus L.	19 ind.
Minois dryas SC.	7 ind.

References

GOZMÁNY, L. (1968): Diurnal moths (Diurna). — Fauna of Hungary XVI: *15*, 2—192.
GOZMÁNY, L. (1970): Owlet-moths (Noctuidae I.). — Fauna of Hungary XVI: *11*, 3—151.
KOVÁCS, L. (1953): The Hungarian large moths and their diffusion. — Folia Ent. Hung. *6*, 77—184.
The Tisza Lowlands 2. (1969): Publishing House of the Hungarian Academy of Sciences, Budapest, 58—60.

Adatok a Bodrogzug lepkefaunájának ismeretéhez Tokaj térsége

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Kivonat

A szerző adatokat szolgáltat a Bodrogzug lepkefaunájának ismeretéhez, melyeket a nyári aszpektusokban a Bodrog torkolatvidékén gyűjtött. Az értékeléshez, viszonyítási alapként ismerteti két Tisza-menti fénycsapda fontosabb dominanciaértékeit, közli a gyűjtött 108 faj jegyzékét, azok tápnövényeik szerint való csoportosítását, valamint a Hypenodes orientalis STAUDINGER fényképét.

Данные для ознакомления с фауной бабочек Бодрогзуга

Район Токай

Ковач Ш. Т.

Резюме

Автор приводит данные для ознакомления с фауной бабочек устья реки Бодрог, собранных им в летний период. Для сравнительной их оценки приводятся результаты двух световых приманой, расположенных возле реки Тиса. Автор приводит список 108 видов собранных бабочек, дает их классификацию по кормовым растениям, а также фотографию изображающую Hypenodes orientalis ITARDINGER.

Prilog poznavanju faune leptira Bodrogzug (područje Tokaj-a)

Kovács S. T.

Abstrakt

Rad predstavlja prilog poznavanju faune leptira Bodrogzug, pordučje ušća reke Bodrog. Materijal je sakupljen u toku leta. Prikaz je izvršen na osnovu analize dominantnih vrednosti pomoću dve svetlosne klopke duž Tise. Za 108 konstatovanih vrsta data je faunistićka lista, te njihovo grupisanje po biljkama hraniteljkama. Data je fotografija vrste *Hypenodes orientalis* STAUDINGER.

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GROWTH AND FECUNDITY OF CARASSIUS AURATUS GIBELIO BLOCH, 1783 IN MRTVA TISZA

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Abstract

The growth and the fecundity of the *Carassius auratus gibelio* in Mrtva Tisza, the former meander, cut off at land reclamation from the main flow of the Tisza river have been analyzed. The material has been gathered within 1983 and 1984. The absolute growth is higher with the 1984 specimens, but the relative growth shown the equal growth tempo. Comparing this specimen with the specimens from the Tisza, Szava and Danube rivers, Palić Lake, west Siberia and Moscow Lake District waters, the specimen from Mrtva Tisca has shown the higher growth tempo, while compared with the specimen from Kazakstan and Semipalatinsk District the growth tempo is lower. The speed and the constant growth in Mrtva Tisza during tested period have shown the uniform decrease. The absolute fecundity has shown the tendency of increase with the body mass increase, standard length and age. The relative fecundity has shown the lower dependence compared with these three biological parametres. The average values for the absolute and the relative fecundity of the separate categories according to the body mass, length, and age of the specimens from Mrtva Tisza have had the higher values from the values in the mentioned literature, due to the more favourite ecological conditions, but first of all due to the nourishement.

Introduction

Mrtva Tisza (Bačko Gradište—Čurug) artificially cut off meander is located on the right bank of the Tisza river. It was cut in 1858 (BUKUROV 1948). It is 23 km long, about 120 m wide and the depth is from 2 m to 12 m, 4 m in average. The total surface of the water glass is 350 ha. The bank is covered with the reed.

The ichthyofauna of this stagnant tributory was examined by GRGINČEVIĆ 1974, 1977, RISTIĆ 1977; giving taxonomy and ecology of some fish species. *C. auratus gibelio,* as the introduced species, in this locality have not arisen the interest of the explorers up to the present. MALETIN et *al.* 1981; PUJIN et al. 1981; MALETIN et BUDAKOV 1982, PUJIN et al. 1982, BUDAKOV et al. 1983a, BUDAKOV et al 1983b, BUDAKOV et al. 1983c, BUDAKOV et al. 1984, BUDAKOV et MALETIN 1984, have examined the taxonomy and ecology of this species in different waters of Vojvodina.

The aim of the work has been to explore the growth tempo and the fecundity of this alochtone species whose expansion on the territory of Vojvodina has been decreasing mildly.

Materials and Methods

The material was gathered within 1983 and 1984. One hundred and sicty individuals all together have been analyzed, 88 individuals in 1983 and 72 individuals an 1984. The length of the body without caudal fin (standard length) has been measured, and to determine the age the scales above the lateral line in the part of the dorsal fin have been taken. The scales have served both for the reconstruction of the length growth by the reciprocal reading on the basis of the lateral radius according to Чугунова 1959, as per the following formula:

$$l_n = \frac{s_n}{s} l$$

The growth speed has been calculated according to the following formula:

$$C = \frac{\log l_2 - \log l_1}{0.4343\ (t_2 - t_1)}$$

as well as the growth constant per Шмальгаузен quoted by Чугунова 1959, as per following forma

$$K = C \frac{t_1 + t_2}{2}$$

The absolute and relative fecundity have been calculated with totally 115 female fish, and out of that number 44 individuals were gathered in 1983 and 71 within 1984. These values have been expressed with regard to the body mass, standard length and age.

Results and Discusion

Growth

C. auratus gibelio in the tested material belongs to the age classes from 3+ to 7+ (1983 specimen) and from 3+ to 6+ (1984 specimen). The calculated values of standard length in separate years of life are higher with 1984 specimen with regard to 1983 specimen. The absolute growth is higher in 1984 as well as up to age 4+, while with older age classes it has been lower. The relative growth, however, has the similar values in the tested years up to 5+ of age (Table 1, Fig 1).

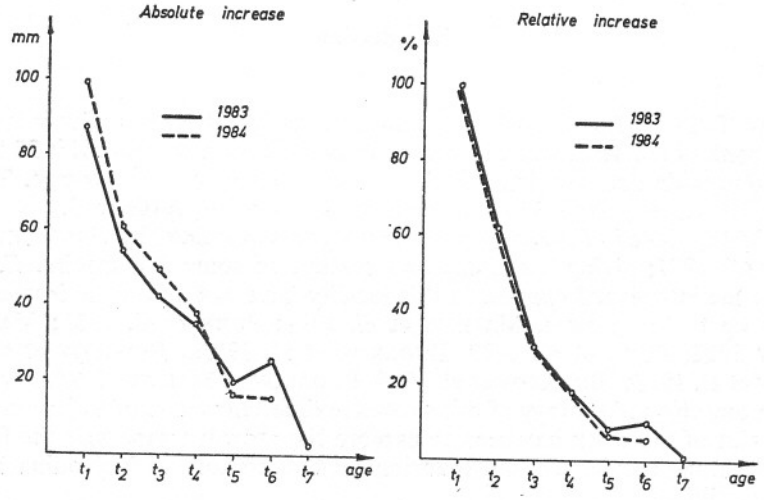

Fig. 1. The growth tempo of *C. auratus gibelio* in Mrtva Tisza

The growth of the specimens from Mrtva Tisza compared with those from the Tisza, the Sava and the Danube rivers has been considerably higher (BUDAKOV et al., 1979) as well as compared with specimens from Palić Lake (MALETIN et BUDAKOV 1983), while compared with regard to the specimens from Ludoš it has been approximately equal (PUJIN et BUDAKOV 1979, MALETIN et BUDAKOV 1983). The better growth of *C. auratus gibelio* from Mrtva Tisza with regard to the Tisza, the Szava, the Danube rivers has been due to the higher degree of the trophicity of this ecological system (RISTIĆ et al. 1974). In comparison with specimens from USSR waters accord-

Table 1. *Length growth of C. auratus gibelio in Mrtva Tisza (in mm)*

Growth	n	l_1	l_2	l_3	l_4	l_5	l_6	l_7
				1983				
3+	16	87,57	141,49	179,43				
4+	37	87,17	145,48	191,03	224,37			
5+	32	87,32	138,42	179,86	213,31	238,20		
6+	2	91,45	141,27	187,38	223,69	254,43	277,61	
7+	1	83,33	116,67	150,00	183,33	216,67	250,00	266,67
M	88	87,32	141,71	184,31	218,86	238,51	263,80	266,67
Absolute increase			54,39	42,60	34,55	19,65	25,29	2,87
Relative increase (%)			62,29	30,06	18,74	8,98	10,60	1,09
				1984				
3+	3	117,30	168,71	226,67				
4+	38	102,52	165,67	215,60	255,94			
5+	25	93,81	152,44	198,87	324,60	263,65		
6+	6	88,94	146,96	191,27	228,15	253,77	276,82	
M	72	98,98	159,64	208,22	245,79	261,74	276,82	
Absolute increase			60,66	48,58	37,57	15,95	15,08	
Relative increase (%)			61,28	30,43	18,04	6,49	5,76	

ding to Кривощеков (1953) and Дмитриева (1957) we can state the growth in Mrtva Tisza has been better, while Серов (1959) and Соколов и Новиков (1973) quote the higher values.

The speed and constant growth during the both tested years have shown the uniform decrease (Table 2). The values are similar to those of Ludoš (MALETIN et

Table 2. *Speed and constant of growth of C. aruatus gibelio in Mrtva Tisza*

	1983			1984		
Growth	M	C	K	M	C	K
1+	87,32	—	—	96,98	—	—
2+	141,72	0,48	0,72	159,64	0,51	0,76
3+	184,31	0,26	0,65	208,22	0,28	0,70
4+	218,86	0,18	0,63	245,29	0,16	0,56
5+	238,51	0,08	0,36	261,34	0,07	0,31
6+	263,80	0,08	0,44	276,82	0,05	0,27
7+	266,67	0,01	0,06			

BUDAKOV 1983), while the values from the Tisza, the Sava and the Danube rivers (BUDAKOV et al. 1979) and Ludoš (PUJIN et BUDAKOV 1979) are considerably lower.

Fecundity

The absolute fecundity has been from 11 968 to 360 672, and the relative fecundity has been from 92 to 440 eggs. The values of the absolute fecundity have been increased with the increase of the body mass up to 0—1000g, and then slight decrease can be perceived, while the relative fecundity has been increased with the body mass growth up to 800 g, and then it has been decreased (Table 3, Fig. 2).

Table 3. *Absolute and relative fecundity of C. auratus gibelio from Mrtva Tisa with regard to body mass (in g)*

		Absolute fecundity			Relative fecundity		
Body mass	n	$\bar{x}$	min.	max.	$\bar{x}$	min.	max.
0— 200	8	21 011	11 968	34 200	150	92	285
201— 400	3	61 745	36 890	101 088	213	176	259
401— 600	32	110 291	60 656	174 506	219	110	320
601— 800	33	207 145	124 920	303 322	275	159	402
801—1000	37	235 778	141 772	360 672	267	171	440
1001—1300	2	230 007	209 696	250 318	206	169	243

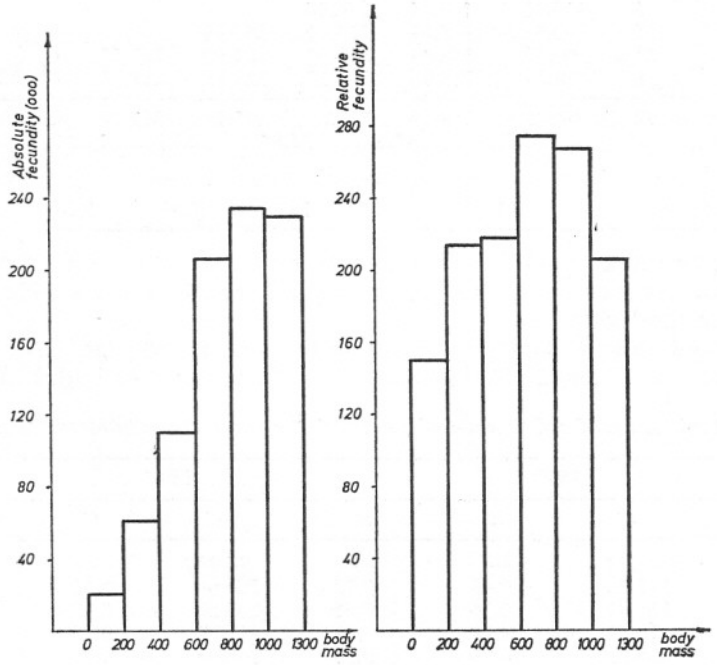

Fig. 2. Absolute and relative fecundity of *C. auratus gibelio* in Mrtva Tisa in dipendence on the body mass (g)

The average values for the separate mass groups are higher with regard to the average values of the individuals from the Tisza, the Sava, and the Danube rivers (MALETIN et al. 1979).

Regarding the standard length (Table 4, Fig 3) the absolute fecundity is in the positive correlatin as well, while the relative one has not shown any direct dependence. These values as well are higher with regard to the specimens from the Tisza, the Sava and the Danube rivers. Кривощеков (1953) quoted the increase the absolute fecundity with regard to the standard length increase, but these values are lower regarding the values for Mrtva Tisza.

Talbe 4. *Absolute and relative fecunditi of C. auratus gibelio from Mrtva Tisza with regard to the standard lenyth (in mm)*

		Absolute fecundity			Relative fecundity		
Standard length	n	$\bar{x}$	min.	max.	$\bar{x}$	min.	max.
100—150	3	19 833	11 968	34 200	172	109	285
151—200	7	34 677	14 801	72 545	152	92	205
201—250	29	106 546	60 656	170 912	217	110	314
251—300	68	215 025	102 120	360 672	270	159	440
301—350	8	236 049	209 496	309 019	243	169	315

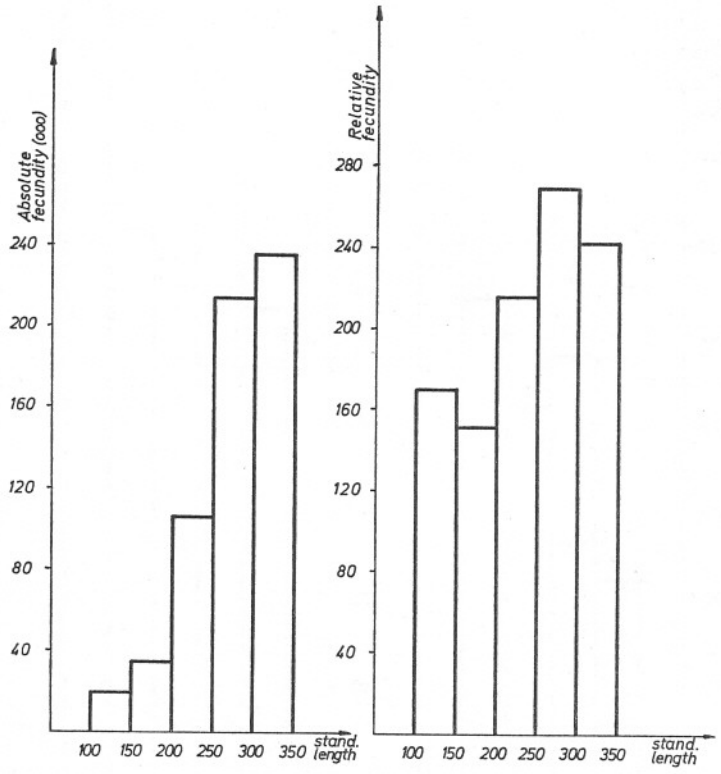

Fig. 3. Absolute and relative fecundity of *C. auratus gibelio* in Mrtva Tisza in dependence on the standard length (mm)

Compared to the age the absolute and relative fecundity have shown the tendency of growth, although the lower values have been noted with the separate age categories (Table 5, Fig. 4).

Table 5. *Absolute and relative fecundity of C. auratus gibelio from Mrtva Tisza with regard to the age*

		Absolute fecundity			Relative fecundity		
Age	n	$\bar{x}$	min.	max.	$\bar{x}$	min.	max.
3+	14	84 977	11 968	225 231	212	92	331
4+	54	191 146	13 332	360 672	259	121	440
5+	39	168 164	22 545	309 019	234	110	381
6+	7	216 242	124 920	250 318	247	159	286
7+	1	268 520	—	—	353	—	—

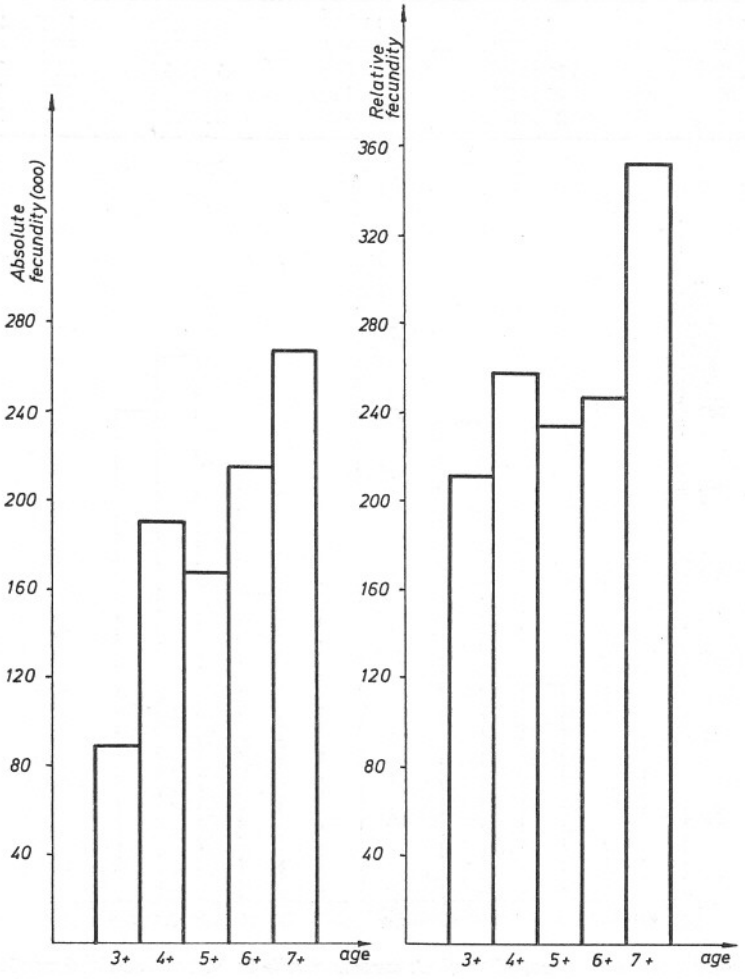

Fig. 4. Absolute and relative fecundity of *C. auratus gibelio* in Mrtva Tisza in dependence on the age

These values have been considerably higher compared to the values of the Tisza, the Sava, and the Danube rivers specimens. Кривощеков 1953 stated as well the increase of the absolute fecundity from 3+ to 5+, but the values have been considerably lower. The better fecundity has been together with the growth the consequence of the favourite ecological conditions.

Conclusion

The growth and the fecundity of *Carassius auratus gibelio* in Mrtva Tisza within 1983 and 1984 have been analyzed.

The absolute growth have been higher with the specimens out of 1984, but the relative growth shows the equal growth tempo. Comparing the specimens from the Tisza, the Sava and the Danube rivers and from Palić Lake, the West Siberia rivers and the Moscow Lake Distric the specimen from Mrtva Tisza have shown the higher growth tempo, while the growth tempo has been lower when compared to the specimens from the Kazahstan and Semipalatinsk District waters. The speed and the constant growth in Mrtva Tisza during tested period have shown the uniform decrease.

The absolute fecundity have shown the increase tendency with increase of body mass, standard length and age. The relative fecundity has shown the lower dependence with regard tothesethree biological parameters. The average values for the relative and absolute fecundity of the separate body mass and age categories of the specimens from Mrtva Tisza have been higher than those in the mentioned literature, being the consequence of the favourite ecological conditions, first of all nourishement.

References

Budakov, Lj., Pujin, V., Maletin, S., Mučenski, V. (1979): Wachstum der Silberkarausche *(Carassius auratus gibelio* Bloch) in der Donau und einigen Nebenflüssen in der Vojvodina. — XXI Arbeitstagung der IAD, Novi Sad, Jugoslawien. 202—208.

Budakov, Lj., Maletin, S., Mučenski, V. (1983a): Prilog poznavanju ihtiofaune Obedske bare. — Drugi Simpozijum o fauni SR Srbije-Zbornik. 119—122.

Budakov, Lj., Maletin, S., Mučenski, V. (1983b): Stanje istraženosti faune riba u Obedskoj bari. Zaštita, uredivanje i unapredivanje Obedske bare — Zbornik radova, Novi Sad: 53—56.

Budakov, Lj., Pujin, Maletin, S., Mučenski, V. (1983c): Prilog proučavanju ihtiofaune Koviljskog rita. — Biosistematika *9,* 51—59.

Budakov, Lj., Maletin, S. (1984): Odnos polova kod populacija srebrnog karaša *(Carassius auratus gibelio* Bloch) u vodama Vojvodine. — Bilten Društva ekologa BiH, serija B, br. *2,* 127—132.

Budakov, Lj., Maletin, S., Kostić, D., Kilibarda, P. (1984): Ihtiofauna Jegričke kao saprobiološki indikator. — Vodoprivreda *16,* 88—89, 314—316.

Bukurov, B. (1948): Dolina Tise u Jugoslaviji. — Izd. srp. geograpf. društ.—, Beograd, sv. 25.

Grginčević, M. (1974): Problem specijacije medu vrstama roda *Abramis.* — Zbor. za prir. nauk. Mat. srp. br. *46,* 99—126.

Grginčević, M. (1977): Ekologija i problem hibridizacije vrste *Abramis ballerus* L. u nekim vodotocima Vojvodine.— (Doktorska disert., PMF, Novi Sad.)

Maletin, S., Pujin, V., Budakov, Lj., Mučenski, V. (1979): Fruchtbarkeit von *Carassius auraus gibelio* Bloch in der Donau und einigen ihren Nebenflüssen in der Vojvodina. — XXI Arbeitstagung der IAD, Novi Sad, Jugoslawien, 234—242.

Maletin, S., Pujin, V., Budakob, Lj. (1981): Variranje morfolšokih karaktera *Carassius auratus gibelio* Bloch, 1783 *(Cyprinidae)* u nekim vodama Vojvodine. — Biosistematika *7,* 181—188.

Maletin, S., Budakov, Lj. (1982): Zastupljenost srebrong karaša *(Carassius auratus gibelio)* u Dunavu na teritoriji Vojvodine .— Vodoprivreda *14,* 75—76, 129—131.

Maletin, S., Budakov, Lj. (1983): Rast nekih riba u jezerima Palić i Ludoš. — Zbornik radova sa konferencije „Zaštita voda 1983" (Opatija) 109—113.

Pujin, V., Budakov, Lj. (1979): Tempo porasta šrana *(Cyprinus carpio* L.), karaša *(Carassius carassius* L.*)* i srebrnog karaša *(Carassius auratus gibelio* Bloch*)* u Ludoškom jezeru. — Drugi Kongres ekologa Jugoslavije, (Zagreb) 1607—1620.
Pujin, V., Ratajac, R., Dukić, N., Maletin, S., Budakov, Lj. (1981): Sastav i dinamika nekih životinjskih grupa kao biološki parametri u oceni kvaliteta voda. — Duri Kongres o zaštiti voda (Ohrid) 265—271.
Pujin, V., Tóth, J., Budakov, Lj., Maletin, S. (1982): Zaštita ihtiofaune Madarsko-jugoslovenskog dela Dunava. „Zaštita, očuvanje i unapredivanje kvaliteta slatkih voda" (Ohrid).
Ristić, O., Pujin, V., Klokočar—Šmit, Z. (1974): Sezonska posmatranja mikroflore i zooplanktona Mrtve Tise. — IV Kongres biologa Jugoslavije (Sarajevo).
Ristić, M. (1977): Ribe i ribolov u slatkim vodama. Nolit, Beograd.
Дмитриева, Е. Н. (1957): Морфо-экологический анализ двух видов карася. — Акад. Наук. СССР, Труд. Инс. морф. жив. им. А. Н. Северцова, вып. *16*, 102—170.
Кривощеков, Г. М. (1953): Караси западной Сибири. Труды Барбинского отделения Всесоюзного научно-исследовательского института озер. и реч. рыб. хоз. *6*, 71—124.
Серов, Н. П. (1959): Материалы по биологии, систематике и промысловому значению карасей из некоторых водоемов Казахстана. Сбор. работ по ихт. и гидр. *2*, 380—394. Изд. АН Казахской ССР, Алма-Ата.
Соколов, Л. Г., Новиков, Д. С. (1973): Материалы по биологии карася в некоторых озерах Семипалатинской области. Биология и география (Сбор. науч. стат. асп. и соис.), *8*, 109—113. Изд. Каз. Гос. Учив. им. С. М. Кирова, Алма-Ата.
Чгунова, Н. И. (1959): Руководство по изучении возраста и роста рыб. Изд. наук. СССР, у Москва.

A Holt-Tiszai Carassius gibelio Bloch, 1783 növekedése és termékenysége

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Kivonat

A szerzők az 1983/84-ben a Holt-Tiszából begyjűtött *Carassius auratus gibelio* növekedését és termékenységét vizsgálták. Megállapítást nyert, hogy az abszolut növekedés 1984-ben nagyobb, annak ellenére, hogy a viszonylagos növekedés üteme egybevágó. Továbbá a Holt-Tiszai példányok növekedési üteme nagyobb értékeket mutat, összevetve a Tisza, Száva, Duna, Palicsi-tó, valamint a nyugat Szibéria és a Moszkvai térség tavaival. A Kazashsztáni és a Szemipalatinusi térséghez viszonyítva ez az érték kisebb. A Holt-Tiszai példányok növekedési állandója és üteme egyenletes csökkenést mutat. Az apszolut termékenység a növekedéssel, súlygyarapodással, korossággal együtt növekszik, míg a relatív termékenység kevésbé függ az említett biológiai paraméterektől. A Holt-Tiszai példányok termékenységének apszolut és relatív átlag értékei nagyobbak a felhasznált irodalomhoz viszonyítva, ami a kedvezőbb ökológiai tényezőknek, elsősorban a táplálkozási adottságoknak tulajdonítható.

Развитие и плодовитость Carassius auratus gibelio Bloch, 1783 в Мертвой Тисе

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Резюме

На основании собранных в 1983—84 годах материалов авторы изучили рост и плодовитость *Carassius auratus gibelio* в Мертвой Тисе. Выяснилось, что в 1984 году абсолютный его рост высокий, несмотря на то, что темп относительного припоста ровный. Дальней-

шие исследования показали, что темпы роста популяции в Мертвой Тисе выше чем в рр. Савы, Дуная, озера Палич, а также озер Западной Сибири и озер, расположенных в окрестностях Москвы. Однако, в сравнении с озерами Казахстана и Семипалатинска являются меньшими. Темпы роста популяций, живущих в Мертвой Тисе, постепенно снижаются.

Абсолютная плодовитость растет вместе с развитием, возрастом и прибавлением веса, причем релативная плодовитость менье зависит от уповянутых биологических параметров.

Результаты абсолятной и релативной плодовитости представителей Мертвой Тисы выше результатов, приведенных в литературных источниках, что показывает на более благоприятные в настоящее время экологические условия и в первую очередь на питательную среду.

Rast i Plodnost Carassius auratus gibelio Bloch, 1783 U Mrtvoj Tisi

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Abstrakt

Analizirani su rast i plodnost *Carassius auratus gibelio* u Mrtvoj Tisi, bivšem meandru, koji j. melioracijom odsečen od glavnog toka reke Tise. Materijal je sakupljen u toka 1983. i 1984. godinee Apsolutni prirast je veći kod primeraka iz 1984. g., no relativni prirast ukazuje na podjednak tempo rasta. U poredjenju sa uzorkom iz Tise, Save, Dunava, Palića, voda zapadnog Sibira i jezera Moskovske oblasti uzorak iz Mrve Tise pokazuje veći tempo rasta, dok je u odnosu na uzorak iz voda Kazahstana i Semipalatinske oblasti tempo rasta manji. Brzina i konstanta rasta u Mrtvoj Tisi u ispitivanom periodu pokazuju ravnomeran pad. Apsolutna plodnost pokazuje tendenciju povećanja sa porastom mase, standardne dužine i uzrasta. Relativna plodnost pokazuje manju zavisnost u odnosu na ova tri osnovna biološka parametra. Prosečne vrednosti za relativnu i apsolutnu plodnost pojedinih masenih, dužinskih i uzrasnih kategorija primeraka iz Mrtve Tise su veće od vrednosti u citiranoj literaturi, što je posledica povoljnijih ekoloških uslova, pre svega ishrane.

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ORNITHOLOGICAL INVESTIGATIONS AT THE AREA OF THE KISKÖRE WATER BASIN (TISZA II)

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Abstract

Author studied the bird-stock at the Tisza-II. water basin bordered by the areas of Tiszafüred—Poroszló—Kisköre—Abádszalók, comparing it with the earlier conditions.

The data were collected at selected points of the livingplaces characteristic to the area — brushwood, remainder forest patches, fishing ponds, marsh, meadow, reed border alongside the bank and mud island — in order to appropriately represent the ornithofauna of the biotop. In such manner the quantitative and qualitative relations of the nesting communities could be determined wihch are well demonstrated by the Tables amidst the text.

The study also threw light on the fact that according to ornithological viewpoint the area is not only important as nesting place, but is significant as alimentary biotop, too. Regarding the predictable changes, certain enrichment is expectable in the nesting communities of the forest, while at the rest of the area major fauna-development cannot be expected due to the increasing interfering effects.

Introduction

The great water conservancy constructions — which have decisive effect on the living world at the area in question — offer an opportunity never to be recaptured for studying the effects of nature remaking activities. Under such circumstances the possibility arises to steadily follow the changes taking place after previous surveying and to accurately determine the development of the new quality. The obtained results can later be well utilized when forming the drafting conceptions as well as for understanding and explaining the processes taking place in nature.

The Tisza Research Committee was also led by this when before construction, it performed detailed survey at the area of the Tisza II. water basin to be established, practically creating a comparative basis for further investigations. In the frame of this manifold work author's task — in 1969 — was to study the avifauna of the flood plain bordered by Tiszafüred—Poroszló—Kisköre—Abádszalók, and he prepared a detailed report on his observations (LEGÁNY 1971).

During the course of the 14 years which have past since then, the planned water basin has been built and its damming up has also mostly been completed, thus besides the continuously performed other biological studies, the newer survey of the ornithofauna, together with its comparison with the earlier states, have become timely; — to study the trend and quality of the changes as well as to draw conclusions in respect to the further development. This gives reason for the series of observations made by author between 1982 and 1984.

Materials and Methods

Author's studies were carried out at the same area investigated earlier, as specified in the introduction. On the occasions of the first tours of inspection, those types of living places were determined which are presently characteristic to the area and are the scenes of the avifauna. Furthermore, the surveying spots where the data were collected were also determined — even several from each type of living place.

Accordingly, studies were performed at areas of the following character: brush-wood, remainder forest patches, fishing ponds, marsh, meadow, reed border alongside the bank, and mud island. Attempt was made to clarify the qualitative and quantitative relations of the nesting avifauna at these areas. During the course of this every circumstance was considered which gave exact information on the hatching and settling down of the birds.

When evaluating the various living places, dominance categories and constant degrees were determined, into which every species was grouped, in the following manner:

Rare species in the case of 0—3% dominance
Accessory species in the case of 3—7% dominance
Subdominant species in the case of 7—9% dominance
Dominant species in the case of 9— % dominance.

Conctant degrees: I. with 0—20% constant
II. with 21—40% constant
III. with 41—60% constant
IV. with 61—80% constant
V. with 81—100% constant.

The formula of Shannon-Wiener was used for calculating the diversity values:

$$Hs = \sum_{i=1}^{i=s} \frac{n_i}{n} \ln \frac{n_i}{n}$$

Owing to the expansisons of the area, it can not only be taken into account as nesting place, but also as alimentary base for a significant mass of birds. These often arrive from distant places only for the purpose of feeding. Measurements were performed to clarify the significance and measures of this bird-motion (movement). From a given spotting post the number of birds coming from a certain direction, advancing on the same route were counted for 30 minutes. The degree of requency was concluded from the obtained data.

Study results

Bird-stock at the brush-woods

Earlier, the largest part of the area was covered by forest. However, at the time of building the storage tank the trees were cut down, but not rooted up. As the result of this, where there was no constant and large water covering, resp., brushwood developed from the root and trunk sprouts, appearing in a mosaic-like form and providing a certain chance of life and establishment for the original ornithofauna remains. These are young and extremely dense stands, which can mostly be regarded as scrub forests (see Fig. 1).

Its species composition is characterized by the *Populus alba, P. nigra, Salix alba, S. fragilis, Fraxinus angustifolia* and the *Acer negundo,* appearing in large masses. Unfortunately, the majority of the stand is formed by these adventive weed trees. At the shrub stratum, apart from the sprouts of the previous species, the *Amorpha fruticosa* is growing quite rapidly, also being an adventive plant.

In respect to the fact that the surface of the area is not exquisitely flat, water-filled marsh patches have developed at the deeper parts with characteristic marsh-plants — *Typha, Glyceria, Scirpus,* etc. — giving reason for the appearance of the warblers at the brush-woods. The living place cannot be characterized by natural plant communities.

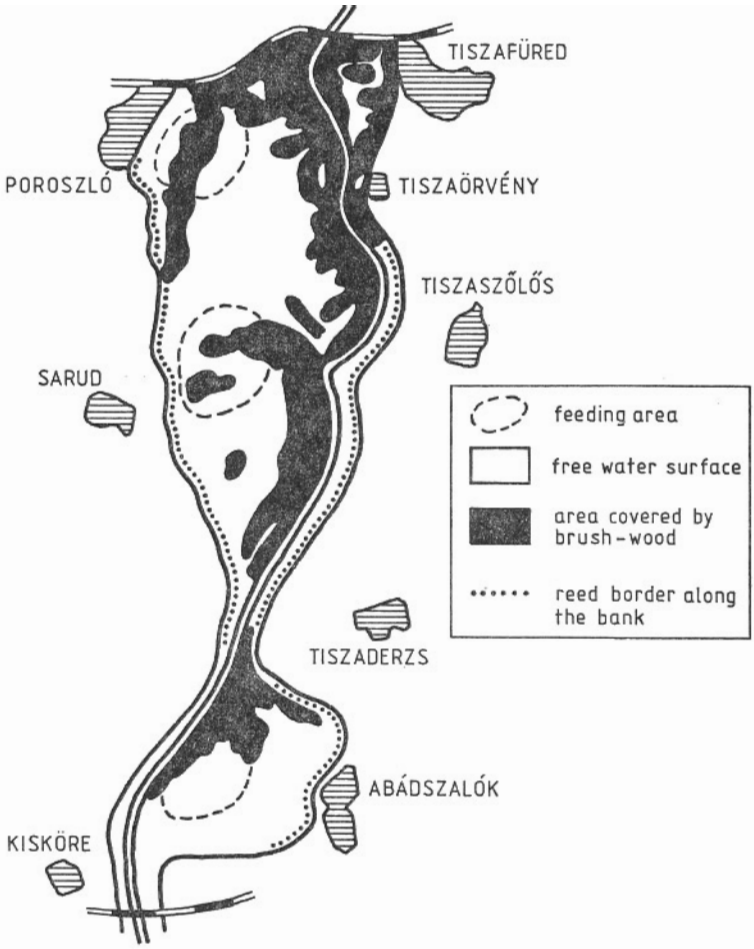

Fig. 1. Distribution of a few living places at the studied area

The largest number of nesting species — 30 — was registered at this area. Its species composition — see Table 1 — cannot be traced back to any earlier forest type. The studies on species identification showed greatest relationship towards the soft-wood groves, nevertheless this value was found to be so low — 19% — that we cannot speak about direct development. It is more likely that the euryecious species of the earlier forests of various types perched at this biotop, estabilishing an entirely characteristic (specific), not typically forest-bird community. At the various surveying spots — 1 ha area — 8—12 species were observable, represented by 13—19 pairs.

Studies on the nasting layers are quite informative about the character and value of the living place; namely, the layer at which the certain members of the community hatch their eggs, and their proportion. In this concern the following results were obtained:

Ground-nesting	3 species	15,78%
Water-nesting	1 species	3,44%
Reed-nesting	5 species	17, 24%

Shrub-nesting	11 species	37,93%
Hollow-nesting	1 species	3,44%
Tree-nesting	8 species	27,58%.

The young age of the forests is referred to by the large number of species hatching at the shrub and tree stratum as well as by the almost complete lack of species living in hollows — only 1 species. At the same time the individual character of the living place is indicated by the appearance of birds nesting at the water and reed stratum, which is owing to the already mentioned water dips and the vegetation developing there.

Table 1. *The nesting bird species observed in the brush-woods*

Species	D	K
1. *Anas platyrhynchos* L.	1,52	I
2. *Gallinula chloropus* L.	1,52	II
3. *Columba palumbus* L.	0,76	I
4. *Streptopelia turtur* L.	5,34	III
5. *Cuculus canorus* L.	9,92	V
6. *Oriolus oriolus* L.	3,81	III
7. *Corvus cornix* L.	1,52	II
8. *Pica pica* L.	0,76	I
19. *Remiz pendulinus* L.	0,76	I
10. *Turdus merula* L	4,58	III
11. *Luscinia megarhynchos* BREHM	8,39	IV
12. *Locustella fluviatilis* WOLF.	7,63	IV
13. *Locustella luscinioides* SAVI.	0,76	I
14. *Acrocephalus arundinaceus* L.	3,05	II
15. *Acrocephalus scirpaceus* HERM.	3,81	II
16. *Acrocephalus palustris* BECHST.	2,29	II
17. *Acrocephalus schoenobaenus* L.	9,16	III
18. *Hippolais icterina* VIEILL	0,76	I
29. *Hippolais pallida* HEMPR.	3,05	II
20. *Sylvia atricapilla* L.	5,34	III
21. *Sylvia nisoria* BECHST.	2,29	II
22. *Sylvia bvrin* BODD.	4,58	III
23. *Sylvia communis* LATH.	7,63	IV
24. *Sylvia curruca* L.	1,52	II
25. *Lanius minor* Gm.	0,76	I
26. *Lanius collurio* L.	2,29	II
27. *Sturnus vulgaris* L.	1,52	I
28. *Carduelis carduelis* L.	0,76	I
9. *Fringilla coelebs* L.	2,29	II
30. *Emberiza schoeniclus* L.	1,52	II

On the basis of nutriment consumption the majority of the species — 70% — are insectivores, while only 23,33% are herbivora and 6,6% live on mixed alimentation.

The dominant species of the community are the *Cuculus canorus* and the *Acrocephalus schoenobaenus*. Besides this, the cuckoo is even constant. Together with the previous species the *Luscinia megarhynchos, Locustella fluviatilis* and the *Sylvia communis* belong to the subdominant and subconstant categories, and as such they practically form the backbone of the stock.

The diversity reached the highest value here — 3,0964 — which, compared to the data of other flood forests (LEGÁNY 1983), can be regarded as being good.

It is characteristic to the fauna-element composition of the community that the dominating species are the European-Turkestan — 40% — and the European — 26,66% — ones, contrary to the commonly experienced palearctic dominance.

Bird-stock at the remainder forest patches

At certain parts of the water basin — 0,5—1 ha — the old trees and smaller forest patches were not cut down. Thus old trees rise above the marshy, watery surroundings here ensuring in such way the settlement of such tree-nesting and hollow-nesting species which demand (require) trees of such size, and to which they cannot get at elsewhere. Their species composition is characterized by the Populus alba, *P. nigra, Salix alba, S. fragilis*. These are the remains of the former soft-wood groves and can mostly be found at smaller areas, rising above the water level. One of these smaller forest patches ensured place for the endurance of a heron colony — already known from earlier.

The bird community observed here is rather poor in species, which can well be seen from Table 2.

Table 2. *The nesting bird species observed at the remainder forest patches*

Species	D
1. *Phalacrocorax carbo* L.	56,75
2. *Ardea cinerea* L.	35,13
3. *Aythya nyroca* GÜLD.	2,7
4. *Cuculus canorus* L.	2,7
5. *Upupa epops* L.	1,35
6. *Lanius collurio* L.	1,35

The dominant species of the community are carnivores, which consume the fish stock at the storage tank. Due to their low individual number the insectivores do not play significant role in the trade in material of the area.

However, these biotops do not only come into account as nesting places, but also as areas of alimentation. The observations have proved that besides the nesting birds, the *Egretta alba, E. garzetta, Anas platyrhynchos* and the *Corvus cornix* were also regularly observable at the surveying spots, generally in the course of their search for food.

The low diversity — 1,0004 — is explained by the area's scantiness in species and the stock's uneven distribution, which indicates the remains of a degraded, rather than a completing community.

Bird-stock at the fishing ponds

The navvy pits digged for gaining clay were developed at the Northern parts of the studied area — alongside the route of Tiszafüred—Poroszló. Today these are fishing ponds. Few *Phragmites communis,* more *Typha angustifolia, T. latifolia* and *Gyceria maxima* grow at the banks and the narrow ridges between them. At places *Scirpus lacustris* and in patches *Bolboschoenus maritimus* grow as well. The *Amorpha fruticosa* forms a rather dense stand at the highest points. This narrow border vegetation and the continuous, intensive fishing — i.e. the continuous disturbing- explain the reason why only a scanty nesting community is found here (see Table 3).

Table 3. *The nesting bird species observed at the fishing ponds*

Species	D	K
1. *Podiceps cristatus* L.	4,34	II
2. *Anas platyrhynchos* L.	13,04	II
3. *Gallinula culhropus* L.	6,52	IV
4. *Fulica atra* L.	2,17	II
5. *Cuculus canorus* L.	10,86	V
6. *Acrocephalus arundinaceus* L.	15,21	V
7. *Acrocephalus schoenobaenus* L.	37,00	V
8. *Emberiza schoeniclus* L.	10,86	IV

Owing to the character of the area the number of nesting layers narrow down; only the followings were found:

Ground-nesting	2 species	28,57%
Water-nesting	4 species	50,00%
Reed-nesting	3 species	37,5%

Despite the fact that the ponds are rich in fish, there is only 1 fish-eating species at the area; the *Podiceps cristatus*. The majority of the community are herbivora — 50% — and insectivores — 37,5%. The one single constant-dominant species of the stock is from the latter; the *Acrocephalus schoenobaenus*.

The regularly observed smaller flocks of *Sterna hirundo, Larus ridibundus* and *Chlidonias nigra* are attracted to come to feed here by the fish stand — mainly the small brood fish.

The diversity value is: 1,8000 which can be judged as being good average under the given circumstances. Studying the fauna elements, the dominance of the palearctic species was found to be complete — 37,5% — which, as will later be seen, is characteristic in the majority of the cases.

Bird-stock at the marshes

Marshes developed at areas covered by shallow — maximum 40—60 cm deep — water, where smaller-larger water surfaces alternate with parts covered by vegetation. Depending on the actual water depth *Typha latifolia, T. angustifolia, Scirpus lacustris Carex elata,* or *Bolboschoenus maritimus* grow in an amount forming a stand. *Phragmites communis* can only be found sporadically and in small patches. At places the *Iris pseudacorus* colours the association. Such marshes are mainly observable at the Northern parts of the studied area.

Table 4. *The nesting bird species observed at the marshes*

Species	D
1. *Anas platyrhynchos* L.	45,—
2. *Aythya nyroca* GÜLD.	2,5
3. *Gallinula chloropus* L.	7,5
4. *Fulica atra* L.	5,—
5. *Cuculus canorus* L.	5,—
6. *Locustella luscinioides* SAVI.	2,5
7. *Acrocephalus arundinaceus* L.	5,—
8. *Acrocephalus schoenobaenus* L.	20,—
9. *Emberiza schoeniclus* L.	7,5

The bird-stock is rather poor despite the relative peace at the area, which is firstly evident by species number and not individual number (see Table 4). The causes of this is found by author to be due to the fact that the nesting possibilities exclude serveral bird species and an entirely hydrophyll community develops, the dominant species of which are the Anthas platyrhynchos and the Acrocephalus schoenobaenus.

The distribution of the species according to nesting layers developed as follows:

Ground-nesting	3 species	33,3%
Water-nesting	2 species	22,2%
Reed-nesting	4 species	44,5%

The tree-nesting birds nest at the smaller islands, rush-beds rising above the water level.

The distribution of the community according to alimentation developed in an interesting manner. Only herbivora — 55,55% — and insectivore warblers were found at the area — 44,44%. Despite the fact that numerous small fish were observable in the shallow and vegetation-rich water, author did not detect the nesting of fish-consuming birds. This fact explains why the fish-eating birds come to these areas in large numbers from more distant places. According to author's observations the smaller flocks of *Phalacrocorax carbo, Egretta alba, Nycticorax nycticorax, Platalea leucorodia* and *Sterna hirundo* feed here regularly.

The diversity of 1,7035 value can be explained by the low species number and the not entirely even distribution. Among the fauna elements, the palearctic species reach a value of high percentage — 33,33 — however, the European-Turkestan elements also appear in a similar degree.

Bird-stock at the meadows

The meadow vegetation remained at those places where there was also meadow earlier, and there is no water covering today. These smaller patches were found by author as the remains of the Sarudi-meadow. Their surface is not consistently smooth, thus the composition of the vegetation changes according to the relief, too. The stand is formed by the *Agrostis alba* and the *Alopecurus pratensis* at the drier areas, while the surface is covered by various *Carex* species at the more watery patches. *Schoenoplectus lacustris, Typha angustifolia* and *Phragmites communis* grow at the deepest parts.

The meadows are relatively of small expansion and apart from their characteristic structure, this is the explanation to the nesting community of such low species number found at the area (see Table 5).

The absolutely dominant species is the tree-nesting one — 66,6% — in respect to the distribution according to the species' nesting layers. The reed-nesting species settling at the smaller watery patches was found in 11,1%, while the water-nesting species was detected in 22,2%.

According to the quality of the consumed nutriment the insectivores dominated in 66,6%, while the carnivores only represented 11,1% and the herbivora 22,2%.

The dominant species of the living place was the *Vanellus vanellus,* and the *Limosa limosa* was found to be subdominant. It should be mentioned here that the *Larus ridibundus* colony — also found at this living place — was not taken into consideration when calculating the dominance and diversity values, since this colony would have completely distorted the values.

Table 5. *The nesting bird species observed at the meadows*

Species	D
1. *Anas platyrhynchos* L.	6,25
2. *Circus aeruginosus* L.	6,25
3. *Gallinula chloropus* L.	6,25
4. *Vanellus vanellus* L.	37,5
5. *Limosa limosa* L.	18,75
6. *Larus ridibundus* L.	
7. *Acrocephalus arundinaceus* L.	12,5
8. *Acrocephalus schoenobaenus* L.	6,25
9. *Motacilla flava* L.	6,25

The diversity value — 1,8080 — was found to be good average even besides the low species number, which was resulted by the even distribution of the species. Studies on the fauna elements evidenced the dominance of the palearctic species — 55,5% — while the European—Turkestan elements only reached 22,2% here.

Bird-stock at the reed border alongside the bank

The open water of the banked up storage tank is contiguous with the foot of the dam. Therefore, a narrow, mostly only 3—4 metres wide reed border developed, the one single species forming the stand here being the *Phragmites communis*. Only a few shrubs of *Salix alba* and *Amorpha fruticosa* mix here and there with this species, making possible the settlement of a few shrub-nesting birds (see Fig. 1). The narrow and disturbed reed border is only capable of maintaining a bird-stock poor in species and individual number (see Table 6).

Here, only those species settled down which are able to endure the frequent nearness of man and the narrow vegetational zone offers sufficient aliment and lurking hole for them. The distribution according to nesting layers was as follows:

Water-nesting	1 species	16,66%
Reed-nesting	3 species	50,00%
Shrub-nesting	2 species	33,34%

The insectivores represented 83,33%, and the herbivora only 16,67% regarding distribution according to the species' alimentation. This high dominance was complete both in respect to species number and individual number. The constant-dominant species of the stock, the *Acrocephalus arundinaceus,* was from the insectivores.

The diversity value of the community was found to be 1,6094, which could be explained by the low species and individual number, despite the even distribution.

Table 6. *The nestig bird species observed at the reed border alongside the bank*

Species	D	K
1. *Gallinula coloropus* L.	10	II
2. *Locustella luscinioides* SAVI.	10	II
3. *Acrocephalus arundinaceus* L.	40	V
4. *Acrocephalus palustris* BECHST.	20	III
5. *Sylvia nisoria* BECHST.	10	II
6. *Lanius collurio* L.	10	II

During the course of the studies on fauna elements this was the second living place where the European—Turkestan species gained dominance — 50,—% —; the rest of the fauna elements — including the palearctic ones — shared the other 50%.

Bird-stock at the mud islands

In the interest of discharging (draining) the stagnant water, water conduits were hollowed out at the borders of the water basin, along the dams. The mud from here was led out alongside the dams through pipes, where it accumulated and formed characteristic mud island. Rounded, gravel-like formations developed from the clay and mud, which later hardened. As a consequence, the drying out mud islands — until they became covered by the succession — turned into living places resembling shoals, and these were suitable for the settlement of birds which favoured shoals.

During the course of his observations, author could determine the nesting of *Charadrius dubius* at one of these areas. However, the living place will lose its shoal character within 1—2 years, since it will first be occupied by soft-stalked grass-community, and then gradually by shrubwillow plantations.

The water basin as an area for alimentation

Author had mentioned on several occasions earlier that the various living places are not only important for the nesting species, but also for those arriving there only to feed. However, the studied area also includes such parts which are explicitly important from the viewpoint of alimentation. Fish-eating birds arrive to these parts in great number mainly from the two nearby bird reserves.

The birds from the reserve at Tiszafüred come to the Northern and central parts of the studied area — see Fig. 1. —, while those from the bird reserve at Pély visit the bay at Abádszalók. For alimentation they mainly choose those places where many floated timber get caught in the drying branches of the brush-woods exterminated by the water, having the possibility in such way for fishing and landing in the relatively deep water and at the protected places.

Measurements regarding the frequency in respect to the areas were also performed. On May 19, 1984 between 10.30 and 11.00 the following bird species arrived from the reserve at Tiszafüred for feeding, across a zone of 3 kilometres:

1. *Phalacrocorax carbo*	16 individuals
2. *Ardea cinerea*	19 individuals
3. *Egretta alba*	16 individuals
4. *Nycticorax nycticorax*	10 individuals
5. *Platalea leucorodia*	4 individuals
6. *Anser anser*	8 individuals

From the direction of the bird reserve at Pély the following species arrived to the bay at Abádszalók on June 13, 1982, between 13.00 and 13.30:

1. *Phalacrocorax carbo*	2 individuals
2. *Ardea cinerea*	25 individuals
3. *Ardea purpurea*	1 individuals
4. *Egretta alba*	1 individuals
5. *Nycticorax nycticorax*	1 individuals
6. *Platalea leucorodia*	2 individuals

Regarding the shortness of the measured time, relatively high numbers were obtained. Furthermore, if taking into consideration that this movement is continuous, an image can be formed of the area's role in the alimentation of the birds. It can be regarded as an alimentary base, also making it possible for the fish-eating birds covering large areas to settle down beyond the water basin, too, if they find such suitable place. Therefore, the area is capable of alimentation export, which according to the measurements actually does take place continuously and in considerable degree.

Analysing the bird communities of the characteristic living places at the studied water basin area, it could be determined that the avifauna composed of the earlier, explicitly forest — meso and xerophyll — species has disappeared, its place being occupied by a bird community of hydrophyll dominance — 57%. The meso and xerophyll species composing the 43% are mainly the inhabitants of the brush-wood and should be regarded as the remains of the earlier forest avifauna.

The richness in species of the various living places depends on how multifold they are and what ecological requirements they are capable of satisfying. In case the living place is unilateral, extreme, expecting specialization from the species, then this appears in the decreased number of species. This was experienced at several studied living places, e.g. marshes, meadows, etc. If the most varied disturbing effects also accompany this phenomenon — like the young age of the forest, the small expansion of the area, continuous fishing, water sports, etc. — the poorness in species at the various living places is at once found reasonable.

Compared to the earlier state, significant changes have taken place in the composition according to consumed nutriments of the bird communities living at the area of the storage tank. The species and individual number of the birds living on composite feed have decreased to a large extent; we only have to refer to the lack of the 4 thousand pairs of rooks, about 10 colonies of which had lived here earlier. However, the percentage of the herbivora and somewhat the insectivores has also decreased, since the proportion of the carnivores has considerably increased, caused by the prominent rise in the amount of fish-eating species.

Being aware of the tendency in change at the area the question can be set forth, what could be expected in the future?

1. As the consequence of the growth of the brush-woods, there will be an increase in the number of forest-bird species. Due to the expectable rise in water level, however, a slight decrease in the area of brush-woods should be counted upon, which would thus mean an excellent fishing and lurking place for the fish-eating birds.

2. There will probably be a decrease in the role and significance of the meadows, marshes and reed borders — for the very reason of the expectable rise in water level.

3. The disturbed nature of the area will increase as the consequence of the enhancing fishing, holidays and water sports, therefore the prominent enrichment of the avifauna at the area of the water basin cannot be counted upon.

4. Nevertheless, the role and significance of the water basin may increase in respect to the alimentation of the birds and during the course of their migration, as a resting place. Thus, greater care should be taken of the peace at the nearby nature conservancy areas, as the water basin may mean an alimentary base for the birds settling there.

References

Bodrogközy Gy. (1965): Die Vegetation des Theiss-Wellenraumes II. Vegetationsanalyse und Standortökologie der Wasser- und Sumpfpflanzenzönosen im Raum von Tiszafüred. Tiscia (Szeged) *1*, 5—32.

Homonnay Sz.—Iharos Gy.—Kolosváry G.—Sterbetz I.—und Vasvári M. (1965): Zoologische Ergebnisse der Tiszaforschungen aus dem Jahre 1962. Tiscia (Szeged) *1*. 71—80.

Legány A. (1970—71): Data to the ornithological conditions of the inundation area Tiszafüred—Kisköre. Tiscia (Szeged) *6*, 41—55.

Legány A. (1983): The ornithological investigation on the forests of „Tiszadob Flood Basin" nature conservation area. Tiscia (Szeged) *18*, 125—134.

Wilson E. O.—Bossert W. H. (1981): Bevezetés a populációbiológiába (Introduction to populationbiology.) — Budapest.

A kiskörei tározó ornitológiai vizsgálata

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Kivonat

A szerző a Tisza II. tározó Tiszafüred-Poroszló-Kisköre-Abádszalók által határolt területének madárállományát vizsgálta, összehasonlítva a korábbi állapotokkal.

Az adatfelvételezések a terület jellegzetes élőhelyein történtek, hogy kellően reprezentálják a Tisza II. rnitofaunáját. Így sikerült megállapítani a fészkelőközösségek mennyiségi és minőségi viszonyait, amelyeket az egyes szöveg közötti táblázatok is jól szemléltetnek.

A vizsgálat fényt derített arra is, hogy a terület nem csupán, mint fészkelőhely fontos, hanem mint táplálkozási biotop is igen jelentős. Az előre jelezhető változásokat illetően az erdő fészkelőközösségének némi gazdagodása várható, míg a többi területen, a növekvő zavaró hatások miatt elentősebb faunafejlődés nem remélhető.

Орнитологические исследования водохранилища Кишкере

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Резюме

Автор провел исследование состава орнитофауны водохранилища Тиса II — Тисафюред — Пороло — Кишкере — Абдсалок в сравнении с его предыдущим состоянием.

Сведения были собраны на определенных характерных живых уголках, с целью представить типичную характеристику орнитофауны Тиса II. При этом удалось определить отношения между качественным и количественным составом гнездующих птиц, что хорошо ил юстрируют таб ицы, приведенные в тексте.

Проведенные исс едования освети и и то, что эта территория яв яется важной не то ько как гнездующее место д я птиц, но играет важное значение как кормовая база д я биотопа.

Что касается перспективы на будущее, то здесь в есах предпо агается опреде енное обогащение ук адков гнезд, причем на других местах этой территории, в связи с уве ичением беспокойства, значите ьный рост и развитие фауны не ожидается.

Ornitolo ka osmatranja akumulacije Kisköre

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Abstrakt

Autor je rezultate osmatranja ornitofaune područja akumulacije Tisza II (Tiszafüred—Poroszló—Kisköre—Abádszalók) uporedio sa ranijim nalazima. Prikupljanje reprezentativnih uzoraka ornitofaune vršeno je sa specifičnih biotopa akumulacije Tisza II. Na ovaj način omogućeno je bilo utvrdjivanje kvalitativnih i kvantitativnih odnosa ptica gnezdarica (vidi tabele). Takodje je ukazano i na činjenicu, da se dato područje pojavljuje kao značajan biotop za ishranu ptica. Na osnovu prognoziranih promena očekuje se izvesno povećavanje brojnosti ptica gnezdarica u šumskim sastojinama. Na ostalim biotopima se, usled njihovog pojačanog narušavanja, ne može očekivati značajniji razvoj ornitofaune.

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DATA TO THE PHENOLOGY OF STARLING (STURNUS V. VULGARIS L. 1758)

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Abstract

Author summarizes his observations related to the migration of starlings at the Southern basin of the Tisza river between 1958—1982. Data are presented on their over-wintering, winter alimentation and a report is given of the regional mean value of the starlings arriving to the environs of Szeged as well as the time of arrival of the native nesting birds, which corresponds to the Lübeck mean value („semicircular migration"). Analysis is given of their mingling with other species during migration, occurring only with five *Limicola* species. This points to the fact that the starlings mostly feed at moist meadows during migration. The staying of a hatching starling pair near a nesting hollow prior to nesting is demonstrated on a figure. The migration still continues at the beginning of the hatching period.

Introduction

The Autumn and Spring migration of starlings is a rather well known process, nevertheless, there are still some obscure points to be clarified. The starlings at the environs of Szeged have been under observation by author irregularly since 1958 and regularly, with special interest since 1977. His data concerning their migration are given in the followings.

Materials and Methods

Author's observation area was the flood-plain forest between Szeged-Tápé and Vesszős located a North from Szeged at the right bank of the Tisza river. Field-work was carried out here on 65 occasions during the mentioned period. Apart from this, averagely 6 hours long observations were accomplished on 11 occasions between Szeged and Klárafalva at the left bank of the Maros; on 28 occasions at the Southern-lowland natron lakes (Makraszék, Őszeszék, Nagy-szék); on 21 occasions at the Pitvaros plains; on 36 occasions at the area of Tőserdő; on 29 occasions at the Szeged Fehértó; on 19 occasions at the Hantház-lakes and on 9 occasions at the Zsombó-meadow, walking through the areas on the same routes with a 10×50 sized binocular. Furthermore, a natural nesting hollow found in an old walnut-tree at Újszeged was followed with attention daily.

Discussion

The Hungarian stock of starlings starts its migration Southwards at the end of Summer. According to the evidence of ringings the majority migrate to North Africa through Yugoslavia and Italy in September (IGALFFY 1952, STUDER-THIERSCH 1969, SCHMIDT 1977). Only few reports have arrived from the Soviet Union and Spain

(latter: MOLNÁR 1962). Large flocks arrive to our country from northernmost parts in September (Poland, Soviet Union), causing great damages in the vineyards especially at the environs of their overnight places (mostly large reeds) at Transdanubia as well as at areas between the Danube and Tisza rivers (SZIJJ 1957, KEVE 1970, NAGY 1981). The last flocks leave in November, thus only the smaller flocks of over-wintering birds can be found later. These mainly feed on the berries of trees and ornamental shrubberies (*Celtis* sp., *Prunus* sp.). Owing to the same alimentation they mostly stay with the flocks of fieldfare *(Turdus pilaris)*. Enormous flocks over-winter in Western Europe (e.g. France) (DAVIS 1955, WAGNER 1958, ROSENBERG 1968, FEIGE 1973, CLERGEAU 1981), also causing agricultural harm in the surroundings of their overnight places (HEIM de BALSAC 1931). Their over-wintering is observable throughout Europe. They endure cold well. In January—February, 1979, author observed two individuals in Elverum in Norway (Northern latitude of 61 °), over-wintering on oil-seeds at a winter feeder in −32 °C cold (MOLNÁR 1980).

Their return in early Spring begins on the first days of February. Their advance in the Carpathian-basin belongs to the *Motacilla*-type migration: early arrival at the lowlands (Table 1), delay at the hill-country (SCHENK 1907). The average speed of the migration is 49 km/day (SZMIRNOV 1930). The migration is strongly influenced by climatic factors, too. A further characteristic of the European migration wave is that the birds reach the Northern parts of Western Europe at approximately the same time as our Lowland: "semicircular migration". Therefore, the mean value for the Lübeck area described by WERNER (1934) is February 15; also being February 15 at Szeged (Table 1).

Tabelle 1. *The earliest arrival of starlings to Hungary according to* SCHENK *and* MOLNÁR

SCHENK, 1906				MOLNÁR, 1981			
Year	month	day	siteofobservation	Year	month	day	siteofobservation
1901.	feb.	3	Békéscsaba	1959.	feb.	1	Szeged-Vesszős
1901.	feb.	9	Óverbász	1961.	feb.	26	Szeged-Vesszős
1902.	feb.	10	Temes—Kubin	1962.	jan.	30	Szeged-Vesszős
1903.	feb.	3	Óverbász	1963.	feb.	26	Szeged-Vesszős
1904	feb.	7	Csallóközsomorja	1967.	feb.	18	Szeged-Vesszős
1905.	feb.	4	Iharosberény	1978.	feb.	25	Szeged
1906.	feb.	6	Overbász	1980.	feb.	17	Szeged—Fehértó
Average: feb. 6				Average: feb. 15			

The February flocks are still not the arrival of the Hungarian stock. Those hatching in our country appear earliest at the end of February. On the basis of a 6 years' observation period a pair hatching year by year in the hollow of an old walnut-tree appeared at time-points between February 25 and March 5 (Ujszeged, 1977—1982).

The main period of the migration is the beginning and middle of March. Large flocks of some thousand individuals also occur at this period, but crowds similar to the Autumn huge clouds do not develop. The birds generally feed at damp meadows, grassy areas and plough-lands during migration. Their "sociable instinct" is well developed (MARIÁN 1975), thus they readily mix with species of similar alimentation area during migration (Table 2). At the Southern Lowland they are observable the most frequently together with the lapwing *(Vanellus vanellus)* which, too, searches

Table 2. *The intermingle of migrating starling flocks with other species*

Date	Site	*Sturnus vulgaris*	*Vanellus vanellus*	*Numenius phaeopus*	*Philomachus pugnax*	*Limosa limosa*	*Numenius arquata*
		No. of individuals					
1976. marc., 23	Makraszék	40	19				
marc., 27	Makraháza	150	30				
marc., 28	Hantháza	100	40				
marc., 28	Hantháza	60	14				
1977. marc., 19	Hantháza	30	15				
marc., 21	Pitvaros	200	60				
marc., 26	Pitvaros	29			7		
apr., 10	Zsombói rét	150	10				
oct., 9	Fehértó	150	2				
1978. marc., 4	Vesszős	20	25				
marc., 11	Őszeszék	12	10				
1979. szept., 7	Fehértó	1	50				
1980. marc., 15	Pitvaros	150					40
marc., 23	Pitvaros	300	40				
oct., 18	Pitvaros	40	6				
1981. marc., 15	Pitvaros	400	80				
marc., 21	Pitvaros	300	200				
marc., 28	Pitvaros	200		50			
marc., 29	Pitvaros	80		25			
apr., 4	Pitvaros	200			25		
aug., 30	Fehértó	60			160		
oct., 7	Fehértó	160				50	
1982. marc., 15	Pitvaros	200		60			
marc., 15	Pitvaros	100				100	
marc., 23	Makraszék	20	4				
marc., 23	Őszeszék	50	40				
apr., 3	Pitvaros	80		40			

for aliment at damp meadows and at the same time, the major features of their migration correlate with those of the starling. These birds also spend the Winter in Tunesia, their earliest arrival is also at the beginning of February, the majority migrate in March, the culmination falls to the time-point of March 8, being March 6 in the case of starlings (HEGYFOKY 1906, SCHENK 1907, FŐNYEDI 1981). The association of the starling flocks with other species is as follows, according to the order of frequency: whimbrel *(Numenius phaepus)*, ruff *(Philomachus pugnax)* black-tailed godwit *(Limosa limosa)*, curlew *(Numenius arquata)* (Table 2). The flocks may intermingle on ground during feeding, but soon after flying up they form homogeneous stocks separated according to species. Small flocks migrate intermingled as well.

Table 2 demonstrates that from the observed 27 cases the intermingle occurred with the lapwing *(Vanellus vanellus)* in 17 cases (63%) and in 10 cases (37%) with other species. In 23 cases (85%) the individual number of the starlings was much higher than that of the species with which they mingled. The species intermingling with starlings do not, or only rarely mix with each other.

After arrival the starlings rove. In this regard their behaviour is similar to that of the blue pigeon *(Columba oenas)* which also arrives early and wanders a lot before

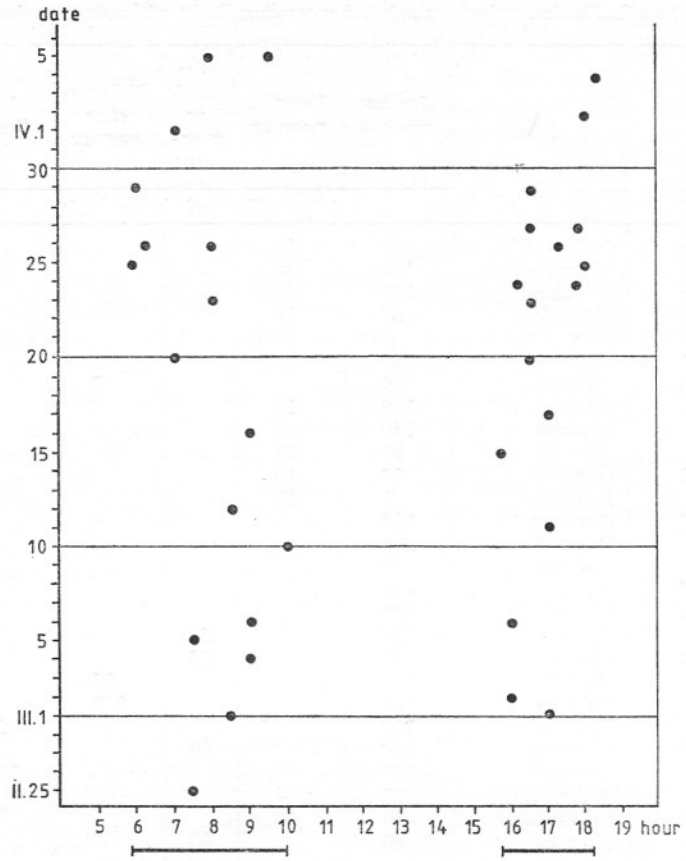

Fig. 1. The daytime dwelling of a starling pair around their nesting hollow from the time of their arrival till the beginning of hatching (February 25—April 6)

starting to nest (HEGYFOKY 1907). The starlings arriving at their usual nesting hollow stay near the surroundings in the early morning and evening hours, they feed and rove during daytime. This is demonstrated on Fig. 1, on the basis of author's observations between 1977—1982. Occasionally they disappear for days as well, and according to assumption and literary data they rove farther at such times.

A further most characteristic feature of their Spring assemble is that the migration is intensively protracted: it still lasts even during the hatching period beginning in April. On April 16, 1980 nests containing 1—2 eggs were found at the flood plain between Szeged-Tápé and Vesszős, on April 15, 1980, at Tőserdő a flock constituted of 70 individuals was migrating to the North, and on April 17, 1980, at Ujszeged 270 individuals were migrating.

The migration of starlings is only known in general outline. With some of his data, author wished to contribute to the clarification of the details.

References

FŐNYEDI, E. (1981): Data on the Spring arrival of some bird species from the environs of Siófok. — Ornithological scenery *7—9*, 160.

HEGYFOKY, K. (1906): Annual bird migration and the weather. — Aquila *14*, 81—90.

KEVE, A. (1970): The avifauna of the Keszthely-mountains and the Small-Bakony. — Results of the natural science researches of the Bakony *6*, 74—77.

MARIÁN, M. (1975): The avifauna of the Protection Area at Pusztaszer. — Aquila *82*, 81—98.

MOLNÁR, GY. (1962): Starling ringed in Szeged and observed in Spain. — People' s Word *90*, 254, 4.

MOLNÁR, GY. (1980): Ornithological notes from Norway. — Ornithological scenery *7—9*, 40—42.

MOLNÁR, GY. (1981): Population-ecological studies on Sturnus vulgaris. — Doctoral Dissertation. Attila József University, Department of Zoology, Szeged.

NAGY, S. (1981): Data to the avifaunaa of Balatonederics and environs. — Ornithological scenery, *4—6*, 75—79.

SCHENK, J. (1906—1907): Migration of birds in Hungary. — Aquila *14*, 32—45.

SCHMIDT, E. (1977): From where and to where do our migrating birds come and go?— Natura, Budapest.

SZIJJ, J. (1957): The alimentation-biology of starlings and its agricultural significance. — Aquila *63—64*, 71—101.

SZMIRNOV, N. (1930): The Spring assemble of starlings in Eastern Europe and Western Siberia. — Aquila *36—37*, 95—104.

WERNER, H. (1934): The Spring arrival of migrating birds to Lübeck. — Aquila *38—41*, 114—121

Adatok a seregély (Sturnus vulgaris L. 1758) fenológiájához

MOLNÁR GY.

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Kivonat

A szerző összefoglalja a seregély vonulásával kocsolatos megfigyeléseit 1958—1982 között a Dél-Alföldön, a Tisza déli szakaszán. Áttelelséről, téli táplálékáról közöl adatokat, majd a Szeged környékére érkező seregélyek területi középértékét, a hazai fészkelők megérkezésének idejét közli. Elemzi vonulás közbeni keveredését más fajokkal, megérkezés utáni kóborlását. Ábrán szemlélteti egy költőpár fészkelés előtti tartózkodását a fészkelő odu közelében. A költés megkezdésekor a vonulás még tartott.

Да фе к фенологии скворцов Sturnus vulgaris L. 1758)

Молнар Д.

Резюме

Автор дает сводки о наб юдении пере ета скворцов по южной части Среднедунайской равнины, а также по южному отрезку реки Тисы в 1958—1982 годах.

Сообщаются данные об их зимних кормах, а также о ко ичестве скворцов, при етающих в окрестности города Сегед и времени при ета. Наводятся данные о местах гнвздования и смешивания их с другими птицами.

На таблице иллюстритуются две пары скворцов вблизи дупла.

Prilog poznavanju fenologije vorka (Sturnus vulgaris L. 1758)

MOLNÁR GY.

Abstrakt

U radu su prikazani rezultati posmatranja seobe čvoraka na južnom području reke Tisza u periodu 1958—1982. godine. Autor daje podatke o prezimljavanju i ishrani č voraka tokom zimei kao i o vremenu dolaska domaćih gnezdarica, i o srednjim vrednostima teritorijalnosti u okolin, Szeged-a. Analizirano je mešanje čvoraka sa drugim vrstama tokom seobe i njihovo lutanje nakon pristizanja. Utvrdjeno je da početkom gneždjenja još traje seoba.

Tiscia (Szeged) Vol. XXI. pp. 123—127 (1986)

SPECTROGRAM AND OSCILLOGRAM COMPARATIVE ANALYSIS OF NIGHT HERON (NYCTICORAX NYCTICORAX L.) ADVERTISING CALL

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(Received November 20, 1984)

Abstract

The gargling, advertising call of the night heron was analysed by two different physical methods: spectrogram and oscillogram analysis. Similar parameters of frequencies were obtained and calculated by the two methods. No regular intensity changes were observed in the oscillogram.

The clusterlike occurence of the call was demonstrated and beside advertising a group coherent function was proposed.

Introduction

In previous work (WOLLEMANN 1980, 1984) a spectrogram analysis was published from different heronries calls esp. night herons, focused on a call present only during the nesting period, which was defined as a gargling, advertising call.

In the present work this call was analysed further by using two independent physical methods i.e. spectrogram and oscillogram analysis were performed. The spectrogram records the freqency distribution of the call in time, whereas the oscillogram reflects directly the intensity changes of the call. It is possible to measure by videodensitometry the intensity of the call from the spectrogram (WOLLEMANN and OLASZY 1976). Using magnification and retardation frequencies can be calculated from the oscillograms of the calls (ALBERT 1983).

Our purpose was to compare the data given by the two different methods and to gain more information on the function of this call.

Methods

Night heron calls were recorded at the heronry of Labodár on May 1, 1984. The microphone FM-300A (Jin-In El. Co) was fixed on a poplar tree at 6 m height from the earth. The microphone was steered by a magnetophone (SANYO, M 2502-U) from some distance before the channel (see map in Wollemann 1981).

Spectrogram analysis was performed as previously described (WOLLEMANN and OLASZY 1976) with a Sound Spectrograph Series model (Voice Identification Inc). Oscillograms were produced on an EMG TR 4653 type oscilloscope at different speeds and pictures were taken with a MOM MF 1—1 camera. Both recordings were carried out before and after filtering off the background noises. Frequency analysis from oscillograms was calculated as described by ALBERT (1983) according to SMETANA (1975) and SVÁB (1981).

Results and Discussion

Previous spectrogram analyses were made after cutting the background noises below 500 Hz (WOLLEMANN 1980 and 1984). Presently both way of spectrogram recording are demonstrated i. e. without filtering the background noises (Fig. 1) and after cutting the background noises below 500 Hz (Fig. 2). As it is seen from the

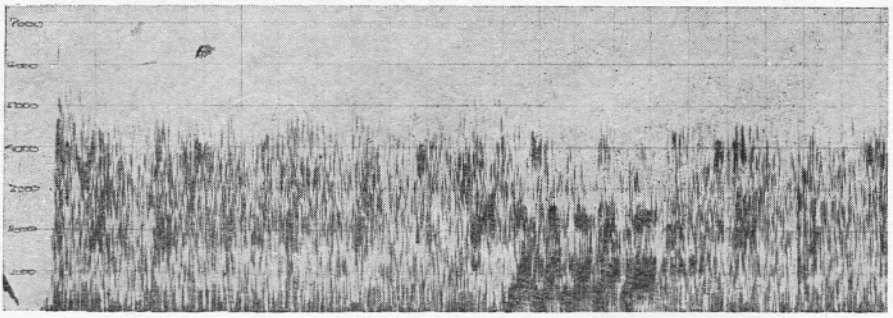

Fig. 1. Sonogram of night heron advertising call cutting the background noises below 500 Herz

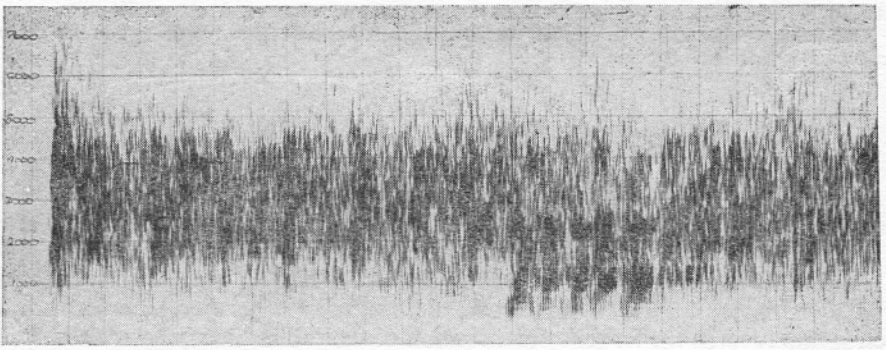

Fig. 2. Sonogram of night heron advertising call without filtering the background noises

figures substantial part of the calls are produced below 500 Hz. The frequency is raising till 1100—1200 Hz and a third harmonic is appearing at 2200 Herz. The call was repeated 5 times and lasted 0.4 sec.

The same call analysed by oscillogram showed no regular periodicity in intensity changes (Fig. 3). By calculating the frequency from the number of soundwaves during a certain time period after varying the velocity of the electron beam and using a twofold (Fig. 4, 5, 6) slowing the following frequencies were calculated: 550 Hz as a ground-note modulated by a second (1100 Hz) and a third harmonic (2200 Hz). There was also a component at 280—290 Hz in both recordings covered by background noises.

The whole call as calculated by this method lasted 0.379 sec. The differences between the time measured by the two registration methods (0.4 resp. 0.379 sec) are due to the background noises, which are more disturbing in the second method.

The maximal amplitudes of the soundwaves varied during the five periods as follows: 22.2, 29.54, 20.6
19.5, 30.9 mm

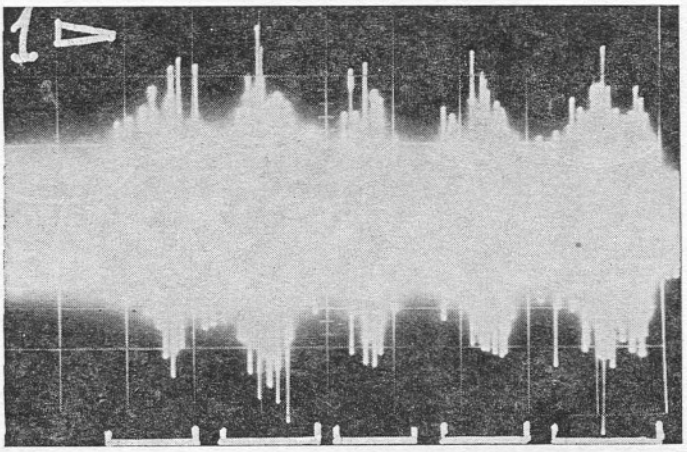

Fig. 3. Oscillogram of the night heron advertising call. Sensitivity 0,05 V/cm; velocity of electronbea 0,1 sec/cm; filtration of background noises below 240 Herz; recording is twofold slowed down

Ethological observations were performed during the sound registration with the following results. The night heron nests were located in contrast to previous years of observations (1978—82) near to the grey herons nests behind the channel on the poplar trees. The reason of abandoning the former willow tree colony, which was more near to the dam was probably that owing to constant low levels of the Tisza river in 1983—84 there was no flood during the springtime as usual, and the willow tree part of the former colony became entirely dry.

We observed on May 1, in Labodár 27 pairs of grey herons, 35 pairs of night herons and 3 pairs of little egrets, which shows a decrease in the number of nesting pairs as compared to previous numbers of night heron and little egret nests (BOD and MOLNÁR 1979, WOLLEMANN 1980). As to the function of the night heron call, there

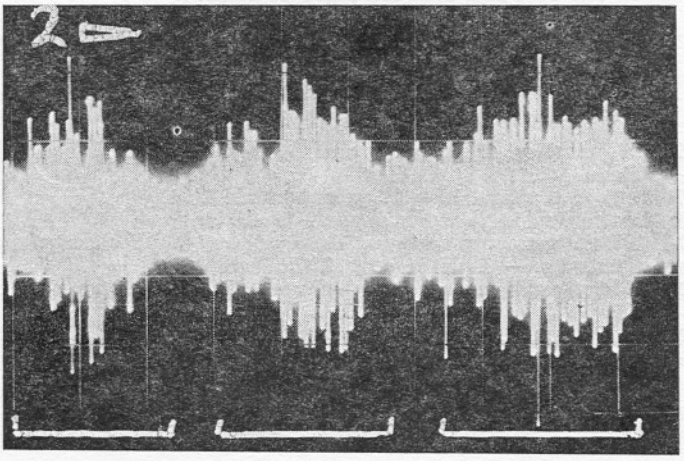

Fig. 4. Oscillogram of the third, fourth and fifth phase of the night heron advertising call. Parameters are the same as in Fig. 3. with exception of electronbeam velocity: 50 msec/cm

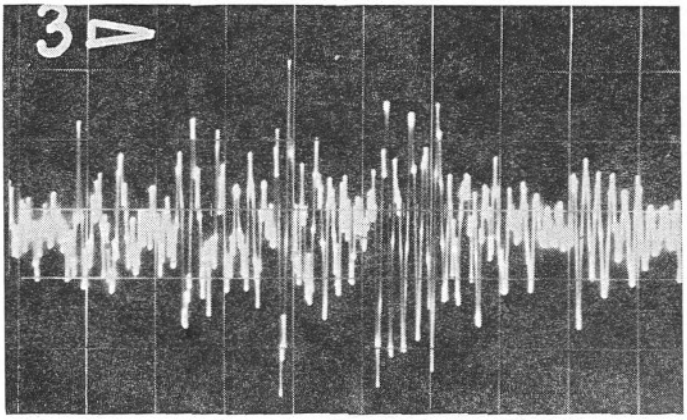

Fig. 5. Oscillogram of the third phase of the night heron advertising call. Parameters are the same as in Fig. 3. with exception of electronbeam velocity: 20 msec/cm

was nothing which could strenghten the pair greeting or nesting function of the call as previously stated (WOLLEMANN 1984), but clusterlike occurence of different lonely standing night heron calls were audible.

In a period starting from 5.28 p.m. the interruptions between the calls were as follows:

3″ 1″ 52″ 33″ 2′52″ 15″ 2″ 9″ 4″ 2′37″
3″ 21″ 10″ 10″ 5″ 1″ 1″ 1″ 1″ 1, 18″ 3″...

This demonstrates well that after a few minutes of interruption clusters of 4—5—8 calls appeared. Therefore beside the advertising character of the call a group coherent function could be also attributed to it.

Future investigations has to demonstrate the eventual differences between the individual calls in one bird and between more of them.

References

ALBERT, A. (1983): A széncinege *(Parus maior)* riasztó hangjának néhány jellemzője fizikai elemzés alapján. — Puszta *1*, 81.

SMETANA, C. (1975): Zaj és rezgésmérés. — Budapest. Műszaki Kiadó

SVÁB, J. (1981): Biometriai módszerek a kutatásban. — Budapest.

WOLLEMANN, M. (1980): Spectrogram analysis of the night heron (Nycticorax nyeitorax L.) calls at the heronry of Labodár. — Tiscia (Szeged) *15*, 131.

WOLLEMANN, M. (1984): Spectrogram analysis of different calls at the heronry of Labodár. — Tiscia (Szeged) *15*, 205.

WOLLEMANN, M. and OLASZY, G. (1976): Spectrogram Analysis of different Alarm Calls in Gulls an Waders. — Agressologie *18*, 97.

A bakcsó (Nycticorax nycticorax L.) reklámhangjának spektrogramos és oszcillogramos vizsgálata

Kivonat

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A bakcsó reklámhangját két módszer eredményeinek összevetésével vizsgáltuk, szonogram és oszcillogram segítségével. Mindkét esetben hasonló eredményeket kaptunk a frekvencia értékekre vonatkozóan. Az oszcillogram kimutatta, hogy nincs determinisztikus hangerősség változás. A kiáltások csoportosulása a jel reklámozó és csoportösszetartó funkciójára utalt.

Спектральное и осциллографое цзучвие крикливой рекламы кваквы Nycticorax

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Резюме

Исследование крикливой рекламы *Nyctieorax nyctieorax* провели на основании сочетания двух методов. В обеих случаях относительно их фреквенции получены одинаковые результаты. Осциллограмма показала, чтоь нет никаких изменений в силе детерминального звука. Изданный сильный крик рекламирует-оа Имхнуи Н групповой солидарности.

Spektrogramska i oscilogramska ispitivanja ogla avanja gaka (Nycticorax nycticorax L.)

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Abstrakt

Ispitivanja signalnog oglašavanja gaka vršena su uporednom analizom rezultata dobijenih sonogramskim i oscilogramskim registrovanjem. U oba slučaja dobijeni su slični rezultati u odnosu na frekvenciju. Oscilogramom je utvrdjeno da nema determinističkih promena u jačini oglašavanja Grupacije glasovnih efekata ukazuju na funkciju signalizacije i okupljanja kolonije.

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SEASONAL COMPOSITION, BIOMASS AND PRIMARY PRODUCTIVITY OF THE PHYTOPLANKTON IN LAKITELEK BACKWATER DURING 1980 AND 1983

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(Received September 28, 1984)

Abstract

Seasonal variations in the species composition and biomass of the phytoplankton were studied in the northern region of the backwater of the River Tisza in the nature reserve at Lakitelek. Samples for the investigations were collected at monthly intervals at three sampling stations at equal intervals. The biomass and density of the hyptoplankton were measured on the basis of total algal counts. Temporal similarities in phytoplankton associations were evaluated via hierarchical cluster analyis. Primary production rates in relation to solar radiation were estimated with the oxygen light-dark bottle method.

The results indicate that the tendencies of the algal communities to undergo compositional changes were the same throughout the backwater during the period studied. However, there were obvious differences between the species compositions during periods ranging from October to March and from July to September. The winter phytoplankton was dominated by species of Chrysophyceae and Pyrrophyta, while in the late spring collections Euglenophyta and Cyanophyceae were the most frequent. In summer the small-bodied ($<10\mu m$) green algae (mainly Chlorococcales) were the most abundant. Diatoms (Centrales) were present in high individual numbers throughout the year.

The seasonal distribution pattern of the biomass showed three distinct peaks: the first maximum between December and February (16—26 mg/1), the second in May or June (6—10 mg/1) and the third in September or October (8—39 mg/1). As concern the primary production rates measured in 1981, eutrophic, polytrophic and hypertrophic subregions were differentiated in the backwater at Lakitelek.

Introduction

The northern section of the dead-arm of the River Tisza at Lakitelek is part of the Kiskunság National Park which preserves the conditions of the river prior to its regulation last century. Research into its phytoplankton started in the early 1960-s. Besides identifying the high dominancy of *Synura uvella* EHR. and *Cyclotella* sp., UHERKOVICH (1971) emphasized that flowering plants and the rich algal vegetation provide evidence of a higher level of limnological individualization. Regular samlings at seasonal frequency were started from 1975 by KISS, I. (1978 a, b). He described a Euglenophyton abundance in the nonprotected southern region of the backwater.

Samples for our investigations were collected continuously every month from 1980 on. In previous studies we suggested that in the northern end of the backwater, which is in a state of natural alluvium, the summer phytoplankton bloom is prevented by shade effects of the macrovegetation and by the alimentary competition of bacteria and epiphytic diatoms (KOVÁCS and DOBLER 1984). Moreover, by means of scanning

electron microscopy we first identified occurrence of *Thalassiosira faurii* (GASSE) HASLE (1978) in Hungary at Lakitelek (KISS, K. T. et *al.* 1984).

The present paper reports results of algological investigations between 1980 and 1983. In this period, the qualitative and quantitative species compositions and seasonal variations in the biomass of the phytoplankton were studied. On the basis of the primary productivity and biomass, the backwater was qualified in FELFÖLDY's classification (FELFÖLDY 1980).

Materials and Methods

Sampling: Sampling areas have previously been characterized in detail (KOVÁCS and DOBLER 1984). Briefly, three sampling stations were set up along the 6 km northern section of the backwater, at 3 km intervals. The first (No. 1) was situated at the research house of the Tisza-Research Committee at the northern end. The second (No. 2) was midway between No. 1 and No. 3, located at the bridge at Tőserdő. Samples were collected from a depth of 0,2 m every month between 1980 and 1982 from the point No. 3, and between May 1982 and April 1983 from all three stations. Primary production was measured in May and July 1981.

Species composition and biomass of the phytoplankton: For this purpose 1 litre raw water was collected and subsamples of 100—500 ml were centrifuged (3000×g, 10 min). Celli dentification and counting were performed with a phase contrast microscope on 5 µl aliquots spread on the surface of a thin (1 mm) agar-agar layer (NÉMET 1982 and personal communication). The total cell count of a species was expressed in terms of individuals per litre (ind/l). The biomass was expressed in mg/l on the basis of the mean cell size multiplied by the number counted in 1 litre. Mean cell volumes were calculated from at least 25 individuals.

Statistical procedures: Temporal similarities in the species composition of the phytoplankton were estimated with the CZEKANOWSKI (1909) index. Resemblance matrices and corresponding cladograms were prepared using the average chain strategy (UPGMA) from the agglomerative, hierarchy methods (SNEATH and SOKAL 1973, p. 230) for the clustering of phytoplankton associations. An investigation was also made as to which species were common and present in similar quantities relative to one another in the various phytoplankton communities.

Primary production rates and solar radiation: Primary production rates were measured in situ with the oxygen light-dark bottle method (FELFÖLDY 1980). Samples were collected with a special self-made sampling device (KOVÁCS 1984). In this manner, 200 ml bottles were filled with homogenous phytoplankton samples through a bronze net. Bottles were incubated at different depths in the backwater. Dark bottles were wrapped with aluminium foil. Oxygen was titrated by the WINKLER method. All incubations and analyses were performed in duplicate. From the light- dark oxygen results, daily rates of gross production (PG) were calculated in mg $C \cdot m^{-2} d^{-1}$ (VOLLENWEIDER 1974, p. 87). Solar radiation was recorded at hourly intervals from sunrise to sunset with a SPECTRA-PHYSICS (USA) pyrheliometer and the record was planimetrically integrated to calculate daily solar input in megajoule $\cdot m^{-2} \cdot d^{-1}$.

Results

Phytoplankton biomass and its seasonal composition

Samples were collected at sampling station No. 3 at monthly intervals between 1980 and 1982. Total cell counts of samples from a depth of 0.2 m for the sampling dates are summarized by major taxa in Table 1. The biomass of the Lakitelek backwater was composed of a total of 303 species, 24 varieties and 7 forms. The phytopplankton was dominated by Euchlorophyceae and Bacillariophyceae, though in 1981 collections indicated a more abundant presence of Cyanophyceae, Euchlorophyceae and Euglenophyta. There was a general decrease in the total number of diatom species during the period studied, whereas the species found in the biomass exhibited increasing individual numbers.

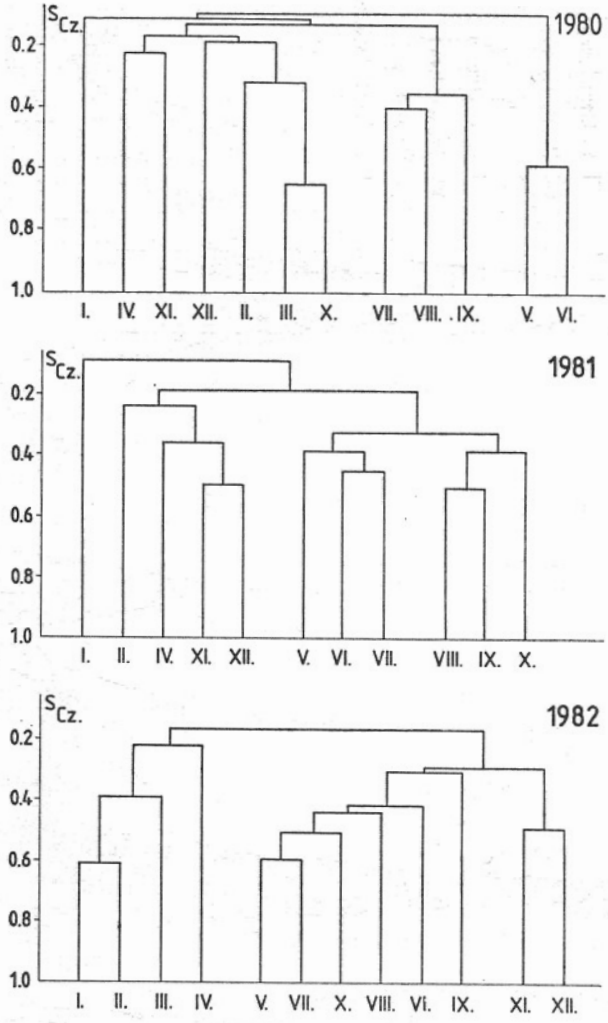

Fig. 1. Cladograms of phytoplankton composition sampled at station No. 3 in three successive years. (1980—1982), based on UPGMA cluster analysis. See details in the text

Hierarchical clustering of abundance for the algal species produced two distinct association groupings every year (Fig. 1). One group consisted of summer associations (May—October), dominated by green algae: *Chlorococcum infusionum* (0.3—3.1 million ind/1), *Crucigenia tetrapedia* (0.5—20.0 million ind/1) and *Ankistrodesmus angustus* (1.0—1.7 million ind/1). The total counts of *Oocystis lacustris, Scenedesmus granulatus* and *Siderocelis minutissima* were relatively high (up to 3.2 million ind/1) in 1981, as were those of *Ankistrodesmus minutissimus, Crucigenia pulchra, Nephrochlamis subsolitaria, Scenedesmus coartatus* and *S. securiformis* (1.0—2.0 million ind/1) in 1982. In addition, two diatoms were typically present: *Stephanodiscus dubius* and *S. hatzschii* (1.1—2.2 million ind/1).

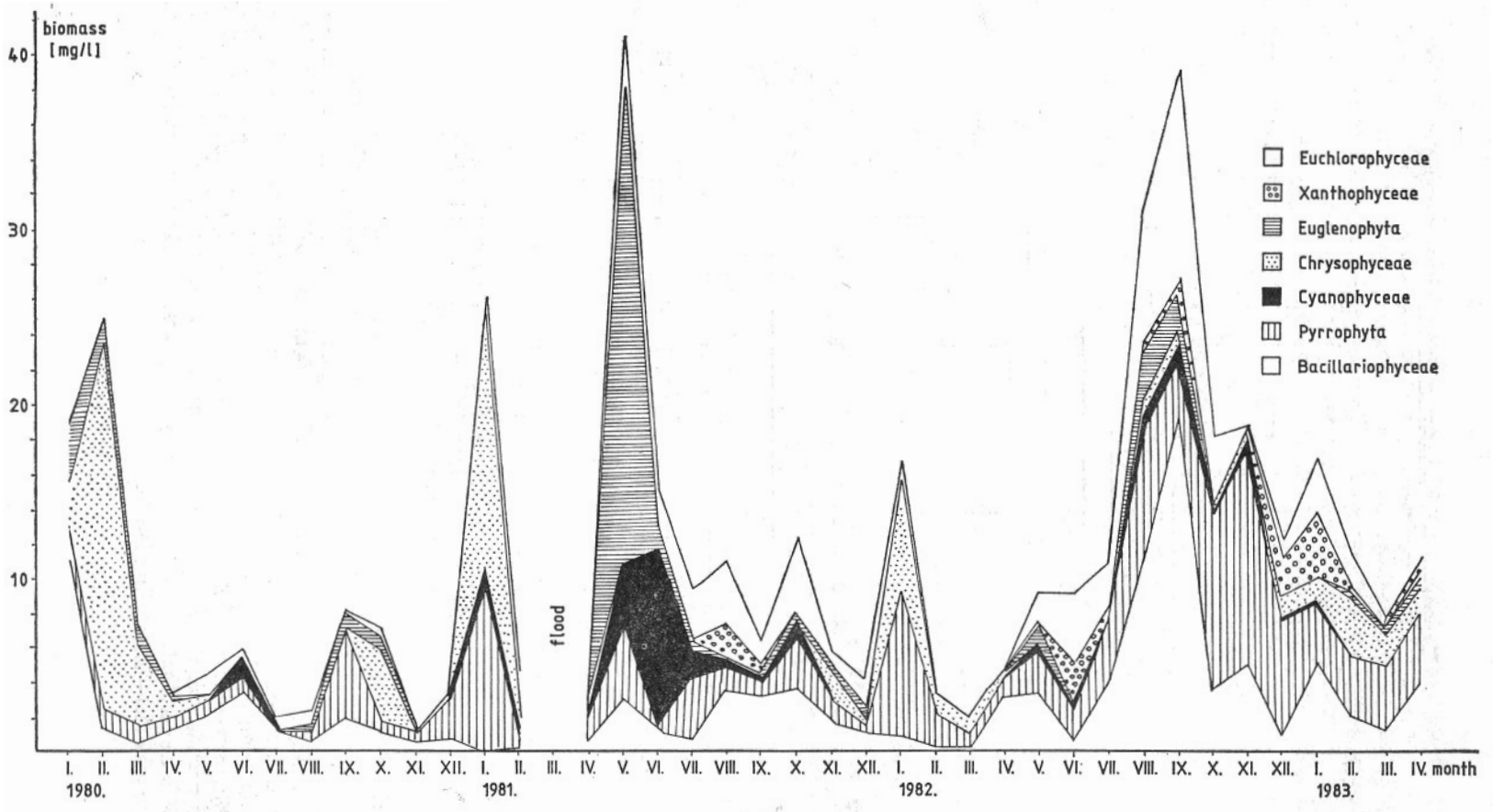

Fig. 2. Seasonal fluctautions of total phytoplankton biomass and composition by major taxa at sampling station No. 3

The other group, composed of winter phytoplankton communities (between October and March), was characterized by the mass production of *Synura uvella* (up to 20.0 million ind/l), *Chrysococcus biporus, Kephyrion inconstans* and *Stephanodiscus hatzschii* (0.5—7.2 million ind/l). Mention should be made of the striking blooms of the small-bodied *Stephanodiscus dubius* (39.5 million ind/l) and *Gloeocapsa siderochlamys* (14.0 million ind/l) in January 1980 and 1981 respectively.

The biomass showed three distinct peaks, one each in winter, late spring and fall (Fig. 2). The winter maximum, ranging between 16 and 26 mg/l, could be attributed to an increased abundance of *Chrysococcus biporus, Kephyrion inconstans, Synura uvella* and the larger-bodied (10—40 μm) *Cryptomonas erosa* and *C. ovata.* Further, *Stephanodiscus dubius, S. hantzschii, Asterogloea gelatinosa* and *Gloeocapsa siderochlamys* were occasionally present in high individual numbers and contributed significant to the winter biomass.

In late spring and early summer, chrysophytes were progressively replaced by Euglenophyta species generating a biomass maximum of 6—10 mg/l (Fig. 2). Following the flood of 1981, when the backwater was flushed by the River Tisza, a pronounced bloom of *Oscillatoria (O. planctonica, O. limnetica* and *O. nigra)* and Euglenophyta *(E. proxima, E. polymorpha* and *Lepocinclis ovum)* yielded an extremely high bimass level (42 mg/l).

In fall, the maximum biomass oscillated between 8 and 12 mg/l and could be attributed to the larger-bodied (12—15 μm) *Stephanodiscus dubius, Chlorococcum infusionum* and *Crucigenia tetrapedia.*

Horizontal distribution of phytoplankton

Samples were taken from a depth of 0.2 m beneath the surface at all three sampling stations (Nos. 1—3) at monthly intervals between May 1982 and April 1983. The results of species identification and counting are summarized by major taxa in Table 2. The phytoplankton along the backwater was composed of 268 species, 23 varieties and 10 forms, predominated by Euchlorophyceae, Bacillariophyceae and Euglenophyta. Total counts of species identified were relatively high at sampling station No. 2, but low at No. 1.

The hierarchical clustering of abundance for phytoplankton species sampled at station No. 1 revealed a shift from a predominantly Chrysophytes assemblage dominated by *Chrysococcus biporus, Dinobryon divergens, Chromulina* sp. (1.0—3.5 million ind/l) and *Synura uvella* (5.7—18.5 million ind/l) during February and March, to a predominantly Pyrrophyta and Euglenophyta assemblage dominated by *Chroomonas acuta, Cryptomonas erosa, C. ovata, Trachelomonas planctonica, T. verrucosa, T. volvocinopsis* and *T. volvocina* (0.2—1.3 million ind/l) in summer. Pyrrophyta dominated in the fall collections (Fig. 3).

At sampling stations Nos. 2 and 3, seasonal variations in the phytoplankton produced two distinct association groupings (Fig. 3). Firstly, the summer samples collected during May and October were dominated by Chlorococcales, *Ankitrodesmus angustus, Chlorococcum infusionum* and *Crucigenia tetrapedia,* as well as by the diatoms *Stephanodiscus dubius* and *S. hantzschii* with high total cell counts (1.4—60.0 million ind/l). *Crucigenia pulchra* (1.0—13.0 million ind/l) was also found at point No. 3. The September association slightly resembled to the summer one and showed an abundant presence of blue-green algae: *Aphanothece* sp., *Chroococcus minutus* and

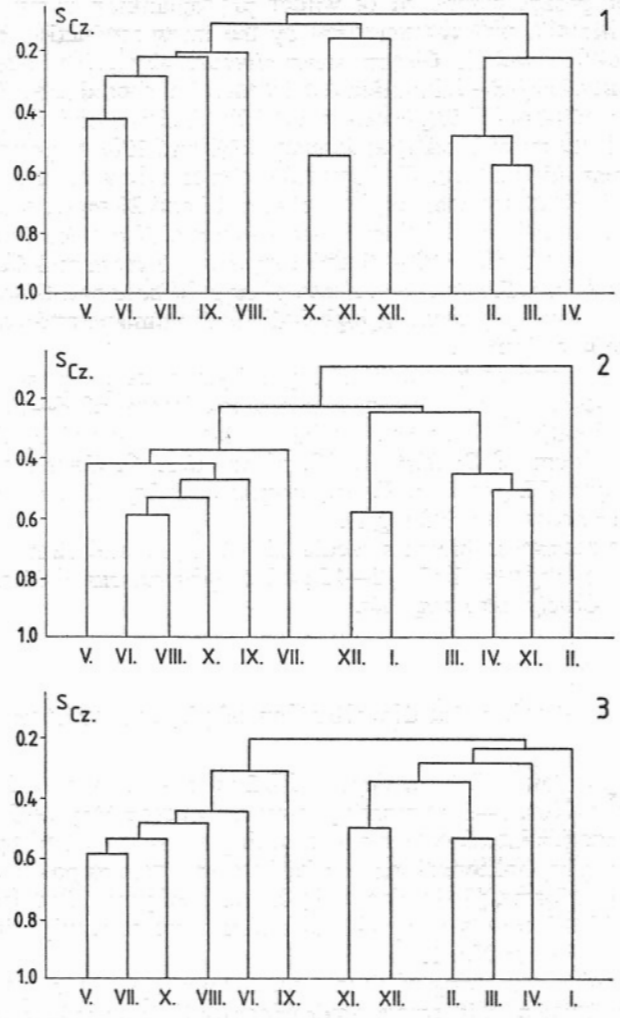

Fig. 3. Hierarchical classification of phytoplankton communities sampled at stations Nos. 1—3 during May 1982 and April 1983. Similarities were calculated on the basis of species abundances

Gomphosphaeria lacustris (1.4—1.9 million ind/1). Secondly, the winter phytoplankton were dominated by the Chrysophyceae *Dinobryon divergens, D. sertularia, Chromulina* sp. and *Chrysococcus biporus* (1.2—13.9 million ind/1), and the diatom *Rhisosolenia longiseta* (3.2—5.6 million ind/1). *Synura uvella* constituted 53% of the total cell count in February sampling area at No. 2, while *Asterogloea gelatinosa* contributed up to 72% of the total cell count in January at No. 3.

Table 1. *Total counts of phytoplankton species displayed by major taxa. Samples were taken for three years (1980—1982) at station No. 3 (at the bridge at Tőserdő)*

Taxa	Counts of species identified annually			Total counts of species	Species occurring every year
	1980	1981	1982		
Cyanophyceae	8	19	19	27	3
Euglenophyta	22	27	22	40	11
Pyrrophyta	10	15	10	17	6
Xanthophyceae	9	9	11	13	7
Chrysophyceae	18	15	15	18	13
Bacillariophyceae	62	42	38	82	18
Euchlorophyceae	65	99	94	134	41
Conjugatophyceae	2	3	0	3	0
Sum total:	193	229	204	334	99

Table 2. *Horizontal distribution of phytoplankton species summarized by major taxa. Samples were collected at all three stations (Nos. 1—3) during May 1982 and April 1983*

Taxa	Counts of species identified from the three stations			Total counts of species	Species occurring in all sampling areas
	No. 1	No. 2	No. 3		
Cyanophyceae	16	14	18	24	8
Euglenophyta	22	23	22	37	10
Pyrrophyta	12	11	11	14	9
Xanthophyceae	11	11	11	14	9
Chrysophyceae	17	17	16	18	14
Bacillariophyceae	33	51	43	63	23
Euchlorophyceae	67	100	99	126	52
Conjugatophyceae	4	0	0	4	0
Sum total:	182	227	220	301	124

Table 3. *Primary gross production(PĞ) in relation to solar radiation and biomass. Eutrophication of the sampling areas was classified according to* FELFÖLDY *(1980)*

Date	Sampling station	Primary production rate (PČ) $mgC \cdot m^{-2} \cdot d^{-1}$	Solar radiation $MJ \cdot m^{-2} \cdot d^{-1}$	Biomass $g \cdot m^{-2}$	Eutrophication class
30. 05. 1981	No. 1.	676	18,2	4,7	Meso-eutrophic
	No. 2.	2324		33,6	Eu-polytrophic
	No. 3.	2831		37,6	Polytrophic
30. 06. 1981	No. 1.	1007	13,2	10,4	Eutrophic
02. 07. 1981	No. 2.	3416	20,4	58,4	Polytrophic
03. 07. 1981	No. 3.	5121	19,5	86,1	Hypertrophic

Primary production rates

The primary gross productions (PĞ) measured simultaneously at the three sampling points at the end of May 1981 with the oxygen light-dark bottle method were significantly different in the longitudinal section of the backwater (Table 3). Correlating with the biomass measured from the same raw-water samples, the highest production rate (2831 mg C $\cdot m^{-2} \cdot d^{-1}$) was found at sampling station No. 3 and the lowest value (676 mg C $\cdot m^{-2} \cdot d^{-1}$) at No. 1.

A month later, however, the productivity with unchanged solar radiation was nearly twice that for the summer phytoplankton bloom (Table 3). The production rates revealed eutrophic, polytrophic and hypertrophic regions in the Lakitelek backwater.

Discussion

Although there were pronounced seasonal changes in the species composition of the phytoplankton, the most characteristic *Synura uvella* was predominantly present throughout the period studied, with the only exception of the mild winter in 1982.

In spring, Chrysophytes were usually replaced by Euglenophyta and Cyanophyceae species, contributing up to 30—40% and 1—2%, respectively, of the total biomass, but the individual numbers of *Dinobryon divergens* and *D. sertularia* increased strikingly. An extremely high mass production of Euglenophyta and filamentous blue-green algae *(Oscillatoria)* was recorded following the spring flood in 1981, when these taxa contributed up to 74% of the total biomass. It was presumed that this phenomenon was due to the decreased alimentary competition accompanying the flush effect of the flood.

However, the obvious increase in dominancy of the small-bodied ($< 10\mu m$) Igreen algae *(Ankistrodesmus, Crucigenia* and *Siderocelis)* and the occurrence of certain Pyrrophyta species *(Chroomonas* and *Cryptomonas)* provided a further evidence of the advanced eutrophication of this backwater. Blooms of Centrales *(Cyclotella* and *Stephanodiscus)* were found typical not only of the Lakitelek backwater, but of other dead-arms of the River Tisza too (DOBLER and KOVÁCS 1982, 1984).

It was also found that *Ceratium hirundinella,* which dominated in the middle of the 1970-s (KISS, I. 1978a), had almost completely disappeared from the phytoplankton in the 1980-s. On the other hand, the only known occurrence of *Thalassiosira faurii* (GASSE) HASLE in Hungary was recently identified (in small numbers) in summer collections from the Lakitelek backwater (KISS, K. T. et *al.* 1984). Otherwise, *Th. faurii* has been recovered from lakes in Central Africa (Ethiopia, Kenya, Congo and Tanzania) (HASLE 1978).

The primary production rate results suggested that the Lakitelek backwater is about twice as eutrophic as for example, the Tihany Basin of Lake Balaton (HERÓDEK 1977), probably because of the isolation and greater agricultural disturbance of the former, while a similar productivity has been revealed in Lake Velence (FELFÖLDY 1981) and in the Keszthely Basin of Lake Balaton (VÖRÖS et *al.* 1983).

References

CZEKANOWSKI, J. (1909) Zur Differencialdiagnose der Neandertalgruppe.— Korres-pbl. dt. Anthrop. Ges. *40*, 44—47.

DOBLER, E. and KOVÁCS, K. (1982) Biological water quality in the Mártély and Körtvélyes back-

waters of the Tisza from 1976 to 1980, with special regard to phytoplankton changes. — Tiscia (Szeged) *17*, 67—88
DOBLER, E. and KOVÁCS, K. (1984) Results of the preliminary investigations on the algacommunities in backwater of the Tisza at Alpár. — Tiscia (Szeged) *19*, 59—69
FELFÖLDY, L. (1980) A biológiai vízminősítés (Biological water qualification. In Hungarian). — Vízügyi Hidrobiológia 9. VIZDOK, Budapest.
FELFÖLDY, L. (1981) A vizek környezettana. Általános hidrobiológia (Environment of freshwaters. General hydrobiology. In Hungarian). — Budapest.
HASLE, G. R. (1978) Some freshwater and brackish water species of the diatom genus *Thalassiosira* CLEVE. — Phycologia *17*, 263—292
HERÓDEK, S. (1977) A Balaton. Hidrobiológiai Továbbképző Tanfolyam, Tihany (Szerk.: FELFÖLDY L.), (Lake Balaton. Proceedings of a Hydrobiological Training Course held in Tihany. Ed.: FELFÖLDY, L).
KISS, I. (1978a) Algological investigations in the dead-Tisza at Lakitelek-Tőserdő. —Tiscia (Szeged) *13*, 49—54
KISS, I. (1978b) Occurrence of *Synura uvella* Ehr. var. *Tiszaensis* n. var. in the dead-arm of the River Tisza near Lakitelek. Tiscia (Szeged) 13, 49—54
KISS, K. T., KOVÁCS, K. and DOBLER, E. (1984) The fine structure of some *Thalassiosira* species (Bacillariophyceae) in the Danube and the Tisza rivers. — Arch. Hydrobiol. Suppl. *67*(4), 409—415
KOVÁCS, K. (1984) A Lakiteleki holt-Tisza fitoplanktonjának összehasonlító vizsgálata. Egyetemi doktori értekezés. József Attila Tudományegyetem Könyvtára, Szeged (Comparative studies on phytoplankton of the backwater of the River Tisza at Lakitelek. Doctoral Thesis. Library of Attila József University, Szeged. In Hungarian).
KOVÁCS, K. and DOBLER, E. (1984) Studies on the qualitative and quantitative composition and the seasonal changes of phytoplankton at three sampling areas of the dead-Tisza at Lakitelek. — (Szeged) *19*, 69—79.
NÉMETH, J. (1982) A Gabcsikovo-Nagymarosi vízlépcsőrendszer hatása a Duna vízminőségére (Effects of the Gabcsikovo-Nagymaros barrage on the water quality of the River Danube. In Hungarian). — VITUKI, *77—83*/3115, 1—20. Budapest.
SNEATH, C. E. and SOKAL, R. K. (1973) Numerical taxonomy. The principles and practice of numerical classification. — W. H. FREEMAN, Calif.
UHERKOVICH, G. (1971) A Tisza fitoszesztonja (Phytosestone of the River Tisza. In Hungarian). — Szolnok.
VOLLENWEIDER, R. A. (1974) A manual on methods for measuring primary production in aquatic environments. In: IPB Handbook 12. Blackwell Sci. Publ., Oxford.
VÖRÖS, L., VÍZKELETY, É., TÓTH, F. and NÉMETH, J. (1983) Trófitási vizsgálatok a Balaton Keszthelyi medencéjében 1979-ben (Eutrophication in the Keszthely Basin of Lake Balaton. In Hungarian). — Hidrol. Közl. *9*, 390—398

A lakiteleki Holt-Tisza fitoplanktonjának összetétele. Biomasszája és primer produkciója 1980—1983 között

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Kivonat

A Lakiteleki holtág északi, védett szakaszán 1980 és 1982 között egy, 1982 májusa és 1983 áprilisa között három ponton havonta vett minták feldolgozásával vizsgálta a fitoplankton összetételének és biomasszájának éves változását. 1981 nyarán két alkalommal mérte az elsődleges tertermelés intenzitásának, a biomassza mennyiségének és az inszolarizációs felületi teljesítmény összefüggéseit.

Az algatársulások szezonális változása a vizsgált periódusban mintavételi helyenként szignifikáns különbséget nem mutatott. A fitoplankton összetételét időben vizsgálva az októbertől márciusig illetve a júliustól szeptemberig terjedő időszak különbségét mutatta ki. A holtág vízterét a téli Chrysophyceae és Pyrrophyta dominancia után május—június hónapokban az Euglenophyta törzs és a Cynophyceae osztály fajainak egyedszámnövekedése jellemezte. Nyáron a 10 μ alatti Chlorococcales zöldalgák tömeges megjelenését regisztrálta. Feltűnő volt a Centrales rend fajgazdagsága, őszi, téli és tavaszi tömegprodukciója. A biomassza annuális változása három jellemző

csúcsot mutatott. Az első maximum decembertől februárig (16—26 mg/l), a második május és június között (6—10 mg/l), a harmadik szeptembertől októberig (8—39 mg/l) volt mérhető. Az 1981 nyarán mért primer produkció alapján a holtág északi vége eutrófnak, a középső és a hídnál levő területe poli- illetve hipertrófnak bizonyult.

Состав фитопланктона, биомассы и первичной продукции Лакителекской мертвой тисы в 1980—1983 годах

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Резюме

В северной частьи охраняемого Лакителекского Мёртвого русла в 1980—1983 годах ежемесячно в рех местах брались пробы для изучения состава фитопланктона и смены их биомассы. Летом 1981 года в вдух случаях были определены взаимные отношения между эффективностью первичного объема биомассы и инсоляционной поверхностью.

На протяжении исследуемого периода водорослевые сообщества не показали никакие сигнификативные изменения. В составе фитопланктона значительные изменения возникли в периоды октябрь-март и июльсентрябрь. Зимой в старице доминировали Chrysophyceal и Pyrrophyta, а в период с мая по июнь — ствол Euglenophyta и класс Cyanophyceal. Летом зарегистрировали здесь массовое появление Chlorococcales. Осенью, зимой и весной наблюдалось появлеиие большого количества представителей порядка Centrales, что представляет большой интерес. В биомассе появились три максимума: I — от декабря до февраля (16—26 mg/l), II — в мае и июне (6—10 mg/l), а III — в сентрябре и октябре (8—39mg/l). На основании исследований, проведенных летом 1981 года, было установлено, что в северном конце Лолителекской Мёртвой Тисы преобладают эутрофы, а в средней части и около моста — поли — или гинертрофы.

Sastavj biomasa i primarna produkcija fitoplanktona Mrtve—Bise Lakitelek u periodu 1980—1983. godine

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Abstrakt

Na zaštićenoj deonici severnog dela mrtvaje Lakitelek, ispitivanja sastava i godišnjih promena biomase fitoplanktona vršena su u periodu 1980—1982. godine na jednom punktu, a od maja 1982. do aprila 1983. godine na tri punkta. U toku leta 1981. godine, merenja intenziteta primarne produkcije i uslovljenosti biomase i insolacione površine, vršena su u dva navrata.

Sezonske promene sastava fitoplanktonske zajednice, u toku perioda ispitivanja na mestima uzimanja proba, nisu pokazivale signifikantne razlike. U odnosu na vremensku dinamiku prikazane su razlike u sastavu fitoplanktona za period od oktabra do marta, odnosno od jula do septe=bra. U mrtvaji, nakon zimske dominacije Chrysophyceae i Pyrrophyta, u periodu maj—juni se javlja povećavanje brojnosti vrsta algi iz razdela Euglenophyta i klase Cyanophyceae. Tokom leta se registruje masovna pojava zelenih Chlorococcales algi, u količini ispod m. Uočljivo je bogatstvo vrsta algi iz reda Centrales, njihova jesenja, zimska i prolećna masovna produkcija. Promena produkcije biomase pokazuje tri karakteristična maksimuma: prvi od decembra do februara (16—26 osnovu utvrdjene primarne produkcije u toku leta 1981. godine, severni kraj mrtvaja spada u eutrofnu kategoriju, dok je srednji deo i područje oko mosta po kvalitetu poli- odnosno hipertrofan.

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STUDIES ON THE VEGETATION DYNAMICS OF NANOCYPERION COMMUNITIES II. CLASSIFICATION AND ORDINATION OF SPECIES

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Abstract

On the basis of the reciprocal averaging ordination studies on the species of the Nanocyperion-like cenoses, similarly to the ordination of the stands, the population of the Nanocyperion zone at the river-bed can be separated in two manners: interior primary succession characteristic to the lower relieves and exterior primary succession characteristic to the higher relieves. The development of the mean characteristic indicator values can be evaluated as the regular concomitant of these processes. The results of the ordination and the applied cluster analysis are well comparable. The development of the clusters shows connection with the distribution of the cenoses in time and space, i.e. with the vegetation dynamics of the river-bed' s mud vegetation.

Introduction

The rapid changes of the river-bed Nanocyperion associations make possible vegetation dynamic studies devoid of exterior effects and feasible under natural conditions, similarly to the qualitative description of the alterations of the flood-plain Bidentetea cenoses (BAGI and BODROGKÖZY 1984). In the first half of the studies the main determinations in respect to the regularities of the alterations of the Nanocyperion-like cenoses were as follows (BAGI 1985). It could be determined on the basis of the reciprocal averaging (RA) ordination studies on the stands that the relative repression of the hygrofrequent species is generally characteristic to the transformation of the vegetation at the studied area, the cause of which is the continuous drying out of the biotope. The relief-dependent appearance of the nitrofrequent species is characteristic. On the basis of the development of the partial coverage of the nitrofrequent species, two types of successions originating from the river-bed Nanocyperion stands could be distinguished. At higher relieves where the vegetation period is longer due to the earlier cessation of water covering, and the Nanocyperion associations are in direct contact with the Bidentetea (Chenopodio-Scleranthea) communities (TÍMÁR 1950a, b), the appearance of the nitrofrequent species is intensive in the second half of the vegetation period. This process leads to the early disintegration of the Nanocyperion associations, and Bidentetea communities develop. This type of succession can be regarded as exterior primary succession. The succession is exterior despite the fact that the major part of the propagules of the developing new community is found at the area even in the initial state, since the propagules originate from the zone of the higher relief which is by now not of Nanocyperion character, their replacement is already started during the Nanocyperion state of

development. The syngenetic character is dominant in this succession process (PRÉCSÉNYI 1981).

At deeper relieves the appearance of the nitrofrequent species is not considerable, during the course of transformation the typically Nanocyperion elements are dispalced by species standing close to both the Bidentetea association-class and the Nanocyperion association-group *(Potentilla supina, Rumex stenophyllus)*, the less hygrofrequent Nanocyperion *(Gnaphalium uliginosum)* and non-nitrofrequent Chenopodio-Scleranthea *(Rorippa sylvestris, Lythrum salicaria)* (Soó 1964—80). This type of succession can be regarded as interior primary succession, because the penetration of the foreign elements at the area is minimal and the dominance values of the hygrofrequent species of the highly hygrophytic Nanocyperion stands decrease to the benefit of the less hygrofrequent species as the consequence of accomodation to dryness. The interior primary succession can also be regarded as change of aspect, in the traditional sense. In the case of the Nanocyperion associations, however, the Nanocyperion — Chenopodio-Scleranthea transformation is so expressed that it oversteps the concept of change of aspect, therefore it can be mentioned as primary succession. The ecogenetic character dominates in the process manifested in accomodation to dryness by a change in species composition.

The studies on classification and ordination in the first part were related to the cenoses and relevés. The described results were gained on the basis of the interpretation of these methods. The question arises whether, subjecting the species to the already applied methods, the afore-mentioned regularities could be evidenced; whether the multivariate analysis of the species would result newer relationships?

The various types of „multivariate analyses" (ORLÓCZI 1975, SZŐCS 1972) are widely used in ecological practice. The most widely used are the classification and ordination methods. Several publications have reported on the possibilities (SVÁB 1979), conditions (SZŐCS 1973), weakness (HILL-GAUCH 1980) and defects (BEALS 1973) of application of the various methods. Reports on the testing of the various methods are also numerous (SWAN 1970, NOY-MEIR-AUSTIN 1970, GAUCH 1982a). The joint application of the methods is frequent; comparative studies on the methods, e.g. application of ordination methods besides regressionanalysis, D^2-analysis (PRÉCSÉNYI 1969), cluster analysis (GAUCH-WHITTAKER 1981).

The multivariate analysis may aim at studies on the species as well as the samples and stands. The multivariate analysis of species is generally used to solve taxonomic (HORÁNSZKY 1960) and cenosystematic (MUCINA 1982) problems. Furthermore, the species analysis is often used to clarify the correlations between environmental parameters and the structure of cenoses (GOLDSMIDT 1973). The ordination studies of species may confirm the results of other statistical methods, like interspecific associations (BATES 1975), non-metric multidimensional scaling (MATTHEWS 1978).

Materials and methods

The base of the calculations was the cenological table published in the first part of this report (Table 1).

The cenosystematic characterization of the species was performed on the basis of the summarizing work by Soó, with particular regard to the cenological references found in Volume VI. (Soó 1964—80).

The classification was performed by applying three different kinds of uniting methods strating from a similarity matrix calculated on the basis of the Rekonen-index: single linkage, complete linkage, simple average (PODANI 1980). The RENKONEN-index is:

$$S_{jk} = \sum_{i} \min \{p_{ij}, p_{ik}\}$$

Table 1

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. *Cyperus fuscus*	20	2	17	10	20	4	11	+	17	+	58	+
2. *Dichostylis micheliana*	36	2	43	6	38	+	11	+	9	+	2	+
3. *Gnaphalium uliginosum*	8	5	5	17	6	9	8	+	3	+	1	5
4. *Veronica anagallis-aquatica*	2	3	1	+	+		3	2				
5. *Rumex stenophyllus*	4	21	2	7	2	17	1	4		4		2
6. *Potentilla supina*		5		2		4		1		2		
7. *Plantago major*	8	9	9	3	10	9	4	6	9	10	17	4
8. *Rorippa sylvestris*	4	9	4	22	5	34	8	3	9	10	6	1
9. *Amaranthus lividus*	+	4	+	1	2	7	2	+	3	+	2	3
10. *Chenopodium rubrum*	5	2	2	17	3	4	12	4	5	7	+	2
11. *Lythrum salicaria*	7	17	7	4	4	3	8	8	7	10	+	8
12. *Xanthium italicum*		2	3	+			8	6	1	1	3	10
13. *Bidens tripartita*		1		1	+	2	1	6	+	1	+	15
14. *Agrostis stolonifera*		+		4		1		+	+	6	+	10
15. *Polygonum lapathifolium*	2	+	1	+	3	+	15	26	3	4	+	3
16. *Polygonum hydropiper*								8	+	6		
17. *Chenopodium album*		1		+			+	4	4	8		2
18. *Echinochloa crus-galli*	2	3	2	2	3	3	1	14	13	13	6	20
19. *Lythrum virgatum*		+	1	+		+	3	2	4	3		
20. *Tanacetum vulgare*		4		1	1	3	1	5	+	4		+
21. *Chenopodium polyspermum*			+		2		2		3			+
22. *Salix triandra (juv)*		1	1				+	+	4	4	3	+
23. *Portulaca oleracea*					1	+			3	2		

where, applied in the given case
I_{jk} is the similarity of species.—j and k-according to their covering values
p_{ij} , p_{ij} are the probabilities of finding of the species j and k, in the i th stand.

The reciprocal averaging technique was applied in the ordination calculations according to the method described by Hill, with the difference that the set of starting scores for the species consisted of random numbers between 0—100 (HILL 1973). The cause of the method selection was partly the objectivity of the RA opposed to the polar ordination (GAUCH—WHITTAKER—WENTWORTH 1977) or the weighted averages ordination, and partly the „meaningful" ordination of species of the RA. The RA ordination is especially suitable for the processing of a base matrix (cenological table) comeposed of moderately heterogeneous data. For the ordination of an extremely heterogeneous mass of data, the detrended correspondence analysis (DCA) (HILL—GAUCH 1980) developed for eliminating the errors of RA is more suitable, while the ordination of homogeneous data can be accomplished the most effecticely with the PCA ordination (GAUCH 1982b). The less effective ordination of species of the PCA method is probably due to the fact that the data of the cenological tables can be regarded as more heterogeneous in respect to species, than to stands. Owing to the less informative character of the ordination of species in the case of PCA, authors usually apply the PCA ordination of stands to demonstrate the effect of species-related, mostly environmental parameters, comparing the various species' distribution among the objects (WARD 1970, ROGERS 1970). Some authors use other methods for the ordination of species, apart from the PCA ordination of stands (ZHANG 1983).

Faults of RA are that the axes of higher serial number are determined by the lower ones, they are poor in surplus information and the median-related crowing of the objects are demonstrable at the end values of the 1. axis (GAUCH 1982b). The degree of axes' independence from other can be checked by calculating the determination coefficient calculated on the basis of the linear regression (SVÁB 1981). Naturally, the standard errors of the method cannot be excluded in such manner, since these do not change according to linear function. The determination coefficient expressing the subor-

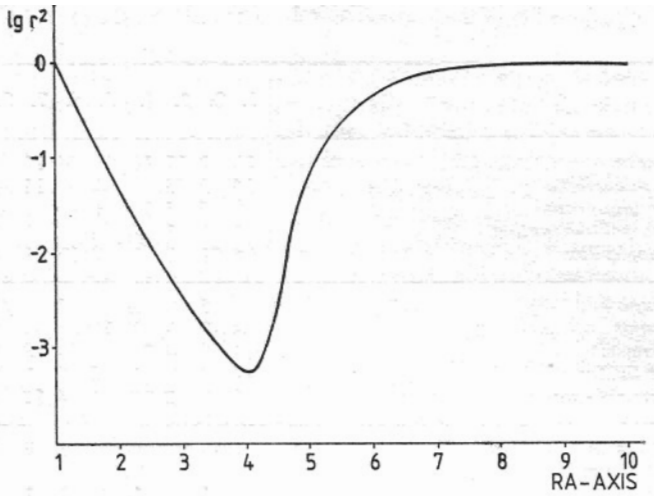


Fig. 1. Change of the determination constant (r^2) in the function of the increase in axis number (on the basis of the data shown on Table 1). The relationship of two variables is expressed by the determination coefficient. In the case of the 1—4 axes regarding the axes as variables the determination coefficient has a minimum, the regression between the two axes is minimal

dination between the first and higher axes develops as follows, in the function of the serial number of the axes (Fig. 1):

The determination coefficient is the lowest between the first and 4th axis (cp. GAUCH 1980). However, comparing the ordination figure with the result of the cluster analysis, the clusters of the dendrogram are the best differentiated between the 1—3 axis pairs, in this case the error arising from the regression of the axes as well as the standard error of the ordination are presumably of opposed gisns.

Results

Classification

With the application of the complete linkage and group average uniting types clusters made up of the same elements can be distinguished (PODANI 1980). The main groups are the followings:

The first group comprises the Nanocyperion character species *(Cyperus fuscus, Dichostylis micheliana, Gnaphalium uliginosum)* and the *Plantago major* ssp. *pleiosperma,* the character species of the Isoëto-Nanojuncetea class (PIETSCH 1973). Those species also assemble in this group, which are present at the area with a significant coverage even at the time of the initial stage of the Nanocyperion associations *(Lythrum salicaria, Chenopodium rubrum).* As the character species of the Chenopodion fluviatile group *Chenopodium rubrum* proves the cenosystematic relationship between the Nanocyperion and the Chenopodion fluviatile association groups.

Such elements belong to the second group, which show the late stage of the vegetation at the river-bed Nanocyperion zone. On the basis of their occurrence, the seare mainly transitional elements: Nanocyperion — Bidentetea *(Rumex stenophyllus, Potentilla supina, Veronica anagallis-aquatica),* Nanocyperion — Chenopodio-Scleranthea *(Rorippa sylvestris).*

The third group comprises those elements which can be found at the area with small coverages, cenosystematically these differentiate from the Bidentetea and Nanocyperion species dominating at the area. (It should be noted that although the Bidentetea association-class is a part of the Chenopodio-Scleranthea division, it can well be separated from the other classes of the division, thus the differentiation does not meet with any difficulties).

Besides the typically Bidentetea elements *(Bidens tripartita, Xanthium italicum)* the fourth group contains the *Agrostis stolonifera* and the *Echinocloa crus-galli.* These species occur at higher relieves with essentially higher covering than at the lower parts, their coverages become considerable at the end of the vegetation period.

The *Polygonum* species, the character species of the Bidention association group, are segregated in the fifth cluster, as is also the *Chenopodium album,* which has wide ability of accommodation and is cenologically indifferent. This species is mentioned in literature as the character species of the Chenopodio-Scleranthea division (Soó 1964—80).

With the application of simple average, the 2., 3. and 4. groups can be united at a common similarity level, the common characteristic of the 2. and 4. groups is their appearance in the later phases of the vegetation period. The united group is linked with the first group at a similarity level of 0.26. In the case of complete linkage the segregation of the 1., 3. and 2., 4., 5. groups is maximal. The common characteristic of the 1. and 3. clusters — distinguishing them from the 2., 4., 5. groups is that their covering quota is more significant in the early stage of the vegetation period, than in the late stage (Fig. 2a, 2b).

Table 2 demonstrates the relationships between the relieves and the phases of the vegetation period, with the changes of the covering values for the species forming the various clusters (Table 2). The table also shows the proportional distribution

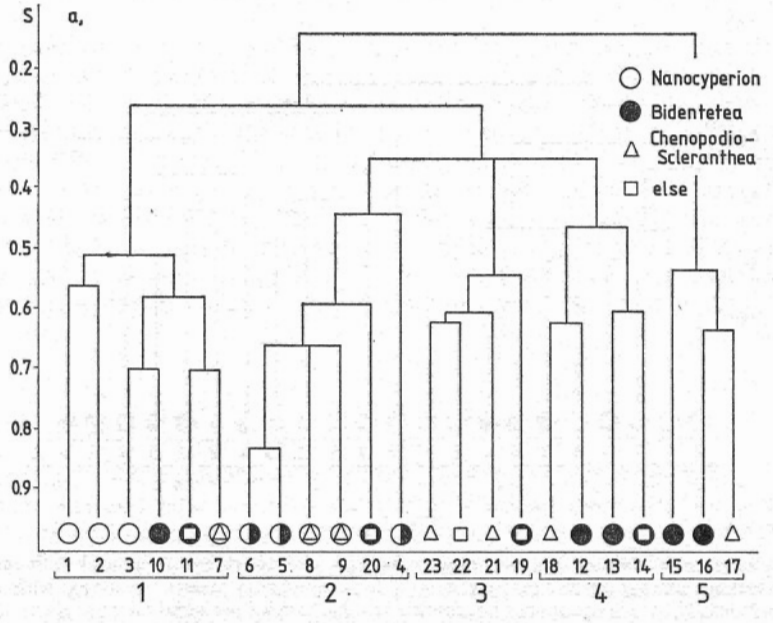


Fig. 2. a

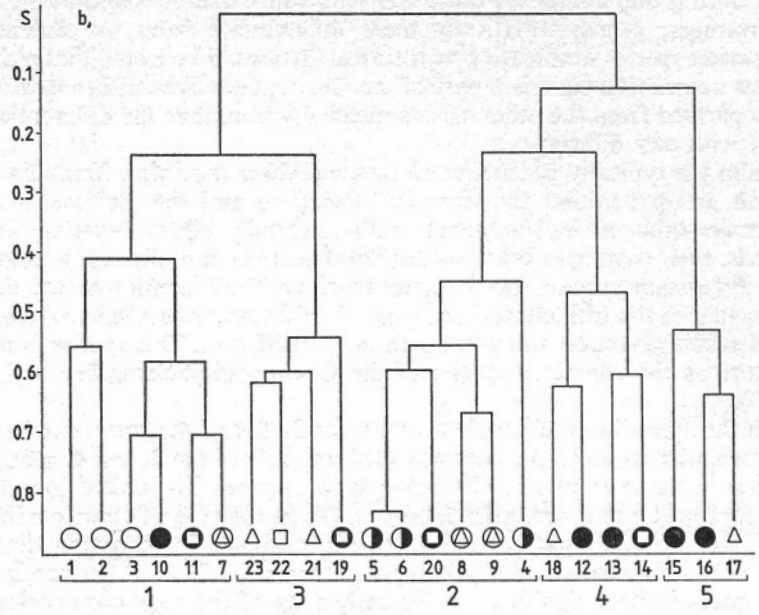


Fig. 2. b

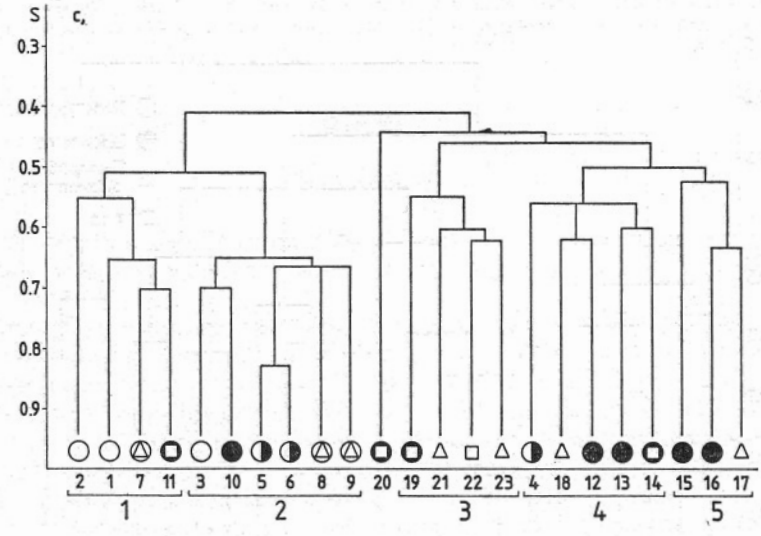


Fig. 2. c

Fig. 2. Dendrograms of cluster analyses prepared with a, simple averages, b, complete lincage and c, single linkage uniting techniques on the basis of the similarity matrix calculated with the Renkonen-index. The plant species can be identified on the basis of the serial number given in Table 1. The symbols drawn to the species refer to the cenological group(s) (combined symbols) where the occurrence of the given species is the most characteristic

among the various clusters of the vegetation covering at the area according to relief and time. It could be determined that progressing from the first towards the fifth cluster, the probability that the selected element of the cluster originates from a lower relief and an early time continuously decreases. The probability continuously increases that the element originates from a higher relief and besides this, is taken up at a later time. From the applied methods, this is emphasized principally by the single linkage method (although with slightly changed clusters) (Fig. 2c). In this case

Table 2

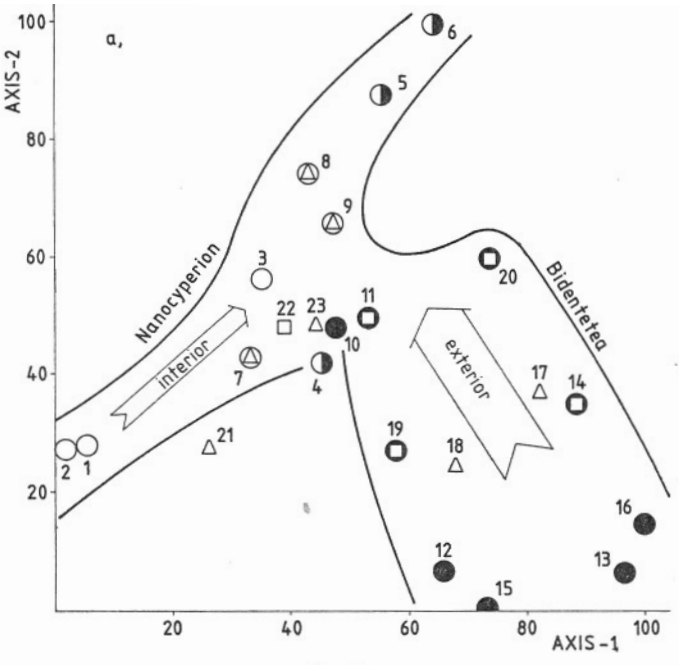
Cluster	A	B	C	D	p_A	p_B	p_C	p_D	p_{AC}	p_{AD}	p_{BC}	p_{BD}
1	64.75	42.48	72.88	34.12	0.6038	0.3962	0.6812	0.3188	0.4113	0.1925	0.2699	0.1263
2	27.92	13.45	10.00	31.20	0.6749	0.3251	0.2427	0.7573	0.1638	0.5111	0.0789	0.2462
3	1.05	5.84	4.58	2.19	0.1524	0.8476	0.6765	0.3235	0.1031	0.0493	0.5734	0.2742
4	5.06	23.54	7.29	21.72	0.1769	0.8231	0.2513	0.7487	0.0445	0.1324	0.2068	0.6163
5	1.22	14.69	5.25	10.77	0.0767	0.9233	0.3277	0.6723	0.0251	0.0516	0.3026	0.6207

A—lower relief
B—higher relief
C—early time
D—later time
$p_{A,B,C,D}$—the probability of selection from the relevant cluster of element possering from the characteristic indicated in the index
$p_{AC,BD}$—the probability of selection in respect to the element possessing both characteristics indicated in the index

the linkage effect only prevails at higher uniting levels, the major groups are essentially unchanged. Two elements of the first cluster *(Chenopodium rubrum* and *Gnaphalium uliginosum)* can be combined with the remaining elements of the second cluster. Those elements which join the second cluster — also doing so at a lower similarity level during the course of the previous uniting procedures — *(Tanacetum vulgare, Veronica angallis-aquatica)* segregate from the second, and even the first group, too. The first and second clusters combine at a similarity level of 0.51. The species of the combined clusters appear with greater covering at the lower relief of the study area. The segregation of the clusters bearing the serial numbers 3., 4., 5. in the previous combination is similar to the preceding ones in the case of single linkage combination.

Ordination

The results of the RA ordination of the species are observable on Fig. 3a. b. c. d. The species characteristic to cenosystematically identical categories can be segregated well. The objects can approximately be arranged into two groups „branches" (Fig. 3a). One branch is mainly formed by Nanocyperion elements, the other mainly by Bidentetea elements. The „transitional" species can be found at the crossing as well as at the common section of the branches. *(Veronica anagalis-aquatica* and *Rumex stenophyllus, Potentilla supina,)*. The third group also segregated by the cluster


a,
AXIS-2
AXIS-1
Nanocyperion
Bidentetea
interior
exterior
100
80
60
40
20
20
40
60
80
100
1
2
3
4
5
6
7
8
9
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21
22
23

Fig. 3.a

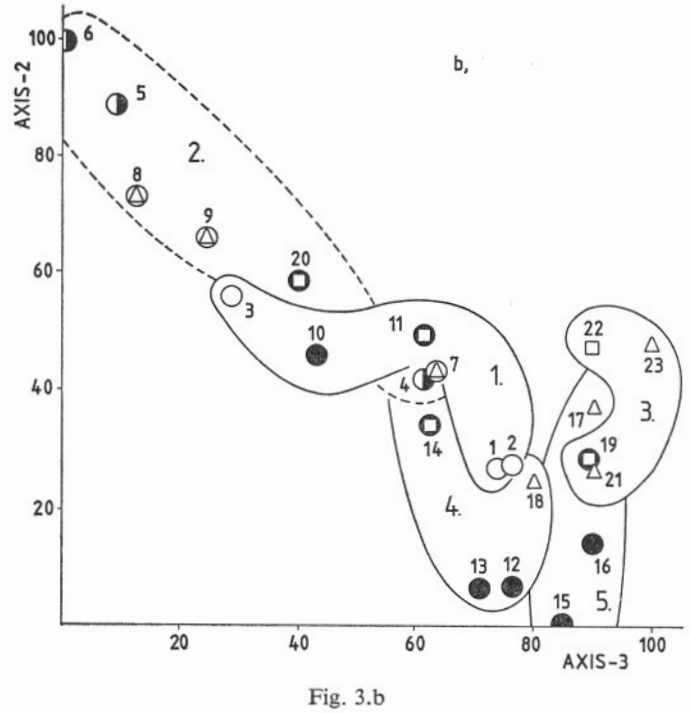
b,
AXIS-2
AXIS-3
1.
2.
3.
4.
5.
100
80
60
40
20
20
40
60
80
100
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Fig. 3.b

analysis (mainly between the 1—3 axes) is ordinated at the area between the two branches. The Nanocyperion elements, with good approach, fall to the same straight line, the equation of which with the transitional elements is as follows:

$$z_{1.ax} = 8.12 - 1.13\ z_{2.ax}$$

The linkage is tight besides the dispersion of r = 0.8510. The Nanocyperion species are situated along the straight line in the sequence of their phenology. First the *Cyperus fuscus* and the *Dichostylis micheliana,* then the *Gnaphalium uliginosum* and the *Veronica anagallis-aquatica* appear in the Nanocyperion associations. The *Rumex stenophyllus* and the *Potentilla supina* reach their highest dominance values in the finishing phase. The relationship between the sequence of appearance and the environmental parameters is shown by the development of the W-indicator value of the species, in due course: 10, 10, 9, 9, 6, 7 (ZÓLYOMI et *al.* 1967). Studying the relationships between the indicator values and the ordination, it could be determined that regularity other than the already mentioned characteristic could not be demonstrated in respect to the location of the species.

Beyond strengthening the results of the cluster analysis, the arrangement of the objects between the 2—3. axes is less informative (Fig. 3b).

Figs. 3c. and 3d. demonstrate the comparison of the cluster analysis with the groups of the ordination. In the case of the 1—3 axes (Fig. 3c) the clusters obtained by the uniting of the complete linkage and the simple average, resp., were segregated, while in the case of the 1—4 axes those clusters were segregated which were obtained from the uniting of the single linkage (Fig. 3d).

Contrary to cluster analysis, the most important, striking advantage of ordina-

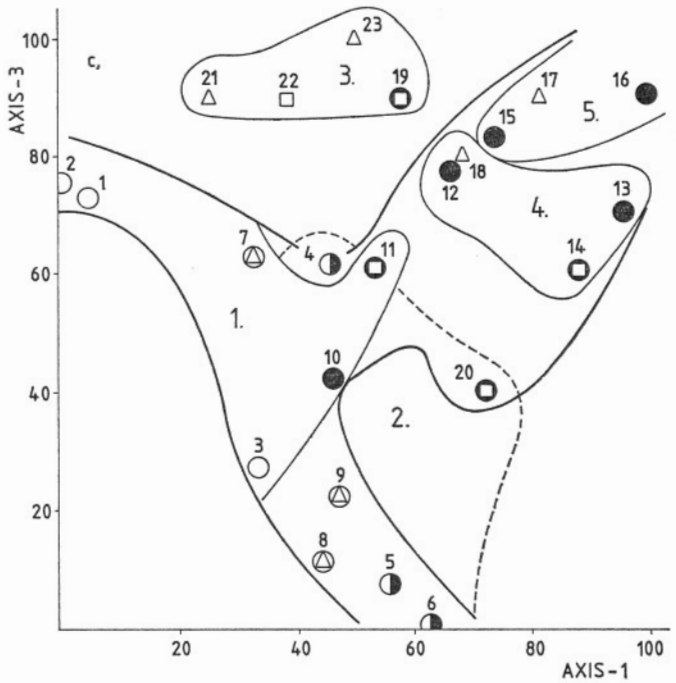

Fig. 3.c

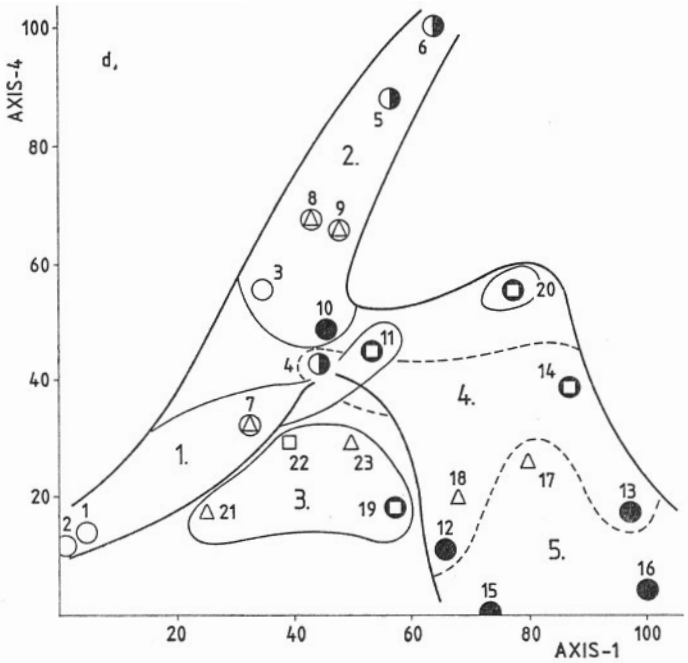

Fig. 3. d

Fig. 3. Results of the reciprocal averaging ordination of species. Detailed interpretation is given in the text. The higher numbers (Fig. b, c, d) indicate the appropriate clusters

tion is that the succession types can be interpreted on the ordination figure. This additional information derives from the dynamic interpretation of the figure, the dynamic character is referred to by the phenological order of succession on the figure of the species belonging to the Nanocyperion group. According to this interpretation the Nanocyperion branch represents the process of the interior primary succession and the Bidentetea branch falling into that of the Nanocyperion represents the process of the exterior primary succession. It is not accidental that the *Chenopodium rubrum,* the character species of the Chenopodion fluviatile association group, was found closest to the Nanocyperion branch. Apart from the major „processes", those species are found the cenosystematic role of which is negligible in respect to the process of both the interior and exterior primary successions (Fig. 3a, 3b).

While the ordination studies reported so far were performed at identical time, providing comparison and evaluation of the various independent relevés, the present study — taking advantage of the possibilities implied in the rapid changes of the Nanocyperion communities — adopts the ordination method to the dynamic system of tightly connected cenoses located at the same area, changing in time and space. As a consequence the quantitative characteristics (e. g. average indicator values) can only be co-ordinated to the different groups of the ordination figure as concomitant phenomena. The ordination of a system or mass of data, which could be regarded as being static, emphasizes the quantitative characteristics, while the main features of a dynamic system are qualitative; the ordination figure lays emphasis on these by the development of the cenosystematical system and the mentioned succession types, resp., as well as by the exact reproduction of the Nanocyperion phenology.

References

BAGI, I. (1985): Studies on the vegetation dynamics of Nanocyperion communities I. Characteristic indicator values and classification and ordination of stands. — Tiscia (Szeged) 20. 29—44.

BAGI, I. and BODROGKÖZY, GY. (1984): Seasonal dynamics of the succession series at the Körös floodplain leading to the association of the *Echinochloo-Heleochloëtum alopecuroidis* (RAPCS. 27) BODRK. 82. — Tiscia (Szeged) *19*, 113—135.

BATES, J. W. (1975): A quantitative investigation of the saxicolous Bryophyte and Lichen vegetation of Cape Clear Island, County Cork. — J. Ecol. *63*, 143—162.

BEALS, E. W. (1973): Ordination: Mathematical elegance and ecological naiveté. — J. Ecol. *61*, 23—35.

GAUCH, H. G. (1982/a): Noise reduction by eigenvector ordinations. — J. Ecol. *63*, 1643—1649.

GAUCH, H. G. (1982/b): Multivariate analysis in community ecology.— Cambirge University Press.

GAUCH, H. G. — WHITTAKER, R. H. (1981): Hierarchical classification of community data. — J. Ecol. *69*, 537—557.

GAUCH, H.G—Whittaker, R.H.—Wentworth, T.R(1977): A comparative study of reciprocal averaging and other ordination techniques. — J. Ecol. *65*, 157—174.

GOLDSMIDT, F. B. (1973): The vegetation of exposed sea cliffs at south stack, Anglesey. — J. Ecol. *61*, 787—818.

HILL, M. O. (1973): Reciprocal averaging :an eigenvector method of ordination. — J. Ecol. *61*. 237—249.

HILL, M. O. — GAUCH, H. G. (1980): Detrended correspondence analysis: an improved ordination technique. — Vegetatio *42*, 47—58.

HORÁNSZKY, A. (1960): Statistical studies on *Festuca* species. — Ann. Univ. Sci. Budapestiensis *3*, 225—227.

MATTHEWS, J. A. (1978): An application of non metric multidimensional scaling to the construction of an improved species plexus. — J. Ecol. *66*, 157—173.

MUCINA, L. (1982): Numerical classification and ordination of ruderal plant communities (Sisymbrietalia, Onopordetalia) in the western part of Slovakia. — Vegetatio *48*, 267—275.

NOY—MEIR, I. — AUSTIN, M. P. (1970): Principal component ordination on simulated vegetational data.—J. Ecol. 51, 551—556.

ORLÓCI, L. (1975): Multivariate analysis in Vegetation reserach. — Junk, Den Haag.

PIETSCH, W. (1973): Zur soziologie und ökologie der Zwergbinsen-Gesellschaften Ungarns (Klasse Isoëto-Nanojuncetea Br.—Bl. ex Tx. 1943). — Acta Bot. Acad. Sci. Hung. *19*, 269—288.

PODANI, J. (1980): SYN—TAX: Számítógépes programcsomag ökológiai, cönológiai és taxonómiai oszályozások végrehajátására. (Computer program package for cluster analysis in ecology, phytosociology and taxonomy). —Abstracta Bot. *6*.

PRÉCSÉNYI, I. (1969): Analysis of the primary production (phytobiomass) in an *Artemisio-Festucetum pseudovinae*. —Acta Bot. Acad. Sci. Hung. *15*, 309—325.

PRÉCSÉNYI, I. (1981): A növénytársulások struktúrája (Structure of plant communities). In ed. HORTOBÁGYI, T. —SIMON, T. Növényföldrajz, társulástan és ökológia (Geobotany, phytosociology and ecology). — Budapest.

ROGERS, D. J. (1970): A preliminary ordination study of forest vegetation in the Kirchleerau area of the Swiss Midland. — Berichte des Geobot. Inst. der Eidg. Techn. Hochschule Stiftung Rübel. Zürich. 40, 28—78.

SOÓ, R. (1964—80): A magyar flóra és vegetáció rendszertani és növényföldrajzi kézikönyve I—VI (Synopsis systematico-geobotanica florae vegetationistique I—VI). — Budapest.

SVÁB, J. (1979): Többváltozós módszerek a biometriában (Multivariate methods in biometrics). — Budapest

SVÁB, J. (1981): Biometriai módszerek a kutatásban (Biometrical methods in research work). — Budapest

SWAN, J. M. A. (1970): An examination of some ordination problems by use of simulated vegetational data. — Ecol. *51*, 89—102.

SZŐCS, Z. (1972): Néhány sokváltozós analizis botanikai alkalmazásáról I. (On the botanical application of some procedures of multivariate analysis I.). — Bot. Közlem. *59*, 181—185.

SZŐCS, Z. (1973): Néhány sokváltozós analízis botanikai alkalmazásáról II. A sokváltozó sanalízisek általános jellemzése. (General characterisation). — Bot. Közlem. *60*, 29—33.

TÍMÁR, L. (1950/a): A Tisza-meder növényzete Szolnok és Szeged között. (Les associations végétales du lit de la Tisza de Szolnok á Szeged). — Ann. Biol. Univ. Debr. *1*, 72—145.

TÍMÁR, L. (1950/b): A Maros-meder növényzete. (Die vegetation dess Flussbettes der Maros). — Ann. Biol. Univ. Szeged. *1*, 117—136.

WARD, S. D. (1970): The phytosociology of Calluna-Arctostaphylos heats in Scotland and Scandinavia. — J. Ecol. *58*, 847—863.
ZHANG, L. (1983): Vegetation ecology and population biology of *Fritillaria meleagris* L. at the Kungsängen Nature Reserve, eastern Sweden. Acta Phytogeogr. Suec. *73*. Uppsala.
ZÓLYOMI, B. et *al.* (1967): Einrechung von 1400 Arten der ungarischen Flora in ökologische Gruppen nach TWR-Zahlen. — Fragmenta Bot. *4*, 101—142.

Vegetációdinamikai vizsgálatok Nanocyperion jellegű cönózisokon II
A fajok klasszifikációja és ordinációja

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Kivonat

A Nanocyperion jellegű cönózisok fajainak reciprocal averaging ordinációs vizsgálatai alapján, a felvételek ordinációjához hasonlóan a folyómeder Nanocyperion zónája benépesülésének kétféle útja különíthető el: interior primer szukcesszió, amely az alacsonyabb térszínekre jellemző és az exterior primer szukcesszió, amely a magasabb térszínekre jellemző folyamat. Az átlagos karakterisztikus indikátorértékek alakulása ezen folyamatok törvényszerű kísérőjelenségeként értékelhető. Az alkalmazott cluster analízis és az ordináció eredményei jól összevethetők. A clusterek kialakulása összefüggést mutat a cönózisok térbeli és időbeli tagolódásával, vagyis a folyómeder iszapnövényzetének vegetációdinamikájával.

Вегетационнодинамическое исследование над растительными сообществами Nanocyperion II.
Классификация и ординация видов

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Резюме

На основании рециировал аверагинг ординантных исследований растительных сообществ Nanocyperion-ного характера, в подобе ординативных приемов в заселении Nanocyperion-ной зоны в речных руслах, где выделяются два путя заселения: интериор пример сукцесивный, который приурочен для более низко расположенного рельефа и экстериор пример сукциесивный — приупочен для более высоко расположенного рельефа.

Образовавшиеся полухарактерные индикаторные результаты в таком случае следует оценивать в процессе закономерных сопровождающих явлений.

Примененный анализ клустера и ординационные результаты здесь хорошо совмещаются. Образование клустеров показывает на взаимные отношения ценозов с территориальным и часовым расчленением, то есть на динамику вегетации иловой растительности.

Ispitivanje dinamike vegetacije sa karakteristikama Nanocyperion zajednice II
Klasifikacija i ordinacija vrsta

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Abstrakt

Na osnovu „reciprocal averaging" ispitivanja vrsta sa karakteristikama Nanocyperion zajednice, slično ordinacijskom snimanju naseljavanja korita reke, uočljiva su dva pravca: interior primer succession koja karakteriše niže slojeve i exterior primer succession karakteristična za više nivoe. Kretanje prosečne karakteristične vrednosti indikatora se javlja kao prateća zakonita karakteristika ovih procesa. Primenjena cluster analiza i rezultati ordinacije se uspešno mogu uporedjivati. Razvoj clauster-a pokazuje povezanost izmedju vremenske i prostorne diferencijacije zajednica, odnosno sa dinamikom vegetacije flore mulja u koritu reke.

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TISZA WATER, AS IRRIGATION WATER, POLLUTED WITH VARIOUS COMPOUNDS

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Abstract

One of the greatest problems in our times is environmental protection, which affects agricultural and horticultural plant cultivation in a complex manner. The compounds getting into the river and canal waters are harmful to the plants in various ways by means of watering.

Introduction

The effects displayed on cultivated plants of polluted matter found in water systems have been studied by several authors, e.g. SHULKA et *al.* 1977, BEJAONI 1980, ALKA et *al.* 1981, KUMAR et *al.* 1983, WAGENER 1983, etc.

The compounds washed into the water system of the Lower Tisza region were studied at the time of watering during the period of sowing and in the case of plants later being in the state of vegetative growth. The degree of damage, tolerance, or wasting away of the plants could be concluded on the basis of the metabolic-indicators. With the adding of Faneron multimixture herbicide + glyphosate, chlorbromurone, common salt and inoxane, a sewage-germicide containing chlorine-iodine, were used in our laboratory experiments.

Materials and Methods

Our experiments were performed with musk melon, hybrid maize and horse-bean plants.

For preemergent treatment the seeds were greminated till the age of 5—6 days, in Petri dishes on filter-paper moistened with the solutions of the compounds, in 23 °C dark thermostat till the day of studying.

In the case of postemergent treatments 3 days old plants germinated under conditions similar to the former, but on filter-paper moistened with tap-water were treated with the adequate solution concentrations of the variouse ompounds. Simultaneously the plants were placed in light thermostat of cc. 7000 lux illumination and grown till the day of studying in general till the age of 8, 9, 11 days. The controls were grown on tap-water in the case of both treatments.

The compound solutions used were: 2 ml herbicide mixture (brominephenoxime + terbutylazime + glyphosate), 0,5 g chlorbromurone (Maloran), 1 g sodium chloride in 1—1 liter tap-water, 0,5 ml inoxane (Incosan-W iodofor) germicide solved in sewage.

Studies were performed on growth, dry matter accumulation, ascorbic acid content, total soluble protein amount, development of peroxidase enzyme activity, total phenol amount as well as the changes in RNA values (Lowry et al. 1951, Lavee-Glaston 1968, Spies 1955).

The experiments were repeated 3—5 times.

Results and discussion

The results obtained for the preemergent treatment of the musk melon seeds are summarized in Table 1.

The sewage displayed greatest effect on the development of the seedlings, even with the presence of a certain amount of germicide. Negligible deviation was experienced in respect to ascorbic acid content, total soluble protein and total phenol amount compared to the control. Therefore the seedlings could not have been damaged.

The musk melon seedlings sustained the various compounds quite well under preemergent conditions.

The measurement data of the 8 days old postemergent-treated musk melon seedlings are summarized in Table 2.

With the exception of ascorbic acid, there was no such difference between the various indicators which would have indicated ageing and wasting away, respectively. However, the amount of ascorbic acid exhibited rather high value, referring to the revived processes. Only slight degree of deviation was observable between the various indicators.

Table 1. *Data of 5 days old musk melon seedlings receiving preemergent treatment*

Treatment	Length	Dry matter	RNA	Ascorbic acid	Total soluble protein	Peroxidase	Total phenol
	mm	mg/g fresh weight	γ/g fresh weight	γ/g fresh weight	γ/g fresh weight	EU/g fresh weight	γ/g fresh weight
	Shoot+ +root	Shoot+ +root	shoot	shoot	shoot	shoot	shoot
2 ml herbicide mixture/ 1 tap water	77	93	126	191	294	23	100
0,5 g chlorbromurone/ 1 tap water	89	92	133	193	330	23	94
1g NaCl/1 tap water	136	79	103	174	243	15	90
0,5 ml inox./1 sewage	166	95	112	159	243	20	112
tapwater control	65	100	105	160	240	18	96

Table 2. *Data from the shoot of postemergent-treated 8 days old musk melon seedlings*

Treatment	RNA	Ascorbic acid	Total soluble protein	Peroxidase	Total phenol
	γ/g fresh weight	γ/g fresh weight	γ/g fresh weight	EU/g fresh weight	γ/g fresh weight
2 ml herbicide mixture/ 1 tap water	195	260	285	37	120
0,5 g chlorbromurone/ 1 tap water	161	213	270	36	128
1 g NaCl/1 tap water	186	267	274	31	116
0,5 ml inox./1 sewage	110	373	233	32	120
tapwater control	124	168	257	28	111

The effect of the various agent solutions was also studied in the case of the hybrid maize seedlings, under preemergent conditions. The results are comprised in Table 3.

Table 3. *Data of 6 days old hybrid maize seedlings receiving preemergent treatment*

Treatment	Length mm Shoot+ +root	Dry matter mg/g fresh weight Shoot+ +root	RNA γ/g fresh weight shoot	Ascorbic acid γ/g fresh weight shoot	Total soluble protein γ/g fresh weight shoot	Peroxidase EU/g fresh weight shoot	Total phenol γ/g fresh weight shoot
2 ml herbicide mixture/ 1 tap water	117	150	251	332	493	43	144
0,5 g chlorbromurone/ 1 tap water	101	277	338	338	532	44	119
1 g NaCl/1 tap water	118	138	257	298	467	54	117
0,5 ml inox./1 sewage	101	118	259	318	490	52	428
tapwater control	139	121	235	351	503	39	120

The growth of the maize seedlings was in every case adequate compared to the control, slight lag was only detectable regarding the germicide + sewage variant. The dry matter accumulation was the greatest in the case of the seedlings treated with chlorbromurone. Parallel with the rise in RNA content, the amount of total soluble protein also increased to a considerable degree. The total phenol amount showed similar results in every treatment, it only increased to the quadruple of that in the control in the case of the inoxane-treated seedlings.

Table 4 contains the measurement data for the shoots of the 9 days old hybrid maize seedlings.

The revived metabolic processes could be concluded from the values of the peroxidase enzyme activity. In the case of postemergent treatment the shoot's ascorbic acid content, total soluble protein and total phenol amounts were raised by the herbicide mixture and chlorbromurone.

Table 4. *Data from the shoots of postemergent-treated 9 days old hybrid maize seedlings*

Treatment	RNA γ/g fresh weight	Ascorbic acid γ/g fresh weight	Total soluble protein γ/g fresh weight	Peroxidase EU/g fresh weight	Total phenol γ/g fresh weight
2 ml herbicide mixture/ 1 tap water	254	816	606	50	833
0,5 g chlorbromurone/ 1 tap water	292	813	608	56	850
1 g NaCl/1 tap water	297	615	443	41	978
0,5 ml inox./1 sewage	369	624	665	50	928
tapwater control	239	589	573	37	826

Table 5. *Data of 6 days old horse-bean seedlings receiving preemergent treatment*

Treatment	Length	Dry matter	RNA	Ascorbic acid	Total soluble protein	Peroxidase	Total phenol
	mm	mg/g fresh weight	γ/g fresh weight	γ/g fresh weight	γ/g fresh weight	EU/g fresh weight	γ/g fresh weight
	Shoot+ +root	Shoot+ + root	shoot	shoot	shoot	shoot	shoot
2 ml herbicide mixture/ 1 tap water	53	118	150	1041	812	20	445
0,5 g chlorbromurone/ 1 tap water	53	118	153	982	803	19	428
1 g NaCl/1 tap water	64	96	123	764	1067	18	413
0,5 ml inox./1 sewage	70	99	104	656	945	17	449
tapwater control	65	99	104	522	955	18	396

Table 6. *Data from the shoots of poste ergent-treated 11 days old horse-bean seedlings*

Treatment	RNA	Ascorbic acid	Total soluble protein	Peroxidase	Total phenol
	γ/g fresh weight	γ/g fresh weight	γ/g fresh weight	EU/g fresh weight	γ/g fresh weight
2 ml herbicide mixture/ 1 tap water	221	661	722	14	513
0,5 g chlorbromurone/ 1 tap water	232	756	851	19	490
1 g NaCl/1 tap water	231	535	859	16	647
0,5 ml inox./1 sewage	223	500	1016	15	651
tapwater control	316	450	768	16	400

Table 5 shows the data of the 6 days old preemergent-treated horse-bean seedlings.

On the basis of the Table, it could be determined that these compounds were not harmful to the horse-bean seedlings, they only displayed harmful effect in higher amounts and greater salt concentrations.

The measurement data of the shoots of postemergent-treated 11 days old horse-bean seedlings are summarized in Table 6.

The herbicide of chlorbromurone effective agent proved to be harmful to the horse-beans. This conclusion could be drawn on the basis of the increase in the total phenol, total soluble protein, ascorbic acid amounts.

* * *

Our experimental plants reacted to the water-pollutant compounds in different manners. The concentration of the solution is of importance, since the minimal presence of the harmful compound cannot cause disturbance; only in case the irrigation water contains it in high concentration.

Különböző vegyületekkel szennyezett Tisza víz, mint öntözővíz

KOVÁCS ANGÉLA és MÉSZÁROS MÁRIA

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Kivonat

A kísérleti növényeink a vízben lévő vegyületek — Faneron multi keverék gyomirtó szer + glyfozát, klórbrómuron, konyhasó és klór-jód tartalmú szennyvízfertőtlenítőszer, inoxán — hatására eltérő módon reagáltak. Az oldat koncentráció lényeges, mert a károsító hatású vegyület minimális jelenléte zavarokat nem okozhat, csak abban az esetben, ha az öntözővíz töményen tartalmazza.

Засоренная различными химическими веществами вода реки Тисы, как поливная вода

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Резюме

Испытуемые растения по различному реагируют на химические вещества, растворенные в воде — фанерон-глифозат, хлорбомурон, поваренную соль, содержащую хлор-йод, дезфи ницирующие сточную засоренную воду, иноксан. Концентрация растворенных в воде веществ имеет существенное значение, поскольку минимальная концентрация вреда не приносит, но увеличение концентрации вредных веществ имеет вредное воздействие на растения.

Voda za navodnjavanje reke Tise zagadjena raznim jedinjenjima

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Abstrakt

Ogledne biljke su na uticaj herbicida — Faneron + glyfozat, hlorbromuron, kuhinjska so i inoxan-sredstvo za dezinfekciju zagadjenih voda sa hlor-jodidom, različito reagovale. Koncentracija rastvora je bitan faktor, naime, rastvor čiji je uticaj štetan, u minimalnim količinama ne prouzrokuje smetnje. Oštećenja se javljaju samo u tom slučaju, ako se isti, u vodi za navodnjavanje, nalaze u u zasićenoj koncentraciji.

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К ИЗУЧЕНИЮ ЭКОЛОГИИ И НЕКОТОРЫЕ БИОМОРФОЛОГИЧЕСКИЕ ХАРАКТЕРИСТИКИ LEUCOJUM AESTIVUM L. В ПОЙМЕННЫХ ДУБРАВАХ ЗАКАРПАТЬЯ

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Аннотация

Leucojum aestivum L. — редкий вид флоры СССР. В Закарпатье он встречается только в Притисянской низменности. В работе характеризуются экологические условия местопроизрастаний вида в пойменных дубравах. Обращается внимание на фитоценотическую характеристику, сезонный ритм развития *L. aestivum*. Сделана попытка установления условного возраста луковиц цветущих особей вида. Для *L. aestivum* свойственна саморегуляция глубины залегания луковицы в пределах 3—7 см, что, возможно, является приспособлением к наносам почвы в период разлива реки. Изучение фертильности пыльцы по ацетокарминовой методике позволяет считать пыльцу *L. aestivum* нормальной (недефектной). Анализируется семенная продуктивность растений открытой местности и растений под древесным пологом.

Введение

Leucojum aestivum L. европейско-западнокавказский вид, занесенный в Красную книгу СССР ("Редкие и исчезающие виды флоры СССР" 1981) как редкий. *L. aestivum* — важное лекарственное, так как служит источником производства галантамина (Черкасов 1975), и декоративное растение.

L. aestivum произрастает в странах Атлантической Европы, Средиземноморья, Балканского полуострова, в Малой Азии, а в СССР — на Украине, в Молдавии и на Кавказе. Западная граница ареала проходит в Ирландии, южная — в Северной Италии, Албании и Болгарии (Артюшенко 1970). На восток *L. aestivum* распространен до Ирана, на севере произрастает в ФРГ, ГДР и Польше (*Soó* 1973).

На Украине *L. aestivum* встречается в Закарпатье, в Карпатах, в Горном Крыму, реже в Степи (Кузнецова 1965).

В Закарпатской области вид встречается только на Притисянской низменности, произрастает на пойменных лугах, в дубовых лесах, по переувлажненным местам. Больших площадей не занимает, образует локалитеты.

В последние годы ареал *L. aestivum* в Закарпатье значительно уменьшился под влиением человека. В настоящее время зафиксировано только несколько локалитетов на берегах рек и каналов. Для сохранения существующих еще

естественных произрастаний необходимо обеспечить охрану растений в таких местах, изучить эколого-биологические особенности вида и причины, вызывающие сокращение ареала.

Материал и методика

Изучение ареала *L. aestivum* проводилось путем маршрутных исследований. Одновременно узучался видовой состав растительных сообществ с участием *L. aestivum*. Ход надземного развития вида изучался на фиксированных площадках и маркированных отдельных экземплярах. Анализ луковиц производился путем последовательного удаления чешуй от периферии к центру, при этом фиксировалось их положение на донце и по отношению к цветоносу.

При изучении фертильности пыльцы нами использовалась ацетокарминовая методика (Хохлов, Зайцева, Куприянов 1978). Пыльники из цветков помещали в каплю ацетокармина на предметное стекло, вычищали препаровальными иглами пыльцу, и, удалив пустые оболочки, каплю краски с пыльцой накрывали покрывным стеклом. На каждом препарате подсчитывалось не менее 100 пыльцевых зерен.

При изучении образования растениями семян под потенциальной семенной продуктивностью (ПСП) понимается количество семяпочек на учетной единице (плоде или побеге), а под фактической семенной продуктивностью (ФСП) — количество семян на той же учетной единице. По соотношению этих показателей определялся процент семяпочек, развившихся в семена (% семенификации) (Вайнагий 1974). Для *L. aestivum* нами определялась семенная продуктивность побегов на 30 учетных единицах (цветоносах), а коробочек — на 50. Обработка числового материала производилась статистическими методами (Зайцев 1973). Вычислялись: M — среднее арифметическое значение; $б$ — среднеквадратическое отклонение t— критерий Стьюдента; V— коэффициент вариации; P — точность исследования.

Результаты

Работы по изучению *L. aestivum* проводились на территории Великодобронского лесничества, во влажных грабовых дубравах вдоль реки Латорицы — притока Тисы. Эта территория относится к зоне дубовых равнинных лесов. Климат умеренно-континентальный, длительность вегетационного периода 230 дней, среднегодовая температура +9,3°С. Последние весенние морозы бывают до середины мая, ранние осенние возможны с конца сентября. Летом максимальная зафиксированная температура +37°С, максимальное зафиксированное понижение температуры зимой −32°С. Среднегодовое количество осадков 530—700 мм. В течение вегетационного периода выпадает более 80% осадков.

Основными древесными породами местобитаний *L. aestivum* являются *Quercus robur L., Carpinus betulus L., Populus tremula L,. Acer pseudoplatanus L., Fraxinus excelsior L., Populus nigra L., Salix fragilis L., Robinia pseudoacacia L.,* Массив образован естественными насаждениями, но подвергался проходной рубке. Полнота покрова — 0,7—0,8. Территория является государственным заказником.

Полог леса представлен одним ярусом, высота которого 25—28 м; возраст лесообразующих пород около 100 лет, средний диаметр стволов 30—40 см. Подлесок представлен отдельными кустами *Crataegus oxyacantha L.*

L. aestivum произрастает на разреженных участках леса — на просеках, лужайках, вдоль канав и ручейков. В глубоком затенении встречаются только отдельные экземпляры вида. Наибольшая плотность особей вида приходится на пониженные участки микрорельефа, на которых длительное время после разлива реки задерживается вода. Периодические разливы реки (возможные

не только весной и осенью, но и летом) и высокое стояние грунтовых вод способствует поддержанию почвы в этих местах в увлажненном состоянии. Здесь почва засыхает только в очень сухой период.

В образовании растительных сообществ вместе с *L. aestivum* принимают участие следующие виды: *Lysimachia vulgaris L., Dactylis glomerata L., Lythrum virgatum L., Cardamine pratensis L., Lycopus europaeus L., Ranunculus repens L., R. auricomus L., R. cassubicus L., Glechoma hederacea L., Carex pilosa* Scop., *Convallaria majalis L., Caltha palustris L., Ficaria verna* Huds, *Rubus caesius L., Urtica dioica L., Galium aparine L.* Пятна травянистых растений прерываются участками мертвой подстилки.

На рассматриваемой территории *L. aestivum* встречается отдельными группами по несколько экземпляров, полосами шириной до 2 м вдоль ручьев и канав, а также занимает более крупные площади (до 1000 м^2) разнообразной формы в зависимости от характера разреженности полога леса и понижений микрорельефа. Места обитания вида образованы отдельными экземплярами и гнездами, состоящими из различного количества луковиц. Наибольшая плотность особей вида в центральной части местообитаний (60—80 экз/м^2), а на краях количество растений на единицу площади уменьшается (20—40 экз/м^2).

Надземное развитие *L. aestivum* начинается с появлением листьев над поверхностью почвы. В условиях Закарпатья это происходит уже в первой половине марта. Следует отметить, что очередные фенофазы наступают раньше у растений, растущих в местах более сухих, поэтому начало фенофазы и массовое вступление растений в нее довольно значительно раздельны во времени. Так, в 1984 г. начало бутонизации *L. aestivum* зафиксировано в первых числах апреля, а массовая бутонизация отмечалась в третьей декаде того же месяца. Наблюдается отчетливое перекрытие фенофаз — когда основная масса особей бутонизирует, на более сухих местах отмечается обильное цветение. Массовое цветение *L. aestivum* в пойменных дубравах наблюдается уже в первых числах мая (рис. I), а завершается в конце мая — начале июня. К середине июня в ко-

Рис. 1. Массовое цветение *Leucojum aestivum L.*

робочках *L. aestivum* уже можно обнаружить еще незрелые белые семена нормальных размеров. Во второй половине июля начинается высыпание зрелых семян, а к середине августа наблюдается массовая диссеминация. Распространение семян *L. aestivum* напоминает распространение семян *Galanthus woronowii* Los. (Шорина, Просвирнина 1971). По мере дозревания семян цветоносы, продолжающие расти в длину и после цветения, все больше и больше наклоняются к поверхности почвы и в конце-концов либо опускают коробочки на землю, либо опираются на соседние растения и не достигают земли. В первом случае коробочки дозревают на почве и слизь, образующаяся при загнивании их стенок, связывает семена и как бы приклеивает последние к подстилке. Во втором случае коробочки дозревают без контакта с почвой, стенки их становятся сухими, а коробочки легко обрываются. Оборвавшиеся коробочки падают на почву и с ними происходит то же, что и в первом случае, а необорванные коробочки после созревания растрескиваются, высыпая семена. Во всех случаях семена оказываются на поверхности почвы недалеко от материнского организма. Но разливы реки в период дозревания семян могут способствовать распространению вида, так как коробочки и семена могут длительное время удерживаться на поверхности воды.

Отмирание надземной части побегов с их верхнего конца начинается в августе, а к середине сентября она отмирает почти полностью. В это же время из почвы на 0,5—1 см показываются кончики зеленых листьев побега будущего года, которые перезимовывают в подстилке. Этим надземное развитие *L. aestivum* завершается.

Нами проводилась работа по изучению строения луковицы *L. aestivum*. В литературе (Артюшенко 1970) указывается, что она состоит из замкнутых чешуй (низовых листьев и оснований ассимилирующих листьев), только лист, предшествующий соцветию, с не замкнутым влагалищем. Наличие в луковице остатков цветоносов прошлых лет позволяет установить ее условный возраст (по О. В. Смирновой 1967).

Максимальная длительность функционирования чешуи в луковице *L. aestivum* составляет не менее 4 лет, а донце (стеблевая часть побега) сохраняется еще не менее года. Отсюда, максимальный условный возраст луковицы *L. aestivum* составляет не менее 5 лет. Невозможность точного установления длительности жизни отдельного побега связана и с тем, что трудно установить границы между побегами в луковице. В литературе (Артюшенко 1970) указывается, что годичный цикл *L. aestivum* заканчивается образованием цветоноса, но наши исследования показали, что кроме такого окончания возможны и другие — после образования цветоноса возможно еще формирование одной, двух и трех замкнутых чешуй, являющихся основаниями ассимилирующих листов. Поэтому остаток цветоноса прошлых лет является только приблизительной границей отдельного побега. Заложение листов, следующих за цветоносом к центру луковицы, отвечает критерию симподиального ветвления луковичных, установленному для *L. aestivum* (Артюшенко, Щепак 1982).

Для *L. aestivum* свойственна саморегуляция глубины залегания луковицы. Подобные свойства описаны у *L. vernum* L. (Irmisch 1850) и некоторых видов рода *Galanthus L.* (Артюшенко 1970). При этом на определенном уровне подземной части побега образуется утолщение, от которого начинают отрастать луковичные чешуи, а позже и корни — формируется новая луковица. В этот период луковица как бы "раздваивается" (рис. 2). Благодаря такому свойству луковица *L. aestivum* может уменьшить глубину своего залегания на 3—7 см.

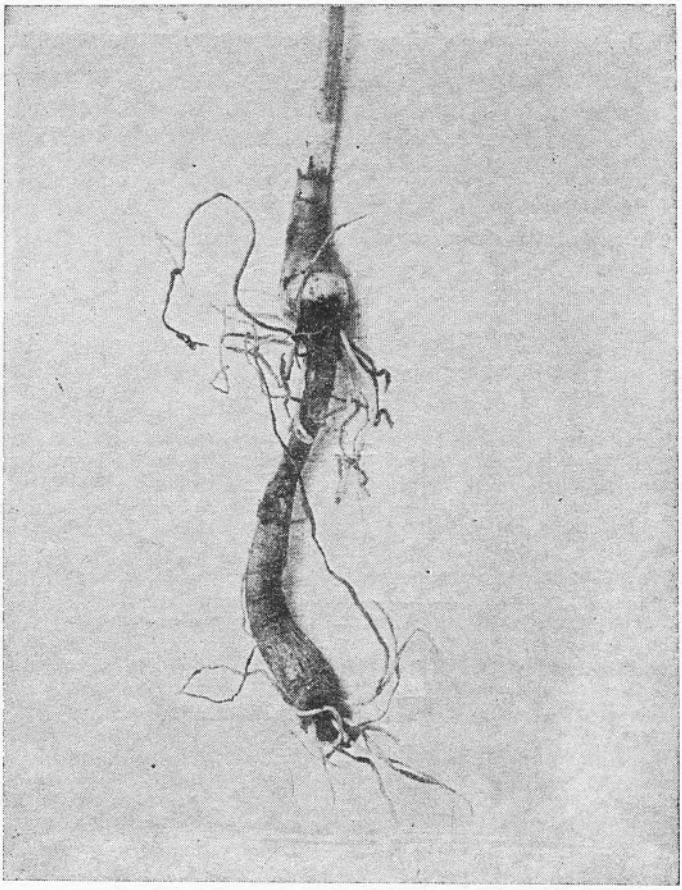

Рис. 2. Саморегуляция глубины залегания луковицы *Leucojum aestivum*

Новообразованная луковица длительное время сохраняет следы описанного процесса. В пойменных дубравах нами отмечена высокая встречаемость луковиц с такими следами, причем по некоторым луковицам можно установить, что они неоднократно изменяли глубину залегания. Возможно, это является приспособлением вида к удержанию подземных органов на определенной глубине при периодических разливах реки, сопровождающихся наносом почвы.

Фертильность пыльцы изучалась на первых цветущих растениях, во время массового цветения и в фазу завершения цветения. Фертильная пыльца хорошо окрашивается ацетокармином, в ней отчетливо видны вегетативное и генеративное ядра. Количество дефектной пыльцы составляет 3—4%. Поскольку дефектность пыльцы *L. aestivum* меньше 11%, то ее следует считать нормальной (Хохлов, Зайцева, Куприянов, 1978).

Вычисление потенциальной и фактической семенной продуктивности производлось в двух вариантах — из растений открытых местностей на краю леса и из растений под более или менее сомкнутым древесным пологом. Такое разделение принято нами только по степени освещенности места произрастания

Таблица I. *Семенная продуктивность Leucojum aestivum в пойменных дубравах Латорицы (1984 г.)*

Место произрастания	Учетная единица	ПСП					ФСП					% семенификации
		M	*δ*	*t*	*V*	*P*	*M*	*δ*	*t*	*V*	*P*	
Открытый участок	цветонос	77,83	25,70	14,85	33,02	6,73	23,38	9,11	12,57	38,96	7,96	30,04
	плод	23,26	3,78	43,89	16,25	2,28	7,46	5,14	10,22	68,90	9,79	32,07
Под пологом леса	цветонос	82,73	28,58	15,85	34,55	6,31	13,71	4,67	17,35	34,06	5,76	16,57
	плод	23,88	3,45	48,73	14,45	2,05	3,88	1,64	16,87	42,26	5,93	16,25

растений. Полученные результаты приведены в таблице I. При близких значениях ПСП у растений обеих групп наблюдается большое различие между ними в значениях ФСП. Под пологом леса образуется меньше семян, чем на открытом месте. Полученные результаты свидетельствуют о более эффективном происхождении процесса образования семян на открытых освещенных местах.

Литература

Артюшенко З. Т. (1970): Амариллисовые *(Amaryllidaceae Jaume St.- Hilaire)* СССР. Морфология, систематика и использование. — Ленинград: Наука. — 180 с.

Артюшенко З. Т., Щепак А. В. (1982): Ветвление победа у представителей семейства *Amaryllidaceae* — "Ботан, журн." *67*, 1074—1082.

Вайнагий И. В. (1974): Семенная продуктивность и всхожесть семян некоторых высокогорных растений Карпат. — "Ботан, журн." *59*, 1439—1451.

Зайцев Г. Н. (1973): Методика биометрических расчетов. Математическая статистика в экспериментальной ботанике. — Москва: Наука.

Кузнецова Г. О. (1965): Білоцвіт — *Leucojum L.* — В кн: Визначник рослин України. Київ: Урожай.

Редкие и исчезающие виды флоры СССР, нуждающиеся в охране. (Под ред. акад. А. Л. Тахтаджяна) (1981): — Ленинград: Наука.

Смирнова О. В. (1967): Жизненный цикл сибирской пролески (*Scilla sibirica* Andr). — „Биол. науки", *9*, 76—84.

Хохлов С. С., Зайцева М. И., Куприянов П. Г. (1978): Выявление апомиктических форм во флоре цветковых растений СССР. — Саратов: Изд-во Сарат. ун-та.

Черкасов О. Я. (1975): Белоцветник летний — перспективный галантамин-содержащий — В кн.: Ресурсы дикорастущих лекарственных растений СССР. Вып. *3*, — 238—241.

Шорина Н. И., Просвирнина Е. А. (1971): Особенности большого жизненного цикла подснежника Воронова (*Galanthus woronowii* Los) в лесах Западного Закавказья. — "Биол науки" *4*, 65—74.

Irmisch Th. (1850): Zur Morphologie der monokotylischen Knollen — und Zwiebelgewächse. — Berlin.

Soó R. (1973): A magyar flóra és vegetáció rendszertani növényföldrajzi kézikönyve I—VI (Synopsis systematico-geobotanica florae vegetationisque Hungariae). — Budapest.

A Leucojum aestivum biomorfológiai és ökológiai jellemzői Kárpátalja mocsaras tölgyeseiben

Komendár V. I. és Szabados V. I.

Uzsgorodi Állami Egyetem Növénytani Tanszéke

A *Leucojum aestivum* Szovjetunió flórájában ritka fajnak tekinthető. Kárpátalján csupán a Felső Tiszavölgy rétjein és erdeiben fordul elő. Szerzők e tanulmányban a Nyári tőzike mocsaras tölgyesekben kialakult életfeltételeinek törvényszerűségéről számolnak be. Tisztázták a faj fitocönológiai jellemzőit valamint szezonális dinamikáját; virágzó példányai hagymáinak hozzávetőleges korát. Megállapították továbbá a *Leucojum aestivum* hagymájának mélység-szabályozó képességét. Határa 3—7 cm között ingadozott. Feltételezhető, hogy ez az önszabályozó alkalmazkodási készség a folyó árhullámaival kapcsolatos talajfeltöltődéssel hozható összefüggésbe. Virágpora tanulmányozásának eredményei arra engednek következtetni, hogy a nyári tőzike virágpora normális, nem defektes. Elvégezték a réteken és az erdőkben nőtt egyedek maghozamának összehasonlító értékelését is.

On ecology and some biological features of Leucojum aestivum L. in flooded oaklands of Transcarpathia

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Leucojum eastivum L. is a rare species of the USSR flora. In Transcarpathia it occurs only in Pritissyanskaya lowland. In the study ecological conditions of naturalareas of the species in flooded oaklands are described. Particular attention is paid to phytocenotypic features, seasonal rythm of development of *L. aestivum*. An attempt has been made to determine a convetntional age of bulbs of fiowering individuals of the species. *L. aestivum* has the power of self-regulation of the depth of bulb bedding 3 to 7 cm, which perhaps may be considered as adaptation to soil deposition in the period of river flooding. Study of pollen fertility by means of acetocarmine technique allows to consider L. aestivum pollen as normal one (non-defective).

Seed productivity of the plants at the open area and that under the crown cover is analysed.

Ekološki i biomorfološki prikaz Leucojum aestivum L. iz močvarho-hrastovih šuma sa podnožja Karpata

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Abstrakt

Leucojum aestivum L. je retka vrsta u flori Sovjetskog Saveza. Na podnožju Karpata javlja se samo u dolini reke Tisza. U radu se ukazuje na ekološke uslove, potrebne za razvoj ove vrste u močvarnim hrastovim šumama. Prikazana je fitocenološka karakteristika i sezonska dinamika razvoja. Izvršen je pokušaj utvrdjivanja starosti lukovica primeraka u cvetanju. Karakteristična je pojava samoregulacije dubine lukovica izmedju 3—7 cm, svakako kao prilagodjavanje na zatrpavanje pri poplavama. Polenova analiza ukazuje na normalnu razvijenost polena. Analizirana je fruktifikacija biljaka sa otvorenih staništa i iz šumske sastojine.

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ПОДСОЛНЕЧНИК ДЕСЯТИЛЕПЕСТНЫЙ HELIANTHUS DECAPETALUS L. В БАССЕЙНЕ РЕКИ ТИСЫ

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Аннотация

Helianthus decapetalus L. — новый адвентивный вид во флоре Закарпатья. Впервые он зарегистрирован членами нашей кафедры в 1975 г. в естественных местообитаниях на берегу реки Уж. *H. decapetalus* с каждым годом заселяет все новые территории вдоль берегов рек Притисянской низменности, подавляя развитие аборигенных видов. Он является господствующим видом в сообществе и интенсивно использует условия экотопа.

Приведены данные об экологической приуроченности вида, ритме его сезонного развития. Изложены результаты изучения биологии цветения *H. decapetalus*, фертильности и жизнеспособности пыльцы, семенной продуктивности и всхожести семян.

Введение

Антропогенное воздействие на природные экосистемы нарушает равновесие, приводит к изменению нормальной структуры и взаимоотношений слагающих их компонентов. Это способствует появлению и внедрению в растительные сообщества новых, не свойственных данному региону видов растений, называемых адвентивными.

На территории Закарпатской области адвентивные растения составляют более 21% от общего числа видов (Фодор 1974). К этой относится исследуемый вид — подсолнечник десятилепестный (*Helianthus decapetalus L.*) из семейства сложноцветых (*Asteracae*). Адвентивное растение очень быстро и нередко весьма обильно заселяет всевозможные нарушенные местообитания — дорожные откосы, заброшенные карьеры, пустыри у населенных пуктов и т. д. Иногда новые поселенцы подавляют развитие аборигенных видов. *H. decapetalus* проявляет способность к полной натурализации.

Нетребовательность этого растения к почве, экологическая пластичность, высокая урожайность зеленой массы и хорошие кормовые достоинства обеспечивают ему внедрение в производство. Одной из причин, препятствующих использованию его в народном хозяйстве, является недостаточное изучение биологических особенностей *H. decapetalus* и недостаточная пропаганда этого растения. Все это побудило нас заняться изучением биологии этого вида.

Материал и методика

Исследования *H. decapetalus* проводились в естественных местопроизрастаниях на Притисянской низменности — вдоль рек Уж, Латорица (притоки р. Тиссы) с 1982 г.

Изучение ареала исследуемого вида проводилось маршрутным методом. Фенологические наблюдения проводились стационарным методом по методике И. Н. Бейдемана (1954). Изучение ветвления побега *H. decapetalus* велось на модельных особях опытного участка ботанического сада Ужгородского государственного университета. Начало ветвления побегов определяли по Г. Э. Шульцу (1966), а порядок побегов — согласно с рекомендациями И. Г. Серебрякова (1952).

Изучая фертильность пыльцы, нами использовалась ацетокарминовая методика (Хохлов, Зайцева, Куприянов 1978). Пыльники из цветков помещали на предметное стекло в каплю ацетокармина, пыльцу вычищали при помощи препаровальных иголок и, удалив пустые оболочки, каплю краски с пыльцой накрывали покровным стеклом. На каждом препарате подсчитывалось не менее 100 пыльцевых зерен. Анализировалась пыльца из периферии и центра корзинки. Жизнеспособность пыльцы определялась путем посева ее на различных искусственных средах (Паушева 1970). Всхожесть и жизнеспособность семян определялась по общепринятой методике (Овчаров 1969; и др.).

Результаты исследований

H. decapetalus — один из самых молодых мигрантов во флоре Закарпатья. Этот североамериканский вид у себя на родине произрастает по берегам рек, на влажной почве (*Prister* 1960). На территории Закарпатской области *H. decapetalus* закрепился и расселился в средних и нижних течениях рек Тисы, Латорицы, Ужа, Реки, Теребли (рис. 1.). Закрепление *H. decapetalus* на новых местах, его натурализация в растительных сообществах области определяется всем комплексом экологических условий новых местообитаний. Климатические и фитоценологические условия оказались благоприятными для этого растения. Оно с каждым годом захватывает все больше территории вдоль берегов рек, образуя местами километровые заросли. Произрастает *H. decapetalus* на влажной, свежей, наносной и заливной почве вместе с представителями родов *Rudbeckia L.*, *Cuscuta L.*, *Echinocystis* Torr. et Gray (Soó 1970), а также среди зарослей ив (*Salix alba L.*, *S. purpurea L.*, *S fragilis L.*, *S. viminalis L.*).

H. decapetalus — клубненосное растение. Надземная масса и корни ежегодно отмирают, клубни (хорошо перезимовывая в земле) весной дают всходы. Появление всходов зависит от температуры почвы. Клубни в условиях Закарпатья начинают прорастать в первой половине апреля при температуре почвы на глубине залегания 5—8°С. Массовые дружные всходы появились в третьей декаде апреля, когда почва лучше прогрелась.

Для исследуемого вида характерно симподиальное ветвление. Начало видимого симподиального ветвления приурочено к периоду бутонизации верхушечного главного побега. В этот период просыпаются боковые аксилярные почки, которые и образуют побеги второго порядка. При симподиальном ветвлении главный побег *H. decapetalus* прекрашает свой рост, в это время образуется боковый побег второго порядка в пазухе первого или второго листа. Он растет в направлении к оси центрального побега. Побеги высших порядков также развиваются по типу симподиального ветвления.

Симподиальное ветвление *H. decapetalus* имеет место как при оптимальной густоте насаждений, так и при разреженной посадке. В процессе онтогенеза особи *H. decapetalus* не переходят от симподиального к моноподиальному ветвлению, поскольку нижние боковые побеги в них не отрастают.

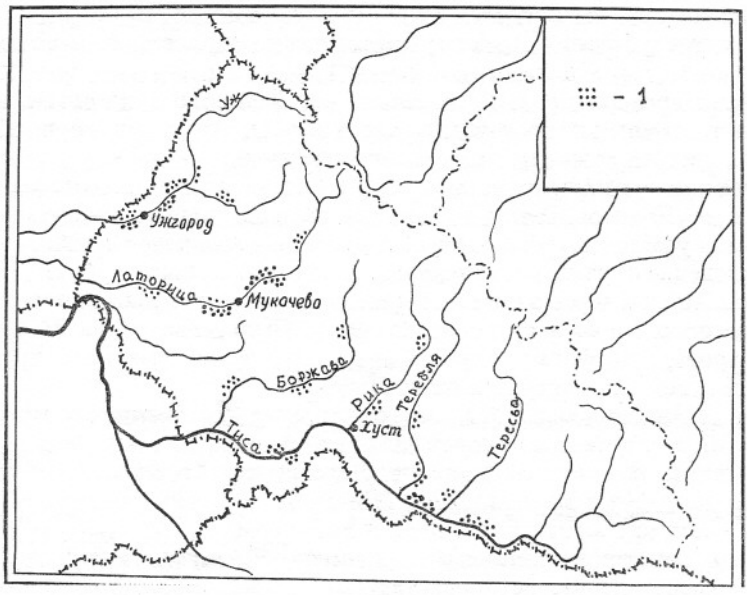

Рис. I. Схематическая карта распространения *Helianthus decapetalus* L. в бассейне реки Тисы.
1 — места произрастания *Helianthus decapetalus* L.

Ветвление — характерная черта растений, обумовленная наследственными особенностями. Известно, что в *H. annuus* L. ветвление контролируется четырьма генами (Hockett, Knowles 1970).

H. decapetalus — представитель подсемейства трубкоцветковых (*Tubuliflorae)*, для которых является характерным собрание многочисленных цветков в одно общее соцветие — корзинку. Количество соцветий на растениях определялось путем подсчета и варьирует от 5 до 50. Диаметр соцветия при развернутых язычковых цветках составляет в среднем 6,8—8,5 см, а диаметр корзинки — 1,1—1,6 см.

Корзинка снизу покрыта ланцетовидными темнозелеными листочками обвертки, которые располагаются черепично. На одной корзинке насчитывается в среднем 20—30 листочков обвертки. Верхняя часть корзинки выпуклая.

По краям корзинки в один ряд расположены оранжево-желтые язычковые цветки. На одно соцветие *H. decapetalus* в среднем приходится 10—13 язычковых цветков; длина их 3,1—5,2 см, ширина — 1,1—1,5 см. Язычковые цветки лишены органов репродуктивной сферы и не плодоносят, но благодаря своей яркой окраске служат для привлечения насекомых опылителей.

Появляяясь из-под листочков обвертки, язычковые цветки вначале прижаты к лиску корзинки имеют зеленоватую окраску. По мере распускания окраска становится все более интенсивной — оранжевожелтой. Время полного разворачивания язычковых цветков совпадает с датой раскрытия крайнего ряда венчиков трубчатых цветков.

Продолжительность цветения язычковых цветков составляет от 10 до 12 дней. Конец цветения язычковых цветков обычно совпадает с датой усыхания рылец трубчатых цветков в центре соцветия, но может быть раньше или позже на 2—3 дня.

Трубчатые цветки в пределах соцветия распускаются от периферии к центру. Общая длина трубчатого цветка с учетом завязи в мужской фазе развития составляет 1,3—1,6 см, а в женской фазе — 1,2—1,4 см. Почти у всех *Asteraceae* наблюдается протерандрия. В соцветиях исследуемого вида также наблюдается протерандрии, которое заключается в том, что тычинки в обоеполых трубчатых цветках созревают раньше, чем пестики.

Максимальное наличие свежей пыльцы на верхушке пыльников. Наблюдается с 8 до 10 часов. Затем количество пыльцы уменьшается, так как подсыхая, она сдувается ветром, собирается и разносится насекомыми.

Определение фертильности пыльцы *H. decapetalus* было произведено путем окраски пыльцевых зерен в ацетокармине. Фертильная пыльца хорошо окрашивается ацетокармином и становит 85—90%. Пыльцевые зерна *H. decapetalus* имеют шаровидную форму, окрашены в желто-оранжевый цвет, трехборозднопоровые и покрыты острыми шипиками.

В семействах злаковых *(Poaceae)*, сложноцветых *(Asteraceae)* генеративное ядро способно вступать во второй митоз в пыльцевом зерне, и в результате образуются два гаплоидных спермия. Деление ядра генеративной клетки *H. decapetalus* проходит в зрелом пыльцевом зерне. В этом случае зрелые пыльцевые зерна содержат вегетативное ядро и два спермия.

Пыльца многих представителей *Poaceae*, *Ericaceae*, *Asteraceae*, *Linaceae* и других семейств, либо не прорастает на искусственной питательной среде, либо прорастает с большим трудом и не образует длинных пыльцевхы трубок (Поддубная—Арнольди 1976). При прорашивании пыльцы *H. decapetalus* в лабораторных условиях нами использовались различные искусственные питательные среды. Прорастания пыльцы исследуемого вида мы так и не добились. Очевидно, фертильная пыльца не всегда прорастает в лабораторных условиях. Результаты прорашивания пыльцы на искусственных средах не всегда соответствуют поведению ее на рыльцах и в тканях пестика.

H. decapetalus в условиях Закарпатской области зацветает поздно — в начале сентября и длится до конца октября. Период вцетения *H. decapetalus* довольно растянут. На растении первыми раскрываются корзинки на верхушке центрального стебля (побег I порядка). Потом раскрываются корзинки побегов высших порядков. В такой же последовательности наступает конец цветения, созревание семян. Несмотря на позднее цветение *H. decapetalus* семена его жизнеспособны, но жизнеспособность их зависит от климатических условий. Семена *H. decapetalus* после сбора не прорастают, они находятся в органическом покое. Изучение лабораторной всхожести семян показало, что они характеризуются низким процентом всхожести (6—35). Имея при свободном опылении сравнительно небольшое количество семянок на одну корзинку — от I до 30 штук, *H. decapetalus* увеличивает семенную продуктивность за счет количества соцветий. Число соцветий на растении зависит от можности развития растения.

Стебли *H. decapetalus* образуют подземные побеги — столоны, на концах которых образуются клубни. Клубни веретеновидной формы, их длина в 3—5 раза превышает диаметр. Веретеновидная форма — признак диких клубненосных видов рода *Helianthus L.* (Пасько 1973). Количество клубней в гнезде незначительное. От длины столонов зависит характер гнезда, а именно, при коротких столонах гнездо компактное, а длинных — раскидистое. Образование столонов начинается через 20—30 дней после начала отрастания надземной массы. Клубнеобразование отмечается в августе. Формирование основного урожая клубней происходит в сентябре — октябре.

Длина вегетационного периода (от массовых всходов до полного отмирания ботвы) составляет 200 и более дней. *H. decapetalus* характеризуется устойчивостью к низким температурам. Весной молодые всходы его хорошо переносят похолодание. Естественное засыхание ветвей и стеблей ускоряется осенним понижением температуры. Отмирание листьев растений *H. decapetalus* идет обычно снизу вверх, так как нижние листья самые старые.

H. decapetalus — травянистое многолетнее растение. Оно может быть использовано как зеленое кормовое, силосное, медоносное растение и является хорошим фильтратором речной воды.

Литература

Бейдеман И. Н. (1954): Методика фенологических наблюдений при геоботанических иссле дованиях. — Москва; Ленинград: Изд-во АН СССР!

Пасько Н. М. (1973): Основные морфологические сортоотличительные признаки топинамбура. — Труды по прикладной ботанике, генетике и селекции. т. 50, вып. 2.

Паушева З. П. (1970): Практикум по цитологии растений. Учеб. пособие для высших с. х. заведений. — Москва.

Поддубная—Арнольди В. А. (1976): Цитоэмбриология покрытосеменных растений. — Москва.

Серебряков И. Г. (1952): Морфология вегетативных органов высших растений. — Москва.

Фодор С. С. (1974): Флора Закарпатья. — Львів: Видавниче об єднання "Вища школа".

Хохлов С. С., Зайцева М. И., Куприянов П. Г. (1978): Выявление апомиктичных форм во флоре цветковых растений СССР. — Саратов: Изд-во Саратов. ун-та.

Шульц Г. Э. (1966): Методы фенологических наблюдений при ботанических исследованиях. — Москва.

Hockett E. A., Knowles P. F. (1970); Inheritance of branehing in sunflowers, *Helianthus annum* L. — Crop. Sci. *10*, 432—436.

Prister Sz. (1960): Megjegyzések adventiv növényeinkhez. — Bot., Közlem., *48*, 265—267

Soó R. (1970): A magyar flóra és vegetáció rendszertani — növényföldrajzi kézikönyve. — Budapest:

A Helianthus decapetalus L. előfordulása a Felső-Tisza völgyében

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Uzsgorodi Állami Egyetem Növénytani Tanszéke

A *Helianthus decapetalus L.* Kárpátalja flórájának új adventív faja. Az Ung-parti természetes lelőhelyén a Tanszék munkatársai 1975-ben lelték fel. Azóta e faj évről évre újabb termőhelyeken honosodik meg a Felső-Tiszavölgy folyópartjai mentén. Térhódításával az abrogén fajokat is elnyomja. Ezáltal az ökotípus termőhelyi viszonyait intenzíven kihasználva egyes növénytársulásokban uralkodó szerepet tölt be. Ökológiai igényére, szezonális dinamikájára vonatkozóan újabb adatok váltak ismertté. A tanulmányban a *Helianthus dacapetalus* virágzás biológiájára, virágporának életképességére s magjának fejlődésére vonatkozó vizsgálati eredmények is közlésre kerültek.

Helianthus decapetalus L. in the Tissa river basin

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Helianthus decapetalus L. is a new adventive species in the flora of Transcarpathia. For the first time it was identified by the members of the chair of botany in its natural area on the bank of the Uzh river in 1975. *H. decapetalus* extends its natural area along the banks of the Pritissyanskaya lowland rivers suppressing the development of the aboriginal species. It is the domin9nt species in the community, and it uses the conditions of the ecotope intensively.

Data of ecological environment of the species, the rythm of its seasonal development are given Results of study of H. decapetalus flovering, fertility and viability of the pollen, seed productivity and vitality are stated.

Helianthus decapetalus L. u dolini reke Tise

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Abstrakt

Helianthus decapetalus L. je nova adventivna vrsta u flori na podnozju Karpata. Prvi put je registrovana 1975. godine na prirodnim staništima uz obale reke Uz, od strane saradnika Katedre za botaniku. *H. decapetalus* is godine u godinu osvaja nove površine uz recni sliv reke Tise, potisnuvši aborigene vrste. Vrsta se javlja dominantnim u pojedinim biljnim zajednicama, pošto intenzivno iskorišćava ekološke uslove staništa. U radu se daju podaci o ekologiji i sezonskoj dinamici razvoja vrste, te o biologiji cvetanja, o virulentnosti polena i o razvoju semena.

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MICROBIOLOGICAL EXAMINATION OF THE CARSKA BARA SWAMP WATER

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(Recived September 30, 1984)

Abstract

Microbiological examinations of the Carska bara swamp water performed from the middle of the 1981 to middle of the 1984. They included the total count of bacterioplankton by means of direct method, and the count of heterotrophic bacteria by means of cultivation methods. Electron microscopic examinations of plankton and attached forms of bacteria were done in order to get more complete pattern of microbe populations of the investigated ecosystem.

The results of examination of bacterioplankton occurence in Carska bara swamp water show the significant fluctuations but not strictly sesonaly dependent. Between the count of bacteria and observed physico-chemical parameters in swamp water relatively low coefficients of correlation were found.

Introduction

A large number of smaller and bigger water pools which were the part of flooded region originated between the Danube, the Tisza and the Begej were located in the area of the west part of Banat once, thanks to geomorphological and pedological factors, but to the contrary of relatively arid climate. The Theiss flow was regulated in the last century and in that way the water regime of the whole region was changed, so came to the significant reduction of flooded terrains. The constructions of canals of the hydrosystem Duna—Tisza—Duna (Danube—Theis—Danube), led to the configuration changes of this terrain, which made the number of natural, especialy statical water pools in this area more decraesed (HAM 1975). The largest part of the area, within 10 km of the former Begej, was surrounded with embankments and separated of the flows of the Theiss and the Begej.

On the right side of the Begej, between its bank and defensive embankment, the well known swamp Carska bara is situated. It is the special type of the natural reservation, in the part of which, Vojtina mlaka is protected since 1955. Carska bara swamp is autochthonous pool over 300 ha (BUJNOVIĆ 1973). That is swampy area in the broadest sence, the water level beeing regulated mostly by the waters of the Old Begej flow. The water level changes during the year lead to the various residences changes. During the steady water level of the Begej, Carska bara is covered by water macrophytes, and it is surrounded by valley flooded forests (DJERFI 1962; ŠOTI. and DIMITRIJEVIĆ 1974). Such conditions make possible for the great number of swamp birds to find exceptional conditions for permanent stay, for bilding nests, as well as for the longer or shorter stop during the migration. That is the very reason for

numerous ornithologic observations and the examination of this pool. We did not find however any details on former microbiological examinations of Carska bara swamp water. Considering the importance of microorganisms in the processes of matter cycling in nature, in the nutrition chaines, we have examined bacterial component in the Carska bara swamp water, which was not studied so far.

Materials and Methods

Microbiological examinations of Carska bara water were performed since the summer of 1981 (the month of July) to the summer of 1984 (the month of August). The total count of bacteria was examined by ultrafiltration method (RAZUMOV 1932), on membrane filters „Sartorius No 2". The count of heterotrophic bacteria (on nutrient agar) was determinated by standard cultivation method (RODINA 1965). Agarised examined water was used for more complete ecological examinations, as the medium the most similar to the nature of examined environment. Electron-microscopic examinations were also done in order to achiece the complete pattern of micropopulations of the ecosystem in question, to recognise that part of bacterial population which can not be seen by classical methods of cultivation.

The variety of planktons and attached forms of bacteria was followed during the microflora examinations by means of electron-microscopic. The examined water was centrifugated in the amount of 10 cm^3, and the fixatif (4% glutar-aldehyde) was poured over the sediment, in order to recognize various planktonic bacteriol forms. The fixations were performed at the room temperature during 2 hours. The cells were centrifugated and rinsed by destillated water afterwards. Such bacterial suspension was poured on the mash and dried on the air. The mashes were contrasted by phosphotungstenic acid pH 1,7 immediately before electronmicroscope (Jeol TEM — 100 C) screening.

Covering glases were dived in the tested water and exposed 2—7 days in the thermostat on 27 °C in order to recognize the attached bacterial forms. After that, without previous fixation covered glasses were put into fluid nitrogen, they were frozen and dried in vacuum. The glasses dried in that way overgrow with bacteria, were glued for carriers, were covered with gold and observed using scanning electron microscope (Jeol SEM — 35).

Paraell to theses analyses some standard physicochemical factors (the amount of dissolved oxigen, pH and water temperature) were followed.

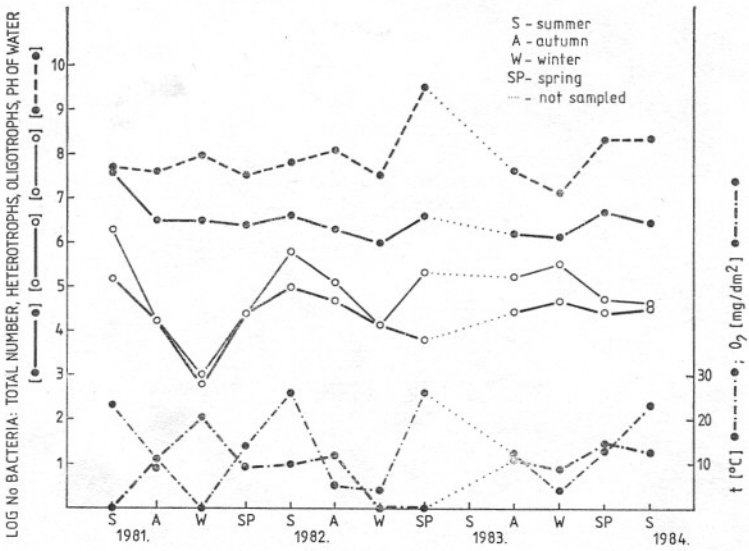
Results

The results of microbiological examinations of Carska bara swamp water showed the variations of amounts of the total count of bacteria as well as their separate groups. These variations depend on seasons although with deviations.

The total count of bacteria went from one to nearly five million cells/cm^3 of water, with exception of summer period of 1971, when even 42 390 000/cm^3 was registrated. Contrary to the total bacterial count (determined by direct method) the number of heterotrophic bacteria (determined on nutrient agar) have shown more significant fluctuations. The number of heterotrophs went from 700—155 000 colonies/cm^3 of water, while the number of colonies obtained on agarised tested water was usually higher and was 1000—1 915 000/cm^3 of water. None of the bacterial groups in question have shown the regular seasonal changes in amount which is partly understandible considering the characteristic of the tested water object.

In the Carska bara swamp water some physico-chemical parameters (pH, water temperature and the amount of the dissolved oxygen) were determined parallel with the following of the count of bacteria. These parameters also changed significantly in tested water.

It should be noted that the obtained values of tested water pH which were shown graphically and compared with logarithm of total count of bacteria (Graf. 1) had similar tendencies. However, correlation coefficient of these two parameters is very low and was only $r = 0{,}23$. The total number of bacteria in the tested water had the



Graf. 1. Number of bacteria and values of physico-chemical parameters in water of Carska bara swamp

higher coefficient of correlation with the temperature (r = 0,40) and with the amount of dissolved oxygen in water (r = −0,42).

Very low coefficient of correlation was found between the number of bacterial colonies and followed physico-chemical factors of the water in question. Heterotrophs had the lowest coefficient of correlation with concentration O_2 in water (r = −0,29), with pH of water (r = −31), and the highest one with water temperature (r = 0,55), while the number of bacteria counted on agarised tested water was the least coased by pH values of water (r = 0,015), a little bit more by dissolved oxygen (r = −0,44), and it correlated the best with water temperature also (r = 0,59).

Relatively low correlation coefficients of bacterial count and aberved physico-chemical parameters in Carska bara water are certainly the result of the complex ecological conditions in this relatively shallow water ecosystem in which we have included only a minor number of the most important factors in our investigations. In such natural residences which are under the very high influence of changes of a borad spectrum of interrelated abiotic and biotic factors, which can hardly be all included in investigations, it is almost impossible to find direct correlation among certain factors. Other autors came to the similar conclusion. BRKOVIĆ—POPOVIĆ and POPOVIĆ (1977) found the abundance of the bacterioplankton inwater current to be naturally variable and dependable on large number of physico-chemical and biological factors which, acting in the same time, very often could influence opositly the development of autochthonous microflora. BRASFIELD (1972), using multiple linear regression analyses in the determination of the dependance between the size of bacterial population in the river water and some physico-chemical factors of the environment, for the largest number of tested parameters also did find statisticaly reliable correlations.

The tested Carska bara water, according to the number of saprophytic bacteria/ cm^3 (SLADEČEK 1973; TÜMPLING 1969) belonged to the second class of quality mostly,

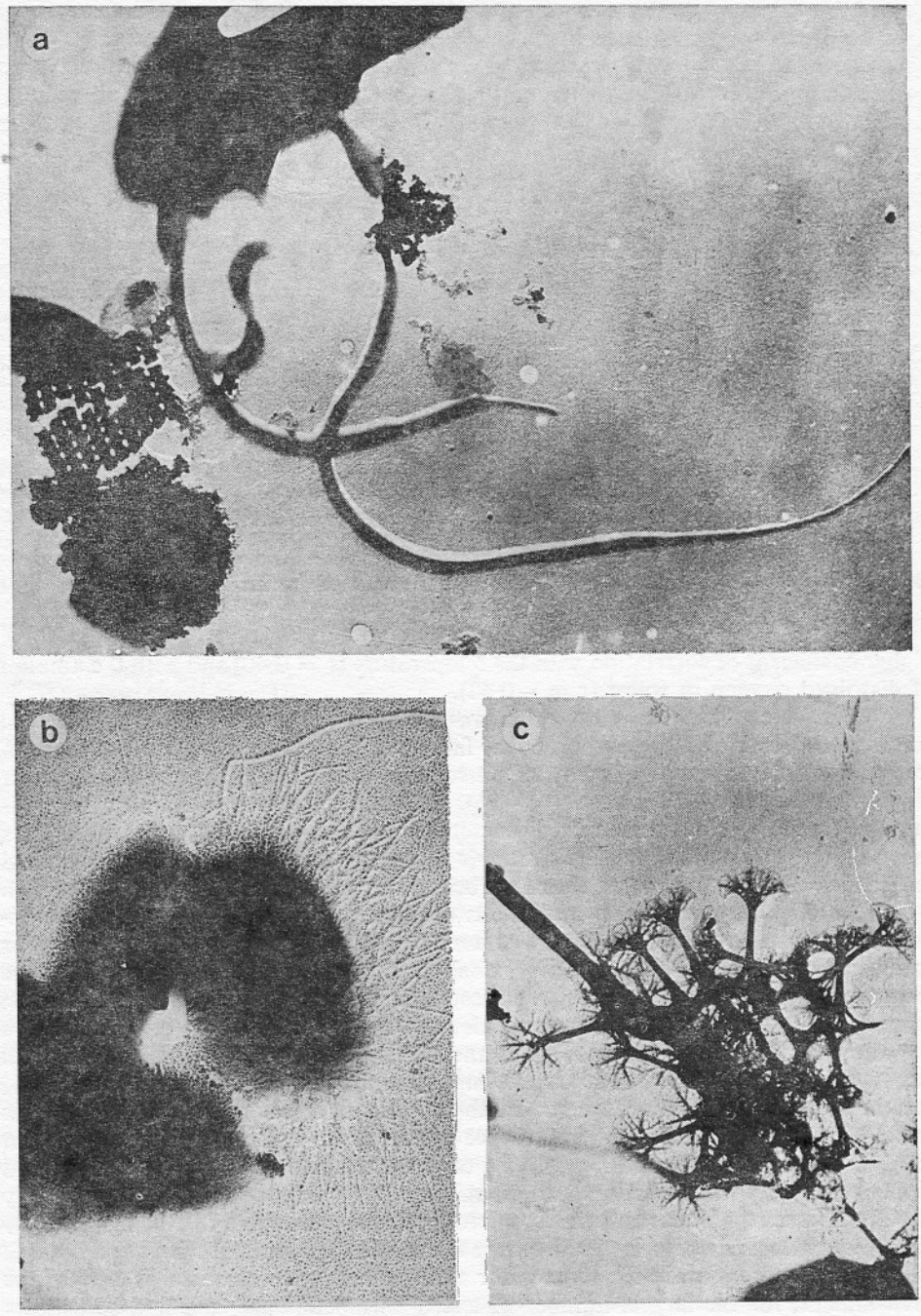


Fig. 1 Various forms of bacterioplankton from the examined water. Caulobacter-like organisms (a), fimbria bearing bacteria (b), unidentified forms (c). Bar indicates 1 μm

with exception in the summer period 1981 and 1982 when it slowly decreased to the third class quality, and the winter period 1982 when it belonged to the first class. The second microbiological indicator of water quality — Korsh's index (the relation between the total count of bacteria and the number of heterotrophic bacteria) have shown that the Carska bara swamp water during the period of investigation was mostly in the category of polluted waters. Moderately polluted was only in 1981 as well as in summer periods during next years of investigations (1982—1984).

A great differences between the total bacterial count and number of heterotrophic bacteria obtained on nutrient agar, were visible regarding to the obtained results. The participation of heterotrophs in the total count of bacterioplankton was only 0,02—3,4%. That was the very reason for us too, wishing to find also those bacteria which could not be grown by standard microbiological methods in laboratory conditions, to use also the electronmicroscopy. Betwen the plankton of the tested water dominated filamentous bacteria which resemble *Caulobacter* (Fig. 1a) by a narrowed and expanded end. Among rod-shaped bacteria, which were numerous, we have noticed also such cells with thick tuft of fimbria on their surface (Fig. 1b). Except the microbial forms which, according to its morphology and dimensions could be easely identified as bacteria or algae, such forms whose origin and nature could not be identified have been noticed (Fig. 1c).

The attempt to observe microflora in its natural sample by method of overgrown slides and observing by scanning electron microscope, have even more shown the wealth and variety of bacterial forms of Carska bara water. Filamentous bacteria *Sphaerotilus — Leptothrix* type, which covered the largest part of overgrown glasses surfaces (Fig. 2a) occured the most frequently as the attached bacterioflora. Among this forms there were such filamentous forms in which individual cells were clearly visible (Fig. 2b) or they were not visible due to the thick slimy sheath (Fig. 2c). Slimy sheath had characteristic irregular form probably as the result of drying. These filamentous bacteria, beside the developed slimy sheath had also slurry filaments which they use to be attached to the substrat (Fig. 2d). In certain cases branching of these bacteria were noted (Fig. 2b, c). Beside the bacteria of *Sphaerotilus — Leptothrix* type, also rod-shaped bacteria of various forms were observed. They occured the most frequently in microcolonies and rarely separatly. The cells themselves had pointy (Fig. 3a) or rounded (Fig. 3b) tips. The characteristic of such microcolonies is the presence of extracellular polysaccharide resembling net matrix (Fig. 3c, d) Such form of slimy matrix leads to the conclusion that racextellular polysaccharides form interrelation, ie. certain communication between cells, besides their role as fixator to substrate. Even when the slime was not very distinct the connections between cells in form of thinner filaments was noticed.

Scanning electron microscopy of original natural sample has advantage over microscopy of cultivated material because it excludes the complex factor of change of environment. This is the way how the forms which usually cannot be obtained in culture have been observed. Apart of that, applied method made the observations of interrelationship among microorganisms in situ possible.

Conclusion

The results of investigation of bacterioplankton quantity in Carska bara swamp water shaw significant fluctuations which are not seasonal always. Relatively low coefficient of correlation between the count of bacteria and observed physico-chemical parameters in water were found.

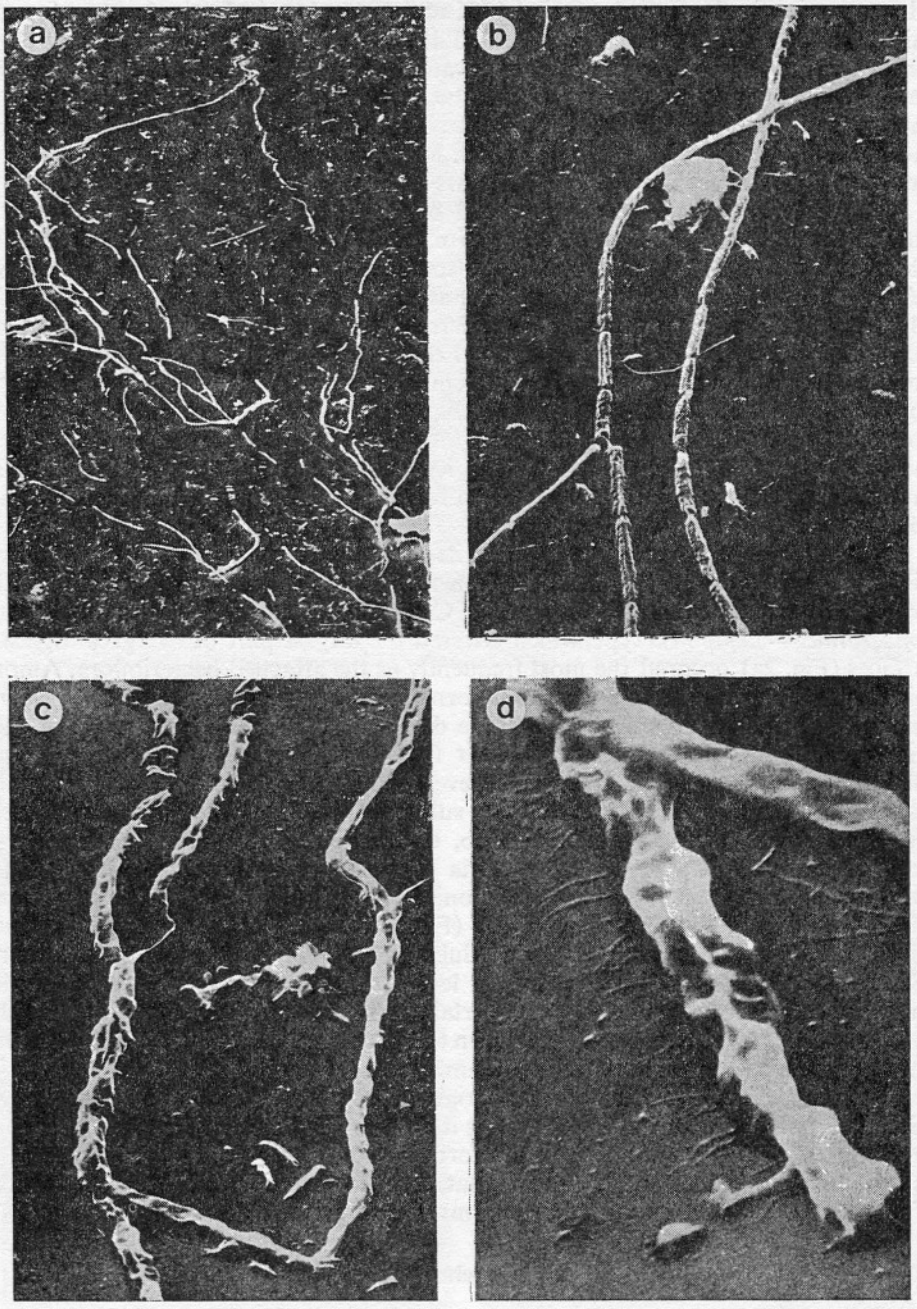


Fig. 2 Attached filamentous microorganisms. Abundance od Sphaerotilus-Lepthotrix-like microorganisms (a), filaments formed of rod-shaped cells (b), filaments embeded in a thick mucilagenous sheath (c), tiny mucilagenous threads protruding from the sheath (d). Bar indicates 1 μm

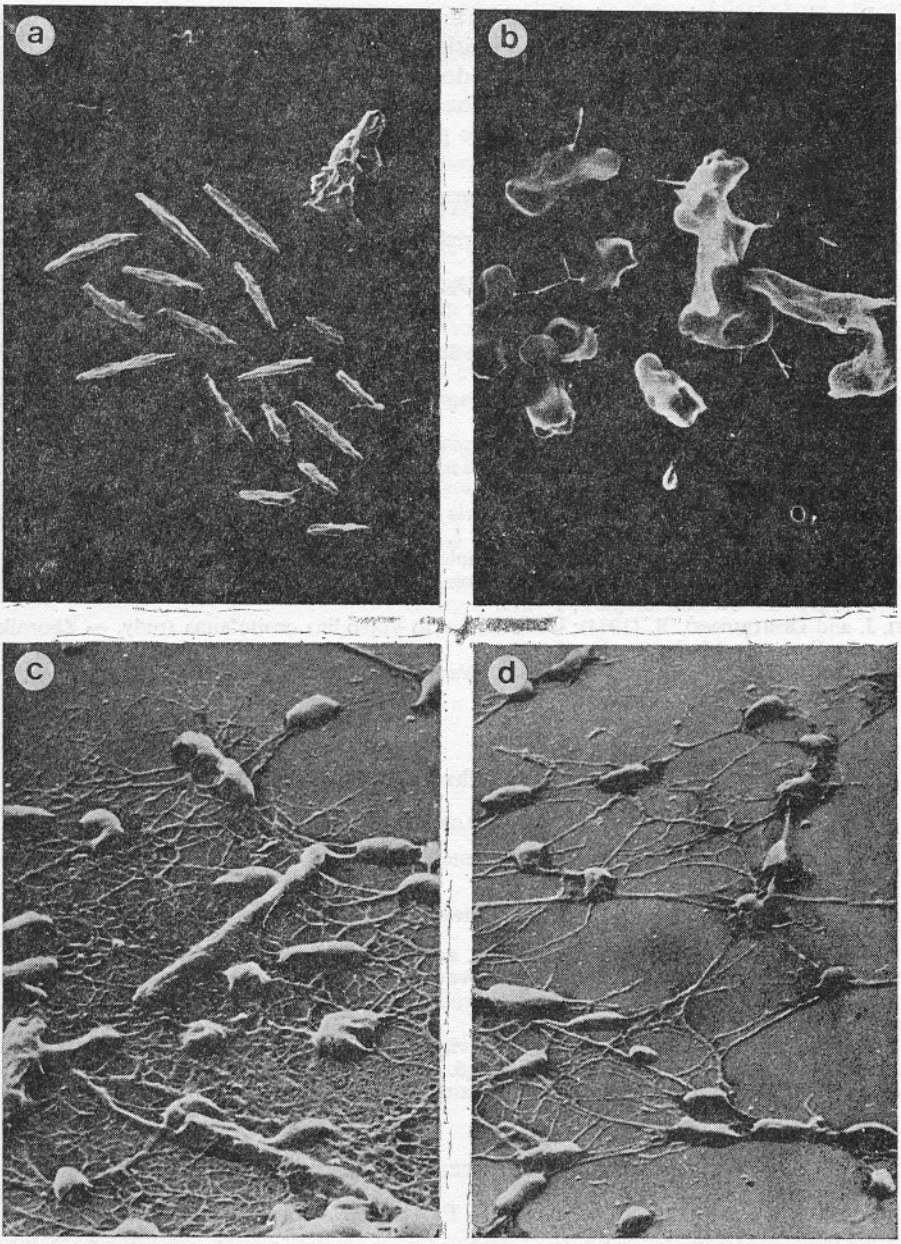


Fig. 3 Attached rod-shaped bacteria. Microcolony of cells with pointed (a) and with rounded (b) ends, and abundant (c) and less abundant (d) presence of mucilagenous threads interconnecting cells in a microcolony. Bar indicates mμ.

By electron microscopic investigation of bacterioplankton microorganisms resembling *Caulobacter,* rods with fimbriae, but also forms of unidentified origin were found. Among the attached forms dominated filamentous bacteria of *Sphaerotilus — Leptothrix* type, coated by slimy sheath and connected by slurry filaments and the rods with visible extracellular netlike polysaccharide matrix.

Literature

BRASFEILD, H. (1972): Environmental factors correlated with size of bacterial populations in a pollu ted stream. — Appl. Microbiol. *24*,349.

BRKOVIĆ — POPOVIĆ, I. and POPOVIČ, M. (1977): Dependance of the quantity of bacteria on the amount of organic matter in surface water quality examination. — Mikrobiologija (Belgrade) *14*, 117.

BUJNOVIĆ, D. (1973): Protected natural objects in Socialistic Autonomous Province of Vojvodina. — Priroda Vojvodine *1*, 23,

DJERFI, B. (1969): Structure of biocenosis of „Carska bara" swamp. — Proc. Symp. Ecol., Belgrade, 12—14 Febr. 1969, p. 41.

HAM, I. (1975): Qualitative composition of Heron colony *(Ardeidae)* and the influence of individual factors of environment on its formation in the region of the Lower Begej in Vojvodina. — Larus *26—28*, 143

RAZUMOV, A. S. (1932): Direct method for bacteria counting in water. A comparison with the method after Koch., — Mikrobiologiya (Moscow), *1*, 131.

RODINA, A. G. (1965): Methods of water microbiology, — Moscow — Leningrad, Nauka.

SLADEČEK, V. (1973): System of water quality from the biological point of view. — Arch. Hydrobiol. *7*, Ergebnisse der Limnologie 7, 1—218.

ŠOTI, J. and DIMITRIJEVIĆ, S. (1974): Contribution to Vojvodina ornitofauna study. — Zbornik za prirodne nauke Matice Srpske *46*, 125.

TÜMPLING, W. (1969): Zur Klassifizierung der Wasserbeschaffenheit aus biologischer Sicht. — Wiss. Z. Univ. Rostock *18*, 793—798.

A Carska bara mikrobiológiai vizsgálata

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Kivonat

A Carska bara mikrobiológiai vizsgálata az 1981—1984-es időszakban a bacterioplankton összmeghatározására - közvetlen módszerrel, illetve tenyészetben a bactériumok számbeli meghatározása mellett az adott ökoszisztéma plankton mikróbái, valamint rögzített formái elektron-mikroszkópos vizsgálatával történt.

Megállapítást nyert, hogy a Carska bara vizében a bactérioplankton összetételének jelentős ingadozása nem szabályos évszakonkénti jellegű. A bactériumok számbeli változása viszonylag alacsony értékeket mutat a víz fizikai-kémiai paramétereihez viszonyítva.

Микробиологические исследования царской лужи

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Резюме

Микробиологические исследования воды Царской лужи произведены в 1981—1984 годах и они охватили совокупное поголовье бактерий прямым методов и поголовье бактерий методами выращивания-разведения, а в целях получения всеохватывающей катрины микробных популяций исследуемой экосистемы проведены также электрон-микроскопические исследования планктонных и прикрепченных форм бактерий.

Результаты исследования представительства (наличия, количества) бактериопланктонов в воде Царской лужи указывают на значительные колебания, не являющийся колебаниями правильного сезонного характера. Также найдены и сравнительно низкие коэфициенты корреляции поголовья бактерий и сопровождающих физико-химических параметров в воде.

Mikrobiološka ispitivanja vode Carske bare

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Abstrakt

Mikrobiološka ispitivanja vode Carske bare su vršena od sredine 1981 do sredine 1984 godine, obuhvatila su ukupnu brojnost bakterioplanktona — direktnom metodom i brojnost bakterija-odgajivačkim metodama, a u cilju dobijanja sveobuhvatne slike mikrobnih populacija ispitivanog ekosistema vršena su i elektron -mikroskopska ispitivanja planktonskih i pričvršćenih oblika bakterija.

Rezultati ispitivanja zastupljenosti bakterioplanktona u vodi Carske bare ukazuju na znatna kolebanja koja nisu pravilno sezonskog karaktera. Nadjeni su i relativno niski koeficijenti korelacije brojnosti bakterija i pra enih fizičko-hemijskih parametara u vodi.

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DIE SAISONALEN VERÄNDERUNGEN DES ZOOPLANKTONS IM ALTWASSER DER THEISS BEI TISZAALPÁR WÄHREND DER JAHRE 1981—83

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Auszug

Anhand von allmonatlichen Materialsammlungen haben wir während der Jahre 1981—1983 die saisonalen quantiativen und qualitativen Veränderungen des Zooplanktons (Testacea, Rotatoria, Entomostraca) verfolgt.

Auch für das Altwasser der Theiss ist — Wie für die meisten lebenden Gewässer überhaupt — charakteristisch, dass in der quantitativen Verteilung des Zooplanktons im Laufe des Jahres gewöhnlich zwei Maxima erscheinen, das eine im Mai (mit etwa 60 000 Ind/10 Liter) und ein kleineres im September (mit rund 48 000 Ind/10 Liter). Die Verringerung der Gesamtindividuenzahl im Sommer kommt gewöhnlich dann zustande, wenn die Temperatur des Altwassers anhaltend über ca. 25 °C steigt. Bei dieser höheren Temperatur setzt eine intensive Zersetzung der im Altwasser reichlich vorhandenen organischen Substanzen ein, was meistens mit der Entstehung grosser Mengen Schwefwlwasserstoff und Methan einhergeht, die sich auf die Mitglieder des Zooplanktons toxisch auswirken. Eine Folge davon ist auch, dass die saprobiologische Qualität der Altwässer gerade in den Sommermonaten, wenn sie auch von Badenden aufgesucht werden, am ungüstigsten ist; der Saprobitätsindex des Wassers erreicht aufgrund des Zooplanktons oft Werte bis zu 2,9. Im Sommer dominieren die Alphaemosaproben Organismen und sogar auch die polysaproben Organismen erscheinen in immer grösserer Zahl.

Einleitung

Die „Toten Arme„, d.h. die Altwässer der Theiss sind typische Begleiter des "lebenden„ Flusses. Entstanden sind sie zur Zeit der Regulierung der Theiss von der Mitte des vergangenen Jahrhunderts an, als die grossen Windungen des Flusses abgetrennt wurden. Nach der Abtrennung an den Ufern erschien die für stehende Gewässer charakteristische Makrovegetation, die Zusammensetzung des Phyto- und Zooplanktons änderte sich und immer ausgeprägter wird die Eutrophisation der See-artigen Altwässer. Nachdem manche Altwässer anlässlich des Hochwassers der Theiss regelmässig oder periodisch überschwemmt werden und weil manche von ihnen entweder durch direkte Kanäle oder Schleusensysteme in ständigem Kontakt mit der Theiss stehen, beeinflusst das aus ihnen in die Theiss gelangende Phyto- und Zooplankton bis zu einem gewissen Grade auch die qualitative und quantitative Zusammensetzung des Phyto- und Zooplanktons des lebenden Flusses.

Die Zusammensetzung des Zooplanktons der Altwässer entlang der Theiss haben Frau L. SZÉKELY (1954), J. MEGYERI (1961) und D. GÁL (1982) untersucht. Frau SZÉKELY hat anhand einjähriger systematischer Sammlungen die Rotatorienfauna des Altwassers bei Gyálarét aufgearbeitet. MEGYERI untersuchte die Zusam-

mensetzung des Planktons von 9 Altwässern entlang der Theiss im Sommer 1957 und 1958. GÁL erschloss die qualitative und quantitative Zusammensetzung des Zoolanktons des Altwassers bei Körtvélyes mittels regelmässiger monatlicher Sammlungen in den Jahren 1971—76. Als Fortsetzung dieser Untersuchungen berichtet die vorliegende Arbeit über das Ergebnis der qualitativen und quantitativen Aufmessungen des Zooplanktons (Testacea, Rotatoria, Entomostraca) im Altwasser bei Tiszaalpár während der Jahre 1981—83.

Das Altwasser von Alpár breitet sich im Bereich der Gemeinde Tiszaalpár am rechten Theissufer auf dem Gebiet des 258.—263. Flusskilometers aus. Die Abtrennung war 1856 erfolgt. Der abgetrennte Altwasserraum hat Hufeisenform, ist ca. 8 km lang und 100—150 m breit (Abb. 1). Das Sammelgebiet liegt etwa bei einem Drittel des nördlichen Teiles des Altwassers, das sich hier in nord-westlicher bzw. südöstlicher Richtung erstreckt. Der eine Teil des südwestlichen Ufers — das Dorf-

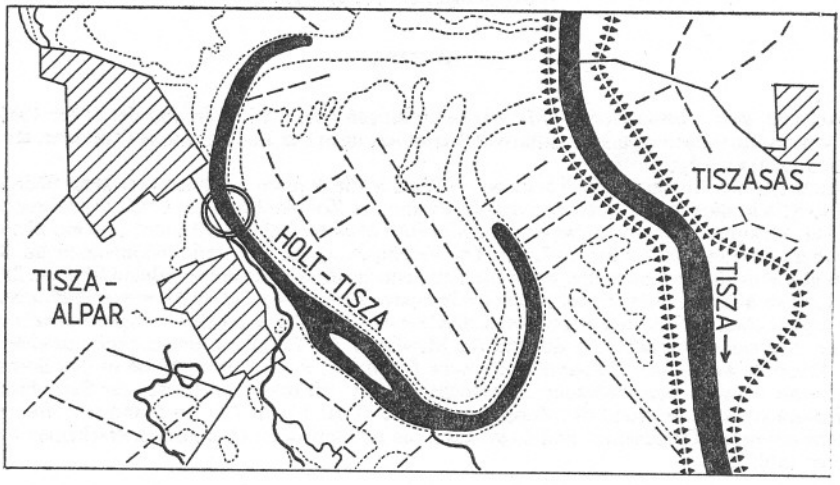

Abb. 1. Schematische Karte des Altwassers der Theiss bei Tiszaalpár. (⊙ Sammelstelle)

nahe Ufer — fallt leicht ab, ist sandig und wird im Sommer als Freistrand benutzt. Das Wasser ist hier seicht, erst in ca. 3—4 m vom Ufer entfernt erreicht es eine Tiefe von 1 m. Mit Ausnahme des als Badestrand abgegrenzten Uferabschnittes findet sich am Wassersaum in einem schmalen Streifen eine Wasservegetation. Das gegenüberliegende Ufer ist schlammig und in einer Breite von 30—40 m mit Wasserpflanzen besiedelt: es decken Schilf *(Phragmites communis)*, Binsenarten (Typhaceae), verhiedene Tümpelunkräuter (Ceratophyllaceae), stellenweise mit Stachelnuss *(Trapa natans)* und Teichrosen *(Nymphaea alba)* Flecken. Der mittlere Teil des Altwassers ist ein offener Wasserpiegel, hier beträgt die Wassertiefe 2,5—3 m, den Boden deckt eine 70—80 cm hohe lockere, schwarze Schlammschicht (mit Schwefelwasserstoff- und Methangehalt).

Sammel- und Aufarbeitungsmethoden

Die Sammlungen fanden allmonatlich in der Mitte des Monates zwischen dem 12. und 18. in den Mittagsstunden — zwischen 10 und 12 Uhr — statt. Die Wasserproben wurden im Bereich des Strandes 2—3 m vom Uferrand mittels Planktonnetz Nr. 25 entnommen und anälsslich der einzelnen Samm-

lungen 50 oder 100 Liter Wasser filtriert. Das gesammelte Material wurde sofort an Ort und Stelle in Formalin fixiert.

Bei der Aufarbeitung wurde das eingeholte konzentrierte material im Messzylinder mit Wasser auf 10 ml ergänzt und 1 ml davon (oder, wenn das Plankton sehr reichhaltig war, 0,5 ml) auf dem Objektträger unterm Deckgläschen mikroskopisch durchgesehen, die Individuenzahl der vorkommenden Arten registriert, die erhaltenen Resultate auf Ind/10 Liter Individuenzahl umgerechnet (In der

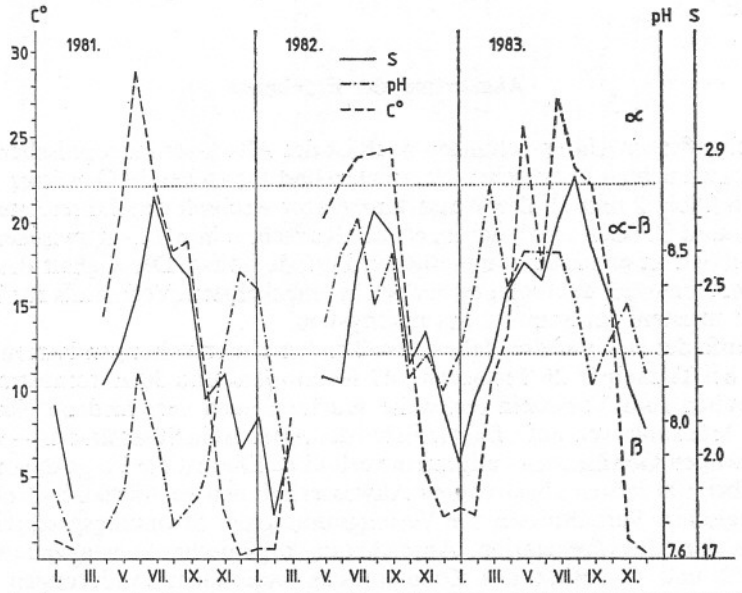

Abb. 2. Veränderungen der Temperatur, des pH und des Saprobitätsindexes (S) des Altwassers der Theiss bei Tiszaalpár

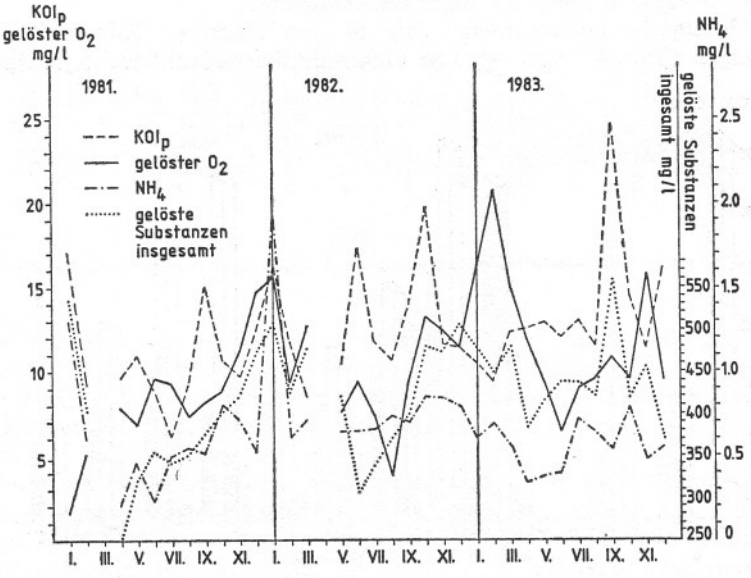

Abb. 3. Einige chemische Parameter des Altwassers der Theiss bei Tiszaalpár (gelöster 0^2, KOIp, NH_4^+, gelöste Substanzen insgesamt)

Tabelle 2. sind die auf 10 Liter berechneten Individuenzahlwerte aus praktischer Sicht abgerundet angegeben), sowie die prozentulle Verteilung der einzelnen Taxongruppen (Tabelle 1) und mit Hilfe der Pantle-Buck'schen Methode der saprobiologische Index errechnet (Abb. 2)

Parallel mit den Sammlungen wurden im Laboratorium der Direktion der Wasserwirtschaft im Unteren-Theiss-Bereich eingehende chemische Untersuchungen angestellt, von deren hinsichtlich des Zooplanktons wichtigeren Daten einige, wie Wassertemperatur, pH-Veränderung Abbildung 2 bzw. bzgl. des gelösten Sauerstoffs, KOI_p, NH_4^+ und der Menge der insgesamt gelösten Sotffe Abbild ung 3 enthält.

Auswertung der Ergebnisse

Den chemischen Untersuchungen nach ist das Altwasser eutrophischen Charakters. Die untersuchten chemischen Parameter sind für stehende Gewässer ähnlicher Art typisch (Abb. 2 und 3). Die Wassertemperatur wechselt den Jahreszeiten gemäss zwischen 0 und 30 °C, das Wasser ist etwas alkalisch, sein pH liegt zwischen 7,6 und 8,7; gewöhnlich ist er in der sommerlichen Periode höher. Der Gehalt des Wassers an gelöstem Sauerstoff wechselt gewöhnlich in umgekehrtem Verhöltnis zur Temperatur und ist meistens im Sommer am niedrigstem.

Im Laufe der sich auf drei Jahr erstreckenden Untersuchungen kamen aus dem Altwasser bei Tiszaalpár 26 Testaceen-, 47 Rotatorien- und 30 Entomostraca-Arten bzw. Varietäten zum Vorschein (zeitweise tauchten auch verschiedene Nematodenarten und Mückenlarven auf). Ein Grossteil der Arten ist in Süsswässern — vornehmlich in stehenden Gewässern — allgemein verbreitet. Dies ist die Folge davon, dass in dem seit über 100 Jahren abgetrennten Altwasser mit den veräderten hydrologischen und ökologischen Verhältnissen wie Verlangsamung der Strömungsgeschwindigkeit, Erscheinen der Makrovegetation, Anreicherung organischer Substanzen usw., auch die Qualität und Quantität des Zooplanktons wesentliche Anderungen erfahren haben. Im Verhältnis zur „lebenden" Theiss ist hier die Arten- wie auch die Individuenzahl erheblich vermehrt: die Artenzahl erreicht ein 2—3-faches und die Individuenzahl ein 10—20-, ja minunter sogar ein 50-faches.

Die Gesamtzooplanktonmenge zeig in den einzelnen Jahreszeiten enorme Schwankungen (Tab. 1, Abb. 4). Die Gesamtindividuenzahl weist jährlich in der

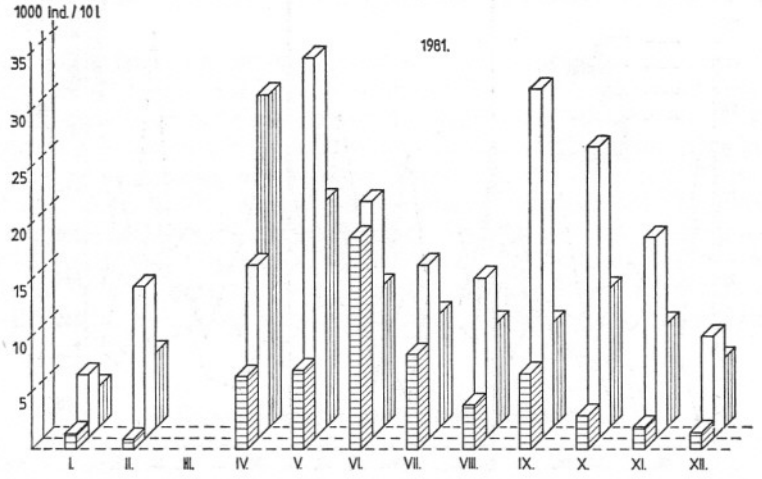

Abb. a

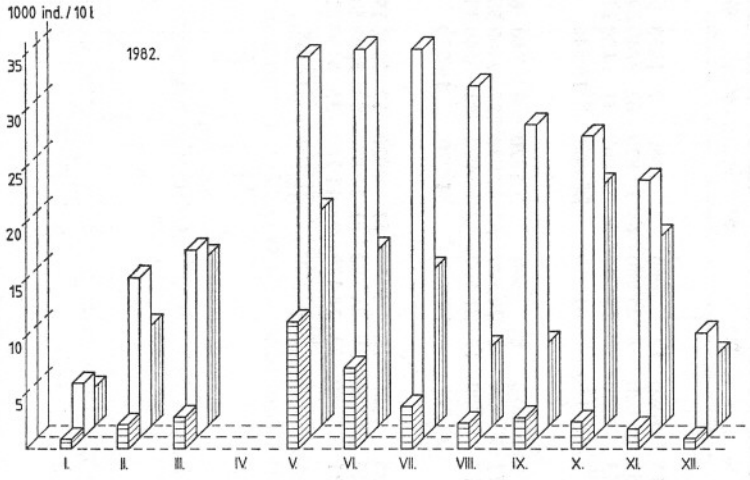

Abb. b

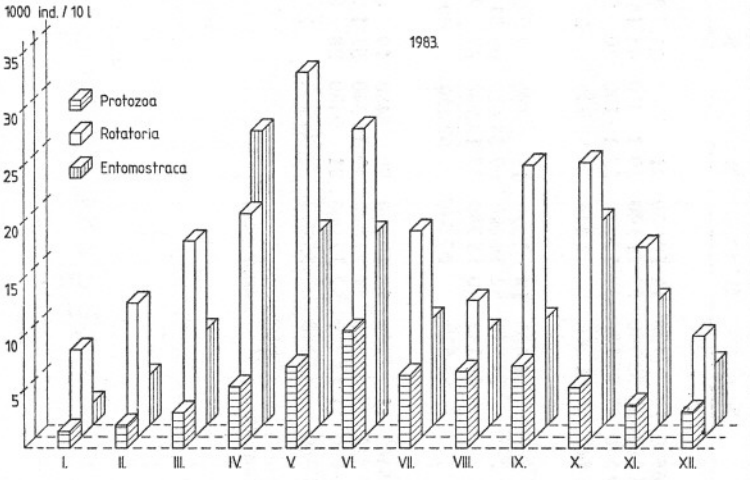

Abb. c

Abb. 4. Die quantitative Veränderung des Zooplanktons im Altwasser der Theiss bei Tiszaladár

Regel zwei Maxima auf: ein grösseres im Frühjahr (57 000—65 000 Ind/10 Liter) und ein kleineres im Herbst (mit 38 000—51 000 Ind/10 Liter). In den Wintermonaten geht die Gesamtindividuenzahl auf 9000—18 000 Ind/10 Liter zurück. Beträchlich geringer gestaltet sich die Gesamtindividuenzahl auch in den Sommermonaten (27 000—52 000 Ind/10 Liter).

Im Plankton dominieren — sowohl was die Arten- als auch die Individuenzahl anbelangt — vornehmlich die Rotatorien. Die Rotatorien machen 50—65%, ja nicht selten sogar über 70% des gesamten Zooplanktons aus (Tab. 1). Die Entomostraca-Arten sind mit einer Individuenzahl von rund 30% vertreten, ausgenommen die Frühlingsmonate, wo sie 50—57% erreichen können. Hier lässt dann das prozentuelle

Tabelle 1. *Quantitative (Ind /10 Liter) und prozentuelle Verteilung des Zooplanktons im Altwasser der Theiss bei Tiszaalpár*

	I.		II.		III.		IV.		V.		VI.		VII.		VIII.		IX.		X.		XI.		XII.	
		%		%		%		%		%		%		%		%		%		%		%		%
	1981																							
T:	1520	14	980	5			6520	13	7120	12	18 920	21	8360	25	3980	15	6760	14	2960	7	1980	7	1480	9
R:	5760	52	13 520	64			15 380	30	33 940	55	21 140	50	15 420	45	14 320	52	31 020	66	25 880	63	17 820	62	8940	54
E:	3740	34	6550	31			29 540	57	20 180	33	12 580	29	10 140	30	9160	33	9340	20	12 420	30	9060	31	6120	37
Z:	11 020		21 050				51 440		61 240		42 440		33 920		27 460		47 120		41 260		28 860		16 540	
	1982																							
T:	880	9	2140	8	2880	8			11 460	18	7320	13	3880	7	2420	6	2880	8	2480	5	1920	4	980	6
R:	4920	53	14 380	57	16 780	48			33 920	52	34 440	60	34 420	66	31 380	77	27 920	73	26 920	53	22 980	55	9460	56
E:	3540	38	8960	35	15 120	44			19 140	30	15 780	27	13 980	27	7140	17	7420	19	21 560	42	17 020	41	6540	38
Z:	9340		25 480		34 780				64 520		57 540		52 280		40 940		38 220		50 960		41 920		16 980	
	1983																							
T:	1460	13	2020	11	3120	11	5460	11	7180	12	10 580	20	6480	19	6880	25	7380	18	5440	11	3920	12	3340	19
R:	7920	69	11 940	64	17 380	60	19 820	38	32 440	56	27 440	49	18 340	53	12 120	44	24 120	59	24 380	51	16 880	53	8980	50
E:	2080	18	4560	25	8480	29	26 080	51	18 220	32	17 060	31	9480	28	8540	31	9460	23	18 120	38	11 160	35	5560	31
Z:	11 460		18 520		28 980		51 360		57 840		55 080		34 300		27 540		40 960		47 960		31 960		17 800	

(T = Testacea, R = Rotatoria, E = Entomostraca, Z = zusammen)

Tabelle 2. *Qualitative und quantitative Veränderungen* des *Zooplanktons im Altwasser der Theiss bei Tiszaalpár während der Jahre 1981—83 (wegen Platzmangels gibt die Tabelle das annähernde quantitative Vorkommen der einzelnen Arten an: + = 1—50 Ind/10 Liter, 01 = 51—150 Ind/10 Liter, ... 25 = 2451—2550 Ind/10 Liter usw.)*

	1981												1982												1983											
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI	XII.
Rhizopoda																																				
Arcella costata EHRBG.						+														+									+							
Arcella discoides EHRBG.	+			03	03	04	04	01	+		+				+		08	09	07	05	06	06	06	03	+	04	05	07	09	10	09	08	10	08	06	07
Arcella gibbosa PENARD									01	+							02	01	+									01	+	02	02	02	01	+		
Arcella hemisphaerica PERTY							+													+																
Arcella stellaris PERTY																		+												+						
Arcella vulgaris EHRBG.	03	02		19	20	24	21	09	16	09	05	04	01	05	09		26	16	10	06	07	06	05	02	03	05	05	14	18	22	14	14	14	10	08	08
Centropyxis aculeata STEIN	05	03		15	19	25	22	11	15	08	06	04	02	06	07		22	13	09	06	06	05	06	02	03	04	06	11	15	19	11	12	16	12	09	06
Centropyxis constricta DEFL.	01	+		03	03	05	04	02	03	02	01	+	+		+		05	03	01					+	01	01	03	03	04	07	05	06	07	05	03	+
Cyphoderia laevis PENARD						01	02	+	+								02	02	+																	
Cyphoderia margaritacea EHRBG.							+															+								+	+	+	01	+	+	
Difflugia acuminata EHRBG.	+	+													+												+	+								+
Difflugia amphora LEIDY								+																						+						
Difflugia corona WALLICH						+						+							+	+	02	02	+	+					+	+	+	+	+	+		
D. curvicaulis PENARD								+		+				+																			+			
Difflugia globulosa DUJ.																				+																
Difflugia gramen PENARD	03	03		11	10	13	14	06	14	07	05	04	02	05	08		12	07	04	03	03	02	02	02	02	03	05	08	10	13	09	09	11	08	07	05
Difflugia lanceolata PENARD	02	02		10	10	12	11	05	08	04	03	01	02	02	03		08	06	05	03	04	01			03	02	03	05	08	11	06	07	05	05	05	06
Difflugia lobostoma LEIDY		+												+																						
Difflugia mammillaris PENARD				+																																
Difflugia oblonga EHRBG.												01	01	01	01		04	03	01	01	01	01	+	+	+			01	01	03	02	02	03	02	+	+
Difflugia pyriformis PERTY					+			+							+			+		+																
Euglypha alveolata LEIDY	01			02	02	03	02	02	05	01	+				+		08	06	01	+			+	+	03	02	03	04	08	10	06	05	04	03	01	01
Euglypha brachiata LEIDY									01								02	02	+		+	+														
Euglypha ciliata EHRBG.																	01	01		+									+	+	+	01		+		
Trinema enchelys EHRBG.						+	+	+	+												+	01														
Trinema lineare PENARD				03	03	02	03	02	04	01	+		+		+		06	04	+	+					+	+	+	+	01	02	01	03	01	01	+	+

	1981												1982												1983											
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Rotatoria																																				
Anureopsis fissa GOSSE		02											01														+	01	03	08	03					
Asplanchna priodonta GOSSE							+	08	10	12	11	08	+				+	09	20	22	25	26	22	02	+	02	05	06	18	16	13	09	19	17	12	02
Brachionus angularis GOSSE	10	23		22	49	25	19	14	25	19	15	12	07	23	25		47	41	34	28	25	24	26	14	14	22	27	34	44	36	13	09	18	20	22	17
Brachionus angularis v. bidens PLATE	01	03		05	26	18	11	11	23	20	14	07	02	03	03		12	09	05	04	03	02	01	01	+	03	05	05	06	05	02	01	02	02	03	01
Br. budapestinensis DADAY																			02	04	01															
Brachionus calyciflorus PALLAS	09	17		21	35	20	14	12	16	14	12	06	04	18	18		39	31	21	16	13	12	13	08	07	13	19	24	32	24	11	07	+	+	+	+
Brachionus calyciflorus v. *dorcas* WIERZ.						+		+	08	09	04	03							+	+	01	03	+							+	01					
Brachionus falcatus ZACH.				+	+	04	12	21	42	45	33	07	01				+	07	18	25	38	44	32	09	04				05	07	11	15	78	81	39	05
Brachionus quadridentatus HERMANN				+	+																								+	+						
Brachionus urceolaris MÜLLER	05	15		16	33	22	16	11	18	14	12	07	03	21	20		45	32	23	16	18	15	14	10	10	16	22	25	31	22	16	12	16	14	16	16
Colurella colurus EHRBG.	04	08		08	27	21	19	14	16	15	09	04	01	03	06		30	35	36	38	22	17	15	07	03	03	08	12	28	25	16	10	16	15	09	05
Colurella uncinata EHRBG.		+																																		
Euchlanis dilatata EHRBG.								06	18	21	17	02			+		04	11	17	19	29	19	17				+	04	07	09	03	+				
Filinia longiseta EHRBG.							+										03	09	16	18	19	17	14			+		02	07	08	04	01	07	08	02	
Filinia terminalis PLATE									01	03	+							+	02	01	01								02	04	04					
Karatella cochlearis GOSSE	08	25		29	52	28	19	12	31	28	26	21	16	34	31		51	45	32	28	26	34	38	23	24	32	38	36	46	25	12	08	14	17	21	19
Karatella quadrata MÜLLER	03	04		04	21	12	06	03	18	13	08	07	02	04	06		18	12	10	06	01	05	02	03	01	03	04	03	03	02	02		+	+	+	
Keratella valga EHRBG.				+		+									04		06	04	01	+										+	+					
Lecane bulla GOSSE	+	04		02	13	09	04	02	04	01					03		14	21	24	23	16	18	14	06	03	03	09	11	19	18	06	16	19	12	05	05
L. closterocerca SCHMARDA									+																											
Lecane curvicornis MURRAY					+			+												+							+	+	02						
Lecane hamata STOKES								01	02	02										+																
Lecane luna MÜLLER	04	04		05	14	13	05	01	10	05	01		02	06	12		19	22	25	21	17	16	13	03	02	02	08	10	18	16	09	05	09	14	08	04
Lecane quadridentata EHRBG.					+																															
Lecane tenuiseta HARRING										+									+								+									
Lecane ungulata GOSSE																												+								
Lepadella ovalis MÜLLER	01	03		03	09	03	02	01	05	02							01	04	06	04	+									01						
Lepadella patella MÜLLER	02	04		03	18	10	07	03	15	07	05	01	01	04	06		09	06	09	07	01			+	+	01	04	05	16	12	07	04	07	08	04	04
Mytilina compressa GOSSE																															+					
Mytilina mucronata MÜLLER																	+			+	+	01	+			+								+		

	1981												1982												1983											
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX	X.	XI.	XII.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Mytilina ventralis EHRBG.																						+														
Notholca acuminata EHRBG.	04	07		03	01						01	03	07	09	04							+	03	08	11	17	09	02							08	11
Pedalia mira HUDSON								+	06	03	01									+	+	02	01													
Philodina roseola EHRBG.	+	+		+	+	+	+	08	14	07	02						05	07	06	05	02	02	01				03	04	07	07	08	02	03	03	+	
Philodina citrina EHRBG.						+	+	02	04	02	+						+	+				+									+	03	01			
Platyas quadricornis EHRBG.									01	01							01	03	01	01		+							+	01	+					
Polyarthra dolychoptera IDELSON	02	06		08	14	09	06	04	08	04	03	01	01	08	09		13	09	08	04	03	02	+		+	02	04	04	09	08	07	05	06	05	02	+
Polyarthra euryptera IDELSON	+			06	09	05	06	05	08	06	02	+			+		02	06	07	05	01	+	+	+			01	02	06	06	09	04	04	05	04	+
Rotaria neptunia EHRBG.	01	03		06	07	09	05	02	07	03	01			03	06		05	06	07	07	06	02	+			+	02	03	07	06	07	07	08	07	03	+
Schizocerca diversicornis DADAY																		01	01	06	09	08	02	+	+											
Testudinella mucronata GOSSE		02		04	04	02	01							03	05		06	05	07	02	01	01		+					+	03	03	03	01			
Testudinella patina HERMANN				+		+												+	+	+		+							+	04	06	05	04	02	01	
Tetramastix opoliensis ZACH.		+		+	+	+														+																
Trichocerca birostris MINK.										+																										
Trichocerca bicristata GOSSE																			+	+									+	+			+	+	
Trichocerca rattus MÜLLER	03	05		07	08	03	01							04	07		09	08	06	02			+			+	04	05	08	04	05	05	08	04	01	
Trichcocerca tenuior GOSSE							+	01													+															

Entomostraca	1981												1982												1983											
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Cladocera																																				
Acroperus harpae BAIRD	03	05		09	03	02	03	+						01	04		04	02	01															02	01	01
Alona rectangula G. O SARS	02	03		08	04	01	+	+						02	03		04	01		+					+	03	+		02	04	03		+	06	05	05
Alonella excisa FISCHER				+	+	01	02								+		+	+																		
Bosmina longirostris MÜLLER	11	14		47	26	11	06	11	15	19	18	16	11	07	13		17	16	24	11	15	52	48	16	06	08	16	62	13	45	37	39	34	54	38	21
Ceriodaphnia quadrangula MÜLLER		+								+																										
Chydorus globosus BAIRD				+	+	02	+																													
Chydorus sphaeriaus MÜLLER	+	04		38	23	09	07	09	13	18	15	12	06	09	09		10	11	09	06	07	03	33	11	02	06	08	35	22	16	06	02	08	23	22	11
Daphnia longispina MÜLLER	01	03		29	17	08	05	03	05	09	03	01		+	+		07	06	05	02	02	05	03	02	+	02	03	12	11	07	02	06	14	06	01	+
Daphnia magna STRAUS				12	12	06	03										02	02	+			+	+				+	03	02	01						
Diaphanosoma brachyurum LIEVIN		02		+	05	03	03	04	02	07	05	01		02	04		02	02	+	+	+		02	+	+	02	05	07	01	+	+					
Graptoleberis testudinaria FISCHER					+	01	02	03	01																											
Moina rectirostris LEYDIG	08	10		41	12	09	09	06	07	11	08	04	01	04	14		19	13	08	03	04	12	08	03	01	04	09	18	11	13	09	03	06	19	14	06
Peracantha truncata MÜLLER						+	+																													
Pleuroxus laevis G. O SARS								+	+	+							+	+																		
Scapholeberis mucronata MÜLLER	+	+		04	05	06	05	04	01	03	+	+		07	09		11	08	06	04	02	06	04	03	01	02	05	07	04	02	03	+	02	07	09	01
Sida cristallina MÜLLER						+		+																												
Simocephalus vetulus MÜLLER	03	05		07	08	09	08	13	18	25	14	09	05	09	14		21	16	15	10	04	05	05	02	+	01	02	08	04	03	02	01	11	09	04	01
Ostracoda																																				
Cyclocypris ovum JURINE																	+	+		+																
Cypria ophthalmica JURINE						+	+																					+	01	+	01	+	03	04	02	+
Cypricercus fuscatus SARS				03	03	02	01										02	04	03	02	03	02	+	+	+			02	03	01	+	+	02	03	01	01
Cypris pubera MÜLLER	01	02		06	05	03	03	01	+			05	02	06	07				01	03																
Copepoda																																				
Acanthocyclops vernalis FISCHER		+		+	+	08	04	+				+		02	10		16	14	09	01	+						03	11	14	09	01					
Eucyclops serrulatus FISCHER	02	04		13	14	09	08	06	09	07	05	04	02	05	08		11	07	07	03	04	08	07	03	01	01	02	04	05	08	05	03	01	+	+	02
Eudiaptomus gracilis G. O SARS		+			+	02	04	07	05	08	03	02	02	07	09		10	08	06	02	03	05	06	03	01	01	04	04	02	03	02	02	01	08	+	+
Macrocyclops albidus JURINE					+	03	03	04	03	02	+	02	01	+																						
Macrocyclops fuscus JURINE																					01	03	01	01	+	02	01	03	+	+						
Megacyclops viridis JURINE				11	13	05	03	01		+	+			03	07		07	11	08	05	05	06	02	01	02	03	05	08	05	02	+	01	+	07	05	02
Metacyclops gracilis LILLJEBORG	02	04		08	07	03	02	02	03	+				02	04		03	02	01	03	01	03	01	01	+	02	01	03	+	+	03	04	02	07	04	01
Thermocyclops oithonoides G. O SARS				01	02	+																														
Nauplius Larven	04	08		52	41	21	20	16	10	13	18	05	09	22	38		44	33	35	16	19	59	44	18	04	05	14	64	44	49	20	24	10	25	11	04

Verhältnis der Rotatorienarten bedeutend nach. Die Testacea-Arten sind gewöhnlich in geringem Prozentsatz (5—21%) zugegen, besonders während der Frühjahrs- und der ersten Sommermonate nimmt ihre Zahl zu.

Von den Testacea-Arten dominieren *Arcella vulgaris, Centropyxis aculeata* und *Difflugia gramen,* die bei jeden Sammlung — oft sogar in hoher Individuenzahl — zum Vorschein kamen. Als häufige Arten sind noch *Arcella discoides, Centropyxis constricta* und *Difflugia lanceolata* zu erwähnen, die fast jedesmal — mitunter sogar in hoher Individuenzahl — zum Vorschein kamen. Selten, 1—2 mal gefundene Arten sind *Arcella stellaris, Difflugia amphora, D. globulosa, D. lobostoma* und *D. mammilaris.*

Auch von den zahlreichen Rotatoria-Arten sind mehrere anzutreffen, die in der untersuchten Periode im Altwasser stets und zwar fallweise in sehr hoher Individuenzahl anwesend waren: so *Brachionus angularis, B. angularis* var. *bidens, B. calyciflorus,* und sein varietäten, *B. urceolaris, Colurella colurus,* und *Keratella cochlearis* und sein varietäten. Sieben Arten kamen insgesamt nur je einmal zum Vorschein und zwar in geringer Individuenzahl: *Colurella uncinata, Lecane closterocerca, L. quadridentata, L. ungulata, Mytilina compressa, M. ventralis, Trichocerca birostris. Brachionus falcatus* ershien in den Monaten September und Oktober regelmässig massenhaft: manchmal machen sie 30—34% der gesamten Rotatorienmenge, bzw. bis zu 14—16% der gesamten Zooplanktonmenge aus. *Notholca acuminata* kam vornehmlich in den Wintermonaten zum Vorschein.

Von den Entomostraca dominieren in Arten und Individuenzahl gleichermassen hauptsäschlich die Cladocera-Arten. Dominante Arten sind *Bosmina longirostris, Chydorus sphaericus, Moina rectirostris* und *Simocephalus vetulus.* Die Ostracoda-Taxone sind in geringerer Arten- und Individuenzahl vertreten oder fehlen mitunter auch vollkommen aus dem Plankton. Die frequenteste Ostracoden-Art is *Cypricercus fuscatus.* Von den Copepoda-Arten sind die *Nauplius*larven bzw. die verschiedenen Entwicklungsformen ständig zugegen und erreichen fallweise sehr hohe Gesamtindividuenzahl. Eine dominante Art ist *Eucyclops serrulatus;* häufig kommen daneben *Eudiaptomus gracilis, Megacyclops viridis* und *Metacyclops gracilis* vor. Die *Thermocyclops oithonoides* erschien insgesamt nur dreimal (April—Juni 1981).

Das Zooplankton des Altwassers bei Tiszaalpár ist in seiner Gesamtheit als eine *Centropyxis aculeata, Difflugia gramen, Brachionus angularis, Br. angularis* var. *bidens, Br. calyciflorus, Br. urceolaris, Colurella colurus, Keratella cochlearis, Bosmina longirostris, Chydorus sphaericus, Moina rectirostris, Simocephalus vetulus,* und *Eucyclops serrulatus* Zooplankton-Gemeinschaft anzusehen, da die Arten in jedem Falle und oft in grosser Individuenzahl erschienen. Ein Teil der übrigen Arten kam unregelmässig für kürzere oder längere Zeit und gewöhnlich in kleinerer Individuenzahl zum Vorschein. Ein Teil dieser Arten, wie z.B. die *Colurella uncinata, Lecane closterocerca, Mytilina compressa, M. ventralis, Trichocerca birostris* lebt vorwiegend zwischen den Wasserpflanzen bzw. am Boden und kommen vermutlich von hier zeitweise in mehr-minder grosser Individuenzahl ins Plankton. Andere können auch durch Wassereinspülung, mit dem Wind oder auf anderem Wege ins Plankton gelangen und dort eine gewisse Zeitlang als die Fauna kolorierende Elemente leben.

Der Saprobitätsgrad des Altwassers bei Tiszaalpár erfährt in den einzelnen Jahreszeiten erhebliche Veränderungen (Abb. 2). In der Winterperiode ist das Wasser am reinsten und hat Beta-mesosaproben Charakter (der sapribiologische Index wechselt zwischen 1,8 und 2,1), in den Frühlingsmonaten nimmt die Verunreinigung etwas zu, sie bewegt sich an der Grenze des Beta- und es Alpha—Beta-mesosaproben Niveaus. In den Sommermonaten (hauptsächlich im Juli—August) steigt der Sapro-

bitätsindex erheblich, kommt dem Alpha-mesosaproben Zustand nahe, ja im Jahre 1983 hatte er dieses Niveau gar erreicht (2,85). In den Herbstmonaten wird die Wasserqualität allmählich besser, der saprobiologische Index sinkt.

Literatur

BANCSI, I. (1980): The Rotatoria fauna of the flood-plain of the Bodrog at Sárospatak. — Tiscia (Szeged) *15*, 61—92.

CHARDEZ, D. (1964): Thecamoebiens. — Expl. hydrobiol. Bangweolo-Luapula *10*, 1—77.

DÉVAI, I. (1977): Az evezőlábú rákok (Calanoida és Cyclopoida) alrendjeinek kishatározója (Kleines Bestimmungsbuch der Ruderfüssler — Krebse (Calanoida und Cyclopoida). — Budapest.

FLÖSSNER, D. (1972): Krebstiere, Crustacea: Kiemen und Blattfüsser, Branchiopoda, Fischläuse, Branchiura. — In DAHL, F.: Die Tierwelt Deutschlands. 60. Teil.

GÁL, D. (1982): Quantitative und qualitative saisonmässige Veränderung des Zooplanktons im Altwasser der Theiss bei Körtvélyes im Zeitraum von 1971 bis 1976. — Tiscia (Szeged) *17*, 131—142.

GROSPIETSCH, TH. (1958): Wechseltierchen (Rhizopoden). — Suttgart.

GULYÁS, P. (1974): Az ágascsápú rákok (Cladocera) kishatározója. (Kleines Bestimmungsbuch der Wasserflöhe-Krebse Cladocera). — Budapest.

MEGYERI, J. (1961): Vergleichende hydrofaunistische Untersuchungen in den Toten Armen der Tisza. — A Szegedi Ped. Főisk. Évk. *2*, 121—133.

PENARD, E. (1902): Fauna Rhizopodique. — Geneve.

PESTA, O. (1928, 1932, 1934): Krebstiere oder Crustacea, I: Ruderfüsser oder Copepoda. — In Dahl, F.: Die Tierwelt Deutschlands. *9*, 24., 29. Teil

SZÉKELY, L. (1954): A Szegedi Holt-Tisza kerekesférgei (Die Rädertiere der Szegeder Toten Theiss). — Ann. Biol. Univ. Hung. *2*, 479—490.

VOIGT, M. (1956): Rotatoria. Die Rädertiere Mitteleuropas. — Berlin. — Nicolassee.

Egységes vízvizsgálati módszerek. III. Biológiai módszerek (Einheitliche Untersuchungsmethoden, III. Biologische Methoden 1976). Redigit: P. GULYÁS, Budapest.

Az Alpári Holt-Tisza zooplanktonjának szezonális változásai az 1982—1983-as években

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Az 1981—83-as években havonkénti gyűjtésekkel vizsgálta az Alpári Holt-Tisza zooplanktonjának (Protozoa, Rotatoria, Entomostraca) kvalitatív és kvantitatív szezonális változásait.

Az Alpári Holt-Tiszára is, mint általában az élővizek többségére jellemző, hogy a zooplankton mennyiségi eloszlásában az év folyamán általában 2 maximum jelentkezik. Az egyik májusban (kb. 60 000 ind/10 liter), s egy kisebb szeptemberben (kb. 48 000 ind/10 liter). Ezt az összegyedszám változást elsősorban a víz hőmérsékletének változása okozza. A nyári összegyedszámcsökkenés általában akkor következik be, amikor a holtág vizének hőmérséklete tartósan kb. 25 °C fölé emelkedik. E magasabb hőmérsékleten a holtágban levő nagymennyiségű szervesanyag erőteljes bomlásnak indul, amely többnyire jelentős mennyiségű kénhidrogén és metán képződésével jár, s ezek mérgezőleg hatnak a zooplankton tagjaira. Ennek következménye az is, hogy a holtág vizének szaprobiológiai minősége éppen a nyári hónapokban — amikor fürdőzésre is használják — a legrosszabb, a víz szaprobitási indexe a zooplankton alapján gyakran a 2,9-t is eléri. A nyár folyamán dominálnak az alfamezoszaprób szervezetek, sőt a polyszaprób szervezetek is egyre nagyobb számban jelennek meg.

Сезонные изменения зоопланктона в 1981—83 годах в Алпарской Мертвой Тисе

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Резюме

На протяжении 1981—83 годов ежемесячно собирали и определяли сезонные изменения в качественном и количественном отношении зоопланктона Алпарской Мертвой Тисы (Protozoa, Rotaroria, Entomostraca.)

Для Алпарской Мертвой Тисы, как и для всех живых вод, характерным является то, что в количественном отношении зоопланктон имеет два максимума. Один наблюдется в мае (до 60 000 единиц на 10 литров воды), а другой — в сентябре (около 48 000 единиц на 10 литров воды). Разница в количественном отношении зависит от климатических условий. Уменьшение количества зоопланктона наблюдается летом, когда температура воды в Мертвой Тисе выше 25 °С. Выше этой температуры в Мертвой Тисе накопляется много органических веществ, что в свою очередь приводит к образованию большого количества сероводорода и метана, которые ядовито влияют на зоопланктон.

В связи с этим, сопробиологическое качество воды в Мертвой Тисе в летние месяцы (время купания) характеризуется самым высоким индексом и в связи с наличием зоопланктонов часто достигает 2,9. Летом в воде появляются альфамезосапробные и даже полисапробные организмы.

Sezonska dinamika zooplanktona Mrtve-Tise kod Alpára—u periodu 1981—1983. godine

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Abstrakt

Ispitivanja kvalitativnog i kvantitativnog sastava zooplanktona (Protozoa, Rotatoria, Entomostraca) Mrtve-Tise kod Alpár-a u sezonskom aspektu, vršeno je u periodu 1981—1983. godine, na osnovu mesečnih analiza. Utvrdjeno je da se, i u slučaju distribucije količine zooplanktona mrtvaje Alpár, u toku godine javljaju dva maksimuma, što je karakteristično i za većnu tekućih voda. Jedan se javlja u maju (cc 60 000 ind/10 lit.), i jedan manji u septembru (48.000 ind/10 lit.). Promena ukupne brojnosti je u prvom redu pod uticajem promene temperature. Opadanje brojnosti u toku leta obično nastupa tada, kada se temperatura vode mrtvaje trajnije nalazi iznad 25 °C. Pod ovim temperaturnim uslovima dolazi do jačeg razlaganja znatne količine organske materije mrtvaje. Povećana količina metana i fosforvodonika otrovno deluje na članove zooplanktona. Rezultat ovih procesa je taj, da je saprobiološki kvalitet vode mrtvaje u toku leta — u sezoni kupanja— najnepovoljniji. Saprobni indeks, po osnovi zooplanktona, dostiže često vrednost i 2,9. U toku leta sve se više povećava broj polisaproba, a dominiraju alfamezosaprobni organizmi.

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EIN BEITRAG ZUR LIMNOLOGISCHEN UNTERSUCHUNGEN DER CARSKA BARA

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Auszug

Im Rahmen der vorliegenden Untersuchungen wurden in Zeitraum 1982—1984 Zusammensetzung und Dynamik von Zooplankton und Mikrofauna, sowie Bodenfauna in Carska bara, in diesem teilweise beschützten Naturreservat, geprüft. Im Laufe von diesem Forschungen wurden auch ökologische Grundfaktoren: Temperatur, Sauersoffgehalt und pH, welche zusammen mit Wasserstandschwankungen sehr variieren, geprüft. In der Zooplankton und Mikrofaunazusammensetzung waren Rotatoria, Cladocera und Copepoda verteten. Mit Rücksicht auf die unbedeutende Tiefe, sowie auf Bewachsen dieses stehenden Gewässers, meldenten sich bei den Proben sowohl Planktonformen, als auch Phythal- und Benthalbewohner. Obwohl das Artenverzeichnis ziemlich lang ist, kann es nicht als endgültig betrachten werden, besonders mit Rücksicht darauf, dass es sich um die ersten Forschungen dieser Art in diesem Ökosystem handelt. Die Zahl von Zooplankton- und Mikrofaunaarten variier te čje nach Saison und Jahr. Es wurde insgesamt 130 Arten und Formen festegestellt. Die hähste Zahl wurde im Jahre 1984 (108) notiert, die niedrigste 1983 (84). Im zweitgenannten Jahre im Monat Avgust, wegen des ausgesprochen niedrigen Wasserstandes, war Carska bara fast ganz trocken, und so blieben viele Sommerarten aus. Saisonm sseige Schwankungen von Artenzahl ist ebenfalls evident. Die gröste Artenzahl melden sich im Frühjahr und Sommer, und die niedrigsten im Winter. In allen Aspekten dominieren die Rädertiere, und dann kommen die Protozoen. In der Wintermonaten ist die Protozoenbeteiligung grösser als in der Sommer. In gewissen Jahren sind sie vorherrschend. Die quantitative Zooplankton- und Mikrofaunazusammensetzung schwankte ebenfalls je nach Jahr und Saison. In allen Jahren in denen Erforschung unternommen wurde, wurde das Maximum im Frühjahr festgestellt. In der Bodenfauna waren nur Chironomiden und Oligochaeten vertreten. Von Oligochaeten war nur eine Familie, Tubificidae, mit einigen Arten der Gattungen *Tubifex, Limnodrilus, Potamothrix, Psammoryctes* und *Pelosolex* festgestellt. Chironomiden kamen nur im Jahre 1984 vor. Die quantitative Vertretung der Bodenfauna schwankte sehr, von O bis 17227 Ind/m².

Einleitung

Im Bereich des Westbanats gab es einst eine grosse Zahl von grösseren und kleineren Wasserbasains. Durch die Regulierung von Theiss in vorigen Jahrhundert, sowie durch den Ausbau des Hydrosystems Donau—Theiss—Donau in den letzten zwanzig Jahren, wurden in diesem Bereich die Sumpf- und Morastigebiotopen beträchtlich vermindert. Carska bara ist ein überbleibsel, und es befindet sich teilweise unter dem Schutz des Naturschutzgesetzes. Da in diesem Wasserökosystem bis jetzt keine limnologische Forschungen unternommen wurden, ist das Ziel der vorliegenden Arbeit einen Beitrag zur Kenntnis der Zooplankton- und Mikrofaunazusammensetzung, sowie der Bodenfauna in diesem Naturreservat zu liefern.

Angaben über die Lokalität

Zwischen den Flüssen Bega und Theiss, auf der alluvialen Ebene befindet sich ein Komplex von Morastgewässern. Carska bara liegt auf den rechten Bega Seite (Abb. 1). Es ist ein Sumpf mit der Oberfläche von etwa 300 ha, umkreisst von Flachland- Überschwämmwäldern, fast völig mit Wasserpflanzen bedekt (DJERFI 1969). Der Beschützteil, die sogenannte Vojtina mlaka, nimmt etwa 50 ha, mit durchschshnittstiefe von 1,2 m ein. Carska bara stellt einen grossen Wasserbereich dar, dessen mittlerer Teil fast über das ganze Jahr unter Wasser bleibt, mit Ausnahme von ausgesprochen trockenen Jahren, wie z.B. 1983 eines war, als im Monat Avgust auch diese Teile ausgetrocknet waren. Das Wasserregime dieses, wie der meisten geschlossenen Gewässer in Vojvodina steht in bestimmter Abhängigkeit von Niveau des Grundwassers, auf dessen Oscillationen Niederschläge, Flusswasserstand und ihre zeitliche Verteilung stark einwirken. In der Regel ist der niedrigste Wasserstand im Sommer (Juli, Avgust), der höchste aber im Frühjahr (MILOVANOV 1972). Durch Ergiessung von Bega und Theiss wird der ganze Bereich überschwämmt.

Die pedologische Unterlage dieses Terains ist der Fruchtbareboden Schwarzerde (Tschernosjom), Wiesengartenerde und Riedpecherde. Ein kleinerer, aber kein bedeutungsloser Teil ist Salzboden, fast ausschliesslich Solonjec und salzartiger Boden (MILJKOVIĆ 1960).

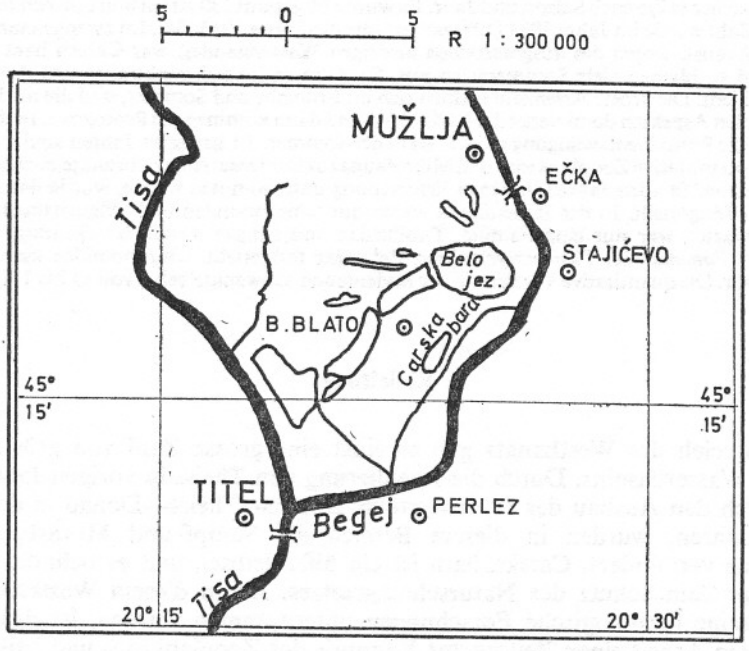

Abb. 1. Schematische Karte des untersuchten Sumpf Carska bara

Material und Arbeitsmethode

Unsere Untersuchungen wurden in der Zeitspanne 1982—1984 durchgeführt. Proben wurden in Zeitabständen von zwei Monaten genommen und behandelt wurden sie nach Saison. Für die qualitative Analyse von Zooplankton und Mikrofauna wurden die Proben mit Planktonnetz aus Mühlenseide No 22 genommen. Zur quantitativen Analyse wurde die Filtrationsmethode angewendet filtriert wurde 1 Liter Wasser.

Proben der Bodenfauna wurden durch Bagger vom Typ Ekman-Birge, mit der Fassungsfläche von 225 cm^{-2} genommen.

Das Material wurde hauptsächlich im lebendigen, teilweise im fixierten Zustand im 4% Formalin behandelt.

Bei der Probeentnahme wurden die physikalisch-chemischen Grundparameter verfolgte: Wassertemperatur, Sauerstoffgehalt und pH.

Diskussion

Mit Rücksicht auf die grösse Oscillationen vom Wasserstand in diesem Ökosystem, sind auch die Schwankungen einzelnen Faktoren stark ausgedrükt. Werte für physikalisch-chemische Grundparameter in der Zeit der Probenentnahme sind in der Tabelle 1. eingetragen.

Tabelle 1. *Physikalisch-chemische Grundparameter zur Zeit der Probeentnahme in Carska bara 1982—1984 (W-Winter, F-Frühling, S-Sommer, H-Herbst)*

Parameter	Jahre Saison	1982				1983				1984		
		W	F	S	H	W	F	S	H	W	F	S
Wassertemperatur °C		0	14	26,5	5	4	28	—	10	2,5	9,5	23
pH		8,5	7,5	7,8	8,1	7,5	9,5	—	7,6	7,1	7,7	8,2
O_2 mg/dm³		20,5	9,2	9,6	11	10,1	1,6	—	12,2	9,5	13	12,6
Sauerstoffsättigung in %		139	89,6	107	93	77	20,9	—	108	69	120	148

Wie in der Angaben zu ersehen ist, sind die Saisonsvariierungen allen Grundfaktoren bedeutend. Die pH Werte bewegten sich von schwachen bis augesprochen alkalen (7,1—9,5), was in Zusammenhang mit Processen im Wasser steht, bedingt aber durch den Einfluss des umliegenden Terains, welches aus dem Boden unter landwirtschaftlichen Kulturen mit intensiven Agrotechnik mit Anwendung von Mineraldünger, Pestizieden u.a. besteht. Mit Rücksicht auf der Makrophytenbewuchs, aber auch auf die Algenentwicklung, sind die Schwankungen des Sauertoffgehalts bedeutend, von dem sehr niedrigen, insgesamt 20% Sättigungs, zur Supersaturation (107%—148%). Solche Oscillationen übten auf jeden Fall Einfluss auf die Zusammensetzung und Dynamik der beobachteten Komponente der Biocönosen.

Zusammensetzung und Dynamik von Zooplankton und Mikrofauna

In qualitativer Zusammensetzung von Zooplankton und Mikrofauna waren die Gruppen Protozoa, Rotatoria, Cladocera und Copepoda vetreten. Mit Rücksicht auf die unbedeutende Tiefe und Bewachsen dieses Gewässers, meldeten sich in der proben sowohl echte Planktonformen, als auch die Bewohner von Phythal und

Tabelle 2. *Die qualitativen zusammensetzung und Häufigketswerte der Arten des Zooplanktons und Mikrofanna in Carska bara a in der Zeitraum 1982—1984 (1-sehr selten, vereinzelt, 2-selten, 3-häufig, 4-sehr häufig, 5-massenhaft; W-Winter, F-Frühling, S-Sommer, H-Herbst)*

Arten	Jahre:	1982				1983				1984		
	Saison:	W	F	S	H	W	F	S	H	W	F	S
Rhizopoda												
Arcella discoides EHR.		1	1	5	2	1	1	—	1		1	1
A. vulgaris EHR.			1	5	1		1	—		1	1	1
Centropyxis aculeata EHR.				3			1	—				3
C. discoides PENNARD				1			1	—			1	1
Difflugia corona WALICH		1	1	3	1	1	1	—		1	1	3
D. limnetica LEVANDER			2	3	1		1	—			1	1
D. pyriformis PERTY				1	3		1	—			1	1
Ciliata												
Aspidisca lynceus EHR.			1				1	—	1			
Carchaesium polypinum L.			1				1	—	1			
Chilodonella cuculus O. F. M.				1	1	1		—	1			
Colpidium colpoda (Ehr) STEIN		1	1	1	1	1		—		1		
Didinium nasutum O. F. M.							1	—	5			
Dileptus anser O. F. M.			1			1		—	1		1	1
Epistylis plicatilis EHR.			1				1			1	1	1
Paramecium anrelia EHR.		2	2	1	1	1	2	—		2	1	1
P. bursaria (EHR.)					1		1	—			1	1
P. caudatum EHR.		1	4	1		1	1	—		1	1	1
P. trichium STOKES			1			1	1	—		1	1	1
Stylonychia mytilus EHR.							1	—				
Tintinnidium fluviatile KENT		3	1				1	—		2		
Tintinnopsis lacustris ENTZ			3					—	1			
Vorticella campanulata (KAHL) SRAM. HUŠ.		2	4	1	3	1	3	—	5	5	1	1
V. convallaria (L.)				1				—	1	1		1
V. microstoma EHR.		3	4	1	1	1	1	—	4	3	1	1
Heliozoa												
Actinosphaerium eichorni (EHR.)							1	—			1	1
Suctoria												
Tokophrya quadripartita (CLAP. et LACHM.)								—			1	1
Rotatoria												
Ascomorpha ecaudis PERTY							1	—			1	1
Anueropsis fissa GOSSE				5			1	—	1		1	1
Asplanchna brightwelli GOSSE			2				1	—		1		
A. priodonta GOSSE		1				1		—		1		
A. sieboldi (LEYDIG)				1				—				3
Brachionus angularis GOSSE		4	2	3	1	1	4	—		1	5	5
B. angularis bidens PLATE				2			1	—			1	1
B. calyciflorus calyciflorus PALLAS		2	1	1	1	1	1	—		1	1	1
B. calyciflorus dorcas (GOSSE)			1	1			1	—				2
B. calyciflorus amphiceros EHR.			3	1	1	1		—				1
B. budapestinensis DADAY		1		1	1		1	—				5
B. budapestinensis similis (LESSL.)				1				—				1
B. diversicornis (DADAY)				1			3	—				1
B. leydigi leydigi COHN				1				—				3
B. leydigi rotundus (ROUSSEL.)								—				3
B. quadridentatus quadridentatus (HERM.)								—			1	1
B. quadrident. cluniorbicularis (SKOR.)			1					—			1	1
B. plicatilis (O. F. M.)			1				1	—			1	
B. urceolaris urceolaris (O. F. M.)			3					—			1	1
B. urceolaris rubens (EHR.)			1				1	—	1			1
Cephalodella catellina (O. F. M.)							1	—			1	
C. gracilis (EHR.)			1	2	3	1	1	—				1
C. tecta DONNER					1	1		—	1			1

Arten	Jahre:	1982				1983				1984		
	Saison:	W	F	S	H	W	F	S	H	W	F	S
Colurella colurus (EHR.)					1		1	—	1		1	1
C. obtusa (GOSSE)					1			—			1	1
C. uncinata uncinata (O. F. M.)					1			—				1
C. uncinata bicuspidata (EHR.)				1				—			1	
Dissotrocha aculeata (EHR.)			3					—			1	
Epiphanes senta (O. F. M.)					1			—	1			
Euchlanis alata WORONKOW			1				1	—				1
E. dilatata EHR.				2				—				
Filina cornuta brachiata (ROUSS.) nom. nov.								—	3			
F. longiseta longiseta (EHR.)				4	1		5	—			1	1
F. longiseta passa (O. F. M. nom. nov.					1	1		—				
F. opoliensis ZACHARIAS					1			—				
F. terminalis (PLATE)					1		1	—			1	
Keratella cochlearis cochlearis (GOSSE)		3	5	1	3	5	1	—	1	1	4	1
K. cochlearis hispida LAUTER.				1				—	1		1	1
K. cochlearis irregularis (LAUT.)			1				1	—			1	
K. cochlearis micracantha (LAUT.)			1					—				1
K. cochlearis robusta (LAUT.)			1	1	1			—	1		1	
K. cochlearis tecta GOSSE			1		5	1	1	—			1	
K. cochl. tecta macracantha (LAUT.)			1	1		1	2	—			1	
K. quadrata quadrata (O. F. M.)			1	4	1	1		—	1	2	4	
K. quadrata frenzelis ECKST.			1		1			—		2		
K. paludosa paludosa (LUCKS)				1	1			—				1
K. serrulata (EHR.)			1				1	—			1	
K. testudo testudo EHR.				3	2			—	1			2
K. ticinensis (CALLERIO)						1		—				
K. valga valga (EHR.)								—	1			
K. valga monospina KLAUSSENER			2				1	—			2	1
Lecane bulla GOSSE			1	1				—				1
L. closterocerca (SCHMARDA)			1	1				—			2	1
L. luna MÜLLER			1	1	1		1	—				
L. lunaris (EHR.)				1	1			—				1
L. ludwigi (ECKSTEIN)								—	1			1
L. nana (MURRAY)								—				1
L. quadridentata (EHR.)								—				5
L. ungulata (GOSSE)			1				1	—				1
Lepadella acuminata (EHR.)				1				—			2	
L. ovalis (MÜLLER)				1				—			2	
L. quinquecostata (LUCKS)								—				3
L. similis (LUCKS)			1					—				
L. patella (MÜLLER)				1	1		1	—			4	1
Liliferotrocha subtilis (RODEWALD)					2			—				
Monommata longiseta (MÜLLER)								—			1	
Mytilina mucronata (O. F. M.)			1	1	1			—				4
Notholca acuminata (EHR.)							2	—				
N. squamula (O. F. M.)			1				1	—			4	
Notommata copeus EHR.			1					—				
Philodina citrina EHR.			1					—			1	1
Ph. roseola EHR.			1					—			1	
Platyas quadricornis (EHR.)								—				1
Polyarthra dolichoptera IDELS		3	3			1	1	—			5	1
P. euryptera WIER.								—			2	
P. majvr BURCKHARD					1			—	1			1
P. vulgaris CARLIN				1				—	1			3
Rotaria rotatoria (PALLAS)			1	5	1			—	1	1	2	3
Synchaeta oblonga EHR.							1	—				1

Arten	Jahre:	1982				1983				1984		
	Saison:	W	F	S	H	W	F	S	H	W	F	S
S. pectinata EHR.				2			1	—			1	
Testudinella patina HERMANN		1						—			3	1
Trichocerca capucina WIERZ.			1					—			1	
T. rattus (O. F. M.)					3		1	—	1			
Trichotria tetractis (EHR.)								—			3	1
Cladocera												
Alona quadrangularis (O. F. M.)			1	1	1		1	—	1		1	1
A. rectangula G. O. SARS				1				—				1
Bosmina longirostris (O. F. M.)		1		1	1		1	—	1	1	1	1
Ceriodaphnia quadrangula (O. F. M.)				1			1	—		1		1
Chydhrus sphaericus O. F. M.			3		1		1	—	1	1	1	4
Daphnia longispina O. F. M.			1					—	1		1	
D. magna STRAUS			1					—				
Diaphanosoma brachyurum LIEVIN								—	1			1
Graptoleberis testudinaria (FISCH.)								—				1
Moina micrura (KURZ) SR. HUŠ.								—	1		1	1
Scapholeberis kingi SARS								—	1			1
Sida cristalina MÜLLER								—	1			1
Copepoda												
Acanthocyclops robustus (SARS)				1	1		1	—		1		
A. vernalis FISCHER		1	1		1	1	1	—	1	1	1	
Cyclops strenuus (FISCHER)		1	1					—		1		
C. vicinus Uljanin		1	1	1	1	1	1	—	1	1	3	
Eucyclops serrulatus FISCHER			1	1		1	1	—	1		1	1
Eudiaptomus gracilis SARS			1	1	1	1		—	1	1	1	
Macrocyclops albidus JURINE			1					—				
Thermocyclops crassus (FISCHER)						1					1	1
Copepodit, Nauplius Stadien		1	5	1	3	1	3	—	2	1	5	1

Benthal, die wir unter dem Begriff Mikrofauna umfassten. Obwohla das Verzeichnis von Arten ziemlich lang ist, kann es nicht als endgültig betrachtet werden, da es sich um die ersten Forschungen solcher Art in diesem Ökosystem handelt.

Bei vielen Arten meldet sich eine grössere Zahl von Formen und so wurden sie auch ins erzeichnis eingetragen.

Nach der Artenzahl sind die Rotatoria die verschiedenartisten, dann kommen die Protozoa, während die Cladocera und Copepoda mit viel geringerer Zahl vertreten sin. Die vertetenen Arten sowie ihre relative Häufigkeit sind in Tabelle 2. angegeben.

Das angegebene Verzeichnis weist auf die Verschiedenartigkeit von Zooplankton und Mikrofauna hin, aber mit grossen Unterschieden und Schwankungen von Artenzahl sowohl nach Jahren, als auch nach Saisons. Von den echten Protozoa-Planktonformen finden wir die Arten: *Tintinnidium fluviatile, Tintinnopsis lacustris,* sowie einige Arten von Gattung *Arcella, Difflugia* und *Centropyxis.* Unter den Rotatorien typische Planktonarten sind *Brachionus angularis, B. calyciflorus, B. budapestinensis, Keratella quadrata, Synchaeta oblonga, S. pectinata,* sowie *Polyarthra-* und *Filiniaarten.* Die übrigen sind meistens litorale Formen, welche dichtbewachsene Teile bewohnen wie z.B. *Keratella testudo, K. ticinennsis, Brachionus quadidentatus cluniorbicularis,* sowie die Arten von Gattungen *Lecane, Colurella, Mytilina, Trichocerca* und *Trichotria* u.a.

Wie schon erwähnt, variiert die Artenzahl nach Jahr und Saison. Die höchste Artenzahl wurde 1984 (108) festgestellt, die niedrigste 1983 (84), was wesentlich ist

da im Sommer des letzgenanntes Jahres Carska bara ganz trocken war, und so blieb der sonst artenreiche Sommeraspekt aus (Tab. 3).

Tabelle 3. *Artenanzahl von Zooplankton und Mikrofauna nach Jahren und ihre procentuelle Vertretung in Carska bara*

Gruppe	1982		1983		1984		Insgesamt in untersuchten Zeitraum	
	Nr	%	Nr	%	Nr	%	Nr	%
Protozoa	22	22,2	23	27,4	19	17,6	26	20,0
Rotatoria	63	63,6	46	54,8	71	65,7	84	64,6
Cladocera	7	7,1	9	10,7	11	10,2	12	9,2
Copepoda	7	7,1	6	7,1	7	6,5	8	6,2
Insgesamt:	99	100	84	100	108	100	130	100

Ausser den Unterschieden nach Jahren sind auch saisonmässige Variierungen ausgeprägt (Tab. 4)

Tabelle 4. *Saisonmässige Variierungen der Artenanzahl von Zooplankton und Mikrofauna in Carska bara 1982—1984 (W-Winter, F-Frühling, S-Sommer, H-Herbst)*

Gruppe	1982				1983				1984		
	W	F	S	H	W	F	S	H	W	F	H
Ptotozoa	8	16	14	11	10	20	—	10	10	15	17
Rotatoria	7	34	32	29	13	31	—	18	7	41	49
Cladocera	1	4	4	3	0	4	—	8	3	5	10
Copepoda	3	6	4	4	5	4	—	4	5	5	2
Insgesamt:	19	60	54	47	28	59	—	40	25	66	78

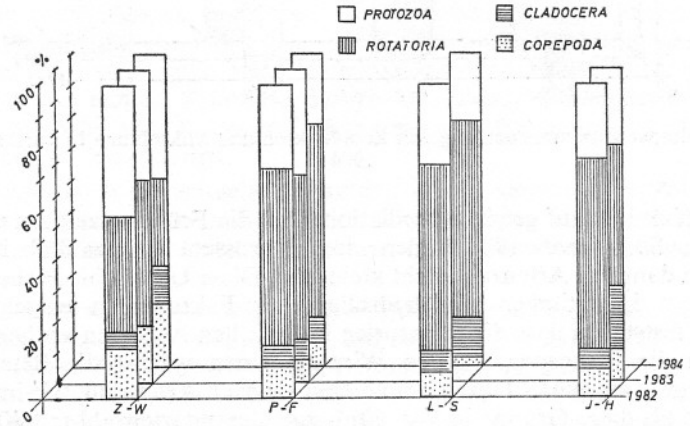

Abb. 2. Die prozentmässige Beteiligung von verschidenen Zooplankton- und Mikrofaunagruppen in Carska bara 1982—1984

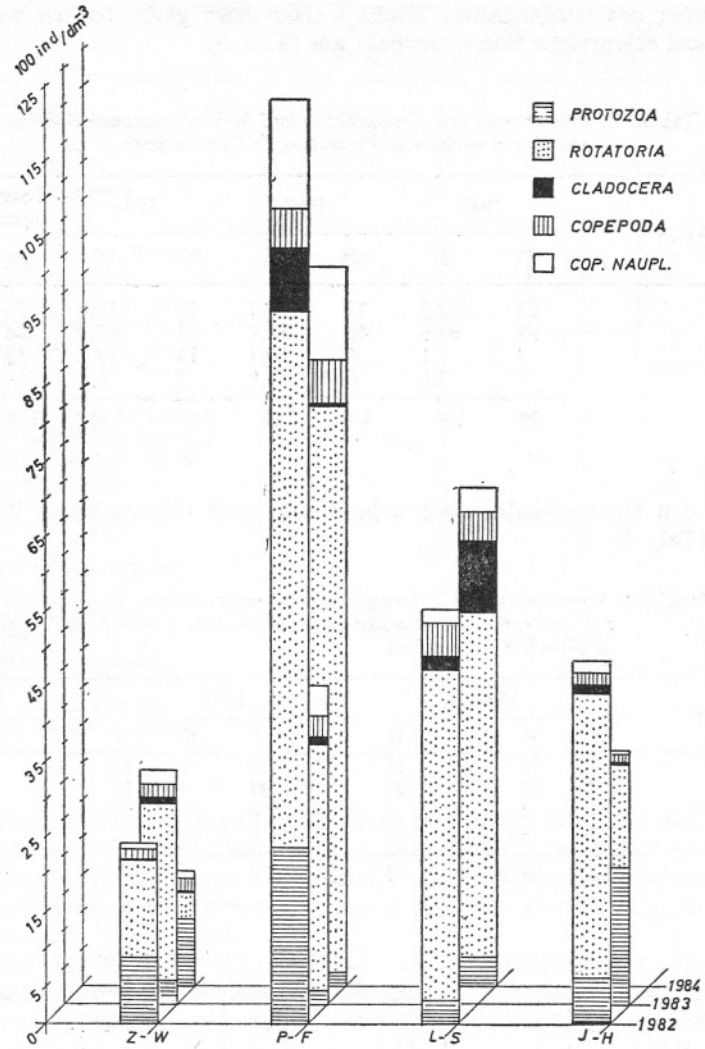

Abb. 3. Quantitative Zusammensetzung von Zooplankton und Mikrofauna in Carska bara 1982—1984

Ohne Rücksicht auf gewisse Oscillationen ist die Frühlingszeit am verschiedenartigsten. Zur Sommerzeit 1984 fanden wir eine grössere Artenzahl als im Frühling, obwohl auch dann die Artenzahl nicht klein war. Diese Unterschiede sind Folge von Schwankungen klimatischer und hydroligoscher Faktoren in einzelnen Jahren. Wir können feststellen dass die Rotatorien in fast allen Aspekten vorherrschen, und dann folgen die Protozoen. In den Wintermonaten wächst die Beteiligung von Protozoa, und in einzelnen Jahren dominieren sie nach Artenzahl, wie im Jahre 1984 der Fall war, als diese Gruppe in Verhältnis zur Gesamtartenzahl mit 40% vertreten war. Die prozentmässige Beteiligung von Rotatorien variiert in qualitativen Zusammensetzung von 28—62% (Abb. 2). Wenn wir die gesamte Artenzahl in der Unter-

suchungszeit und die Vertretung einzelnen Gruppen analysieren würden, würden wir ein ähnliches Verhälnis feststellen (Tab. 3).

Die Beteiligung der Cladocera und Copepoda in qualitativer Zusammensetzung ist sehr gering. Zu ähnlicher Feststellung kommt GAL (1982) im Altwasser der Theiss bei Körtvélyes in Ungarn, sowie einige unsere Autoren in einigen Ökosystemen in Vojvodina (MILOVANOVIĆ, A. ŽIVKOVIĆ 1953, PUJIN et *al.* 1978, PUJIN et *al.* 1982). Eine gewisse Zahl von Rotatoriaarten meldet sich in verschiedenen Formen. Hier sol man die *Keratella* Gattung besonders hervorheben und zwar die Art *K. cochlearis,* die in 7 Formen erscheint (Tab. 1). *Brachionus calyerscheint* auch in mehreren Formen, aber nur 3, während sie sich in der Donau in 5 Formen meldet (MILOŠEVIĆ, PUJIN 1983).

Die quantitative Zusammensetzung von Zooplankton und Mikrofauna schwankte in noch grösseren Grenzen als die qualitative. Abgesehen von der numerischen Unterschieden in allen 3 Jahren, verzeichnet man das Maximum in Frühjahr (Abb. 3). Die Individuenzahl pro Liter ist gross, mit maximalen Werten in Jahre 1982, als die selben 12 333 Ind dm^{-3} erreichen. Im Jahre 1983 sind diese Werte bedeutend niedriger, sie betrugen insgesamt 4400 Ind dm^{-3}, im Jahre 1984 sind sie wieder hoch (10 130 Ind dm^{-3}). (Abb. 3). Nach Zahlenwerte ist die Rotatoria Domination noch mehr ausgeprägt, und im manchen Saisons übesteigt sie 80%. In einigen Perioden, besonders im Winter, steigt auch die Beteiligung von Protozoen, als sie von 9,4% (1982) bis 74,9% (1984) variiert.

Die Anteil von Cladoceren in der quantitativen Zusammensetzung bewegte sich von 0,2% bis maximal 14% im Sommer 1984. Die prozentuelle Vertretung der Copepoden für adulte Formen bewegte sich von 0,6% bis 7,9%. Nauplius- und Copepodit-Stadien waren etwas zahreicher und bewegten sich von 0,3% bis 12%.

Bodenfauna

Im Unterschied zum Zooplankton und Mikrofauna, welche ziemlich verschiedenartig waren, war die Zusammensetzung der Bodenfauna sehr gleichförmig und oft arm. Nur zwei Gruppen waren vertreten: Oligochaeta und Chironomidae, mit ausgesprochener Domination der ersteren. Trotz der Domination waren die Oligochaeten nur mit eine Familie, mit Tubificidae vertreten. Es wurden folgende Arten festgestellt: *Tubifex tubifex, T. kryptus, Tubifex* sp., *Limnodrilus hoffmeisteri, L. claparedeanus, Limnodrilus* sp., *Potamothrix hammoniensis, Psammoryctes albicola, Peloscolex speciosus, P. spureiorensis.*

Durchschnittliche procentuelle Vertretung in der untersuchten Zeitraum zeigt, dass die Gattung *Limnodrilus,* mit der Art *L. hoffmeisteri* in allen Proben am meisten vertreten war (20%). Die übrigen Arten waren prozentmässig bedeudent weniger vetreten (Abb. 4).

Die quantitative Analyse zeigt eine auffällige Veränderlichkeit in der Individuenzahl von Oligocheta, minimal 88 Ind/m^{-2}, und maximal 17 182 Ind/m^{-2}. Änderungen in der Individuenzahl nach Saison stehen im Zusammenhang mit dem Entwicklungszyklus einzelner Arten. Zeitweilige Abwesenheit von Oligocheten in den Proben lässt sich durch Bedingungen des Milieus, vor allem durch den Wasserstand, aber auch durch zeitweilige Austrocknung erkleren. Die quantitative Analyse der Bodenfauna ist in der Tabelle 5. dargestellt.

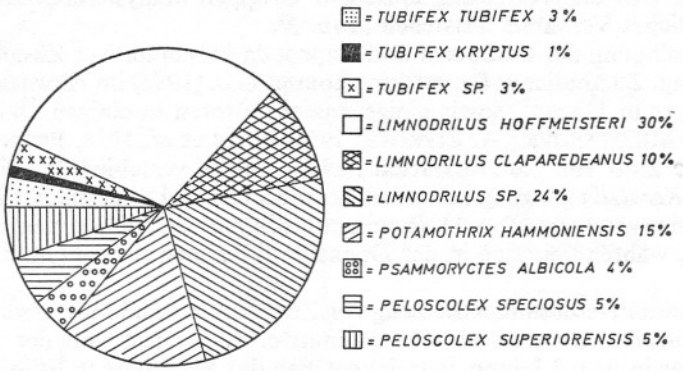

Abb. 4. Die durchschnittlichen prozentmässigen Beteiligung von einzelnen Oligochaetenarten in Carska bara 1982—1984

Tabelle 5. *Quantitative Vertretung der Bodenfauna in Carska bara in der Zeitspanne 1982—1984 nach Saison. (W-Winter, F-Frühling, S-Sommer, H-Herbst)*

Gruppe	1982				1983				1984		
	W	F	S	H	W	F	S	H	W	F	S
Oligochaeta	0	2397	0	444	0	888	—	2930	310	17 182	0
Chironomidae	0	0	0	0	0	0	—	0	0	44	44
Insgesamt:	0	2397	0	444	0	888	—	2930	310	17 227	44

Nach der vertretenen Arten lässt sich schliessen, dass das Wasser der Carska bara in der Untersuchungszeit sehr reich an organischen Stoffe war.

Literatur

Bujnović, D. (1973): Zažtićeni objekti prirode u SAP Vojvodini. — Priroda Vojvodine (Novi Sad *1*, 23—29.

Djerfi, B. (1969): Struktura biocenoza „Carske bare". — Simpozijum iz ekologije, Rezimea saopštenja, II, *41*, 12—14.

Gál, D. (1982): Quantitative und qualitative saisonmässeige Veränderung des Zooplanktons im Altwasser der Theiss bei Körtvélyes im Zeitraum 1971—1976. — Tiscia (Szeged) *17*, 131—142.

Milovanović, D., A.Živković (1953): Ispitivanje planktonske produkcije u ribnjacima Ečke. — Zbornik radova SANU XXIX, Institut za ekologiju i biogeografiju SANU, knj. 3. Beograd, 197—264.

Milovanov, D. (1972): Hidrosistem Dunav-Tisa-Dunav. — Vodoprivredno preduzeće DTD, Novi Sad.

Miljković, N. (1960): Karakteristike vojvodjanskih slatina. — Univerzitet u Novom Sadu, Novi Sad.

Milošević, L., V. Pujin (1983): Prilog proučavanju roda *Brachionus* u rekama Vojvodine — II. Simpozijum o fauni SR Srbije. Zbornik, Beograd, 12—14.

Pujin, V., R. Ratajac, D. Rajković (1978): Prilog proučavanju faune Crustacea i Rotatoria nekih manjih stajaćih voda Vojvodine. — Biosistematika (Beograd) *4*, 115—123.

Pujin, V. R. Ratajac, D. Rajković (1982): Sastav i dinamika zooplanktona Koviljskog rita. — VI Kongres biologa Jugoslavije, Novi Sad.

Adalék a Carska bara limnológiai vizsgálatához

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Kivonat

Az 1982/84-es időszakban a Carska bara védett térségében a kutatások során a zooplankton és mikrofauna összetétele és dinamikája, valamit a fenékfauna vizsgálata került előtérbe, az alapvető ökológiai tényezők mellett (hőmérséklet, oldott oxigén és pH), amelyek a vízmennyiség ingadozásával erőteljes változásnak vannak kitéve.

A zooplanktont és mikrofaunát a Protozoa, Rotatoria, Cladocera és Copepoda csoport képezi. A sekély és benőtt medencében a plankton formák mint a lebegő és bentosz formák vannak jelen. Az adott ökoszisztémában végzett első vizsgálatok alapján a fajlista nem tekinthető véglegesnek. Megállapítást nyert a zooplankton és mikrofauna mennyiségi és minőségi, évi és évszakonkénti változása. A maximum tavasszal jelentkezik. Összesen 130 faj és változat került elő, (84) 1983 és (108) 1984-ben. 1983 augusztusában a meder majdnem teljesen kiszáradt, így a nyári fajok hiányoztak. A tavaszi és nyári időszakban jelentkezik a legtöbb faj, míg télen található a legkisebb fajszám. Minden idényben a Rotatoriák dominálnak, utánuk a Protozoák következnek. A téli hónapokban a Protozoák vannak túlsúlyban, dominánsként is előfordulnak.

A fenékfaunában csak az Oligochaeta + Tubicifidae család *Tubifex, Limnodrilus, Potamotrix* és *Psammoryctes* rend fajait sikerült kimutatni. Elvétve 1984-ben Chironimidák is előkerültek. A fenékfauna mennyiségi összetétele 0-tól 17 182,8 egydm^{-2} között ingadozott. A maximális értékek tavasszal mutatkoztak.

Дополнения к лимнологическим исследованиям Царска бара

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Резюме

На протяжении 1982-84 годов на охраняемой территории Карской Бары проводились исследования по определению составной части и динамики развития зоопланктонов и микрофауны, а также тех экологических условий (температура, наличие кислорода и pH), которые с изменением количества воды могут изменяться.

Зоопланктон и микрофауна представлены здесь группами: Protozoa Rotatozia Cladocera u Copepoda. В мелких и заросших местах котловины имеются различные формы планктона, бентоса. На основании первичных исследований было установлено, что многие виды произрастают здесь не постоянно; установлены годовые качественные и количественные изменения в зоопланктоне и микрофауне, максимальное количество которых наблюдается весной. Всего здесь выявлено 130 видов и разновидностей (в 1983 году 84, а в 1984 году 108). В августе 1983 года русло здесь полностью высохло, в связи с чем летние виды не появились. Больше всего видов появилось весной и летом, а зимой меньше всего. Во всех временах года доминируют ротатории и протозоа. Последние находятся в большем количестве в зимний период.

Prilog limnološkim istraživanjima Carske bare

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Abstrakt

U okviru ovih istraživanja ispitivani su sastav i dinamika zooplanktona i mikrofaune, te fauna dna u Carskoj bari, delom zaštićenom prirodnom rezervatu u periodu 1982—1984. godine. U toku ispitivanja praćeni su osnovni ekološki faktori: temperatura, količina kiseonika rastvorenog u vodi i pH, koji zajedno sa oscilacijama novoa vode, jako variraju. U sastavu zooplanktona i mikrofaune

bile su zastupljene Protozoa, Rotatoria, Cladocera i Copepoda. S obzirom na neznatnu dubinu, kao obraslost bare u probama su se javljali kako planktonski oblici, tako i stanovnici fitala i bentala. Iako je spisak vrsta dosta velik, ne može se smatrati konačnim, s obzirom da su ovo prva istraživanja ovakve vrste u ovom ekosistemu. Broj vrsta zooplanktona i mikrofaune je varirao zavisno od sezone i godine. Ukupno u ispitivanom periodu konstatovano je 130 vrsta i oblika. U odnosu na godine, najveći broj je zabeležen u 1984 god. (108), a najmanji u 1983 (84). U toj godini avgusta meseca, usled izrazito niskog vodostaja, bara je bila skoro potpuno suva, te su izostale mnoge letnje vrste. Sezonsko variranje broja vrsta takodje je evidentno. Najveći broj vrsta se javlja u prolećnjem i letnjem periodu, a najmanji u zimskom. U svim aspektima dominiraju rotatorija, a za njima dolaze protozoa. U zimskim mesecima učešće protozoa je vece nego u letnjim i u pojedinim godinama čak su tada i dominantne. Kvantitativni sastav zooplanktona i mikrofaune takodje varira zavisno od godine i sezone. U svim godinama istraživanja konstatovan je maksimum u proleće. U fauni dna je bila zastupljena samo jedna familija Oligohcaeta-Tubificidae, sa vrstama roda *Tubifex, Limnodrilus, Potamotrix* i *Psammoryctes, Peloscolex*. Veoma slabo, u 1984. godini u fauni dna su bile zastupljene i *Chironomidae*. Kvantitativna zastupljenost faune dna je veoma varirala, od 0 do 17 182,8 ind/m ^{2}. Maksimalne vrednosti zabeležene su u proleće.

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DATA TO THE AMPHIPODA- AND ISOPODA FAUNA OF TŐSERDŐ AND ITS ENVIRONS IN THE TISZA VALLEY

I. AMPHIPODA, ASELLOTA (CRUSTACEA, PERACARIDA)

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(Received September 10, 1984)

Abstract

The studied areas are located in the district of Lakitelek, Tiszaalpár and Bokros. 2 Amphipoda- and 1 Asellota species were found at the study areas of five biocenoses in the Summer aspect of 1983 and 1984: *Synurella ambulans* FR. MÜLLER, *Niphargus mediodanubialis* DUDICH; *Asellus aquaticus* (L.) RACOV. All three species occur together and rather frequently in Hungary. The *N. mediodanubialis* is somewhat rarer than the other two. In differing ratio according to species, polyphagy i-characteristic of all three species. At the same time, they are also significant as the aliment of orgas nisms of higher order.

Introduction

The systematic exploration of the Crustacea-fauna at Tőserdő and its environs has not been accomplished as yet. Therefore, it is of basic significance to study the Crustacea- and within this the Amphipoda- and Isopoda-fauna. The significance of these studies is even greater due to the followings: a large part of the studied area is joint to the unit of the Kiskunság National Park called Tőserdő; the species of the two orders have important role in the decomposing processes of organic matters both in the water and overland (self-cleaning of waters, humification); the representatives of both orders simultaneously form the important nutriment-base for certain aquatic (e.g. fish, newts, insect larvae...) and terrestrial (e.g. frogs, spiders...) animal groups, resp.

The present study is the first part of a projected research series dealing with the Amphipoda- and Isopoda-fauna of the Tisza and its environs, the fauna's ecologic, population-biological and trophobiological relations.

At the studied area — similarly to other areas of the Lowland — relatively low individual- and species-number is characteristic to the Amphipoda- and aquatic Isopoda- (Asellota-) fauna, particularly in relation to the Entomostraca-orders.

The site

The studied area is found in the district of the villages Lakitelek, Tiszaalpár (County Bács-Kiskun) and Bokros (County Csongrád). The collecting sites were: 1. Dead-Tisza at Lakitelek, 2. Lake Sulymos, 3. Dead-Tisza at Alpár, 4. Dead-Tisza at Bokros, 5. Spring at Tőserdő (Fig. 1.: the numbers appearing on the map correspond to the serial numbers given here). The collecting sites Nrs. 1., 2. and 5. belong to the

unit of the Kiskunság National Park called Tőserdő, the rest are located South to this area.

The collections were performed during the Summers of 1983 and 1984. The collected material are in the possession of author's own collection.

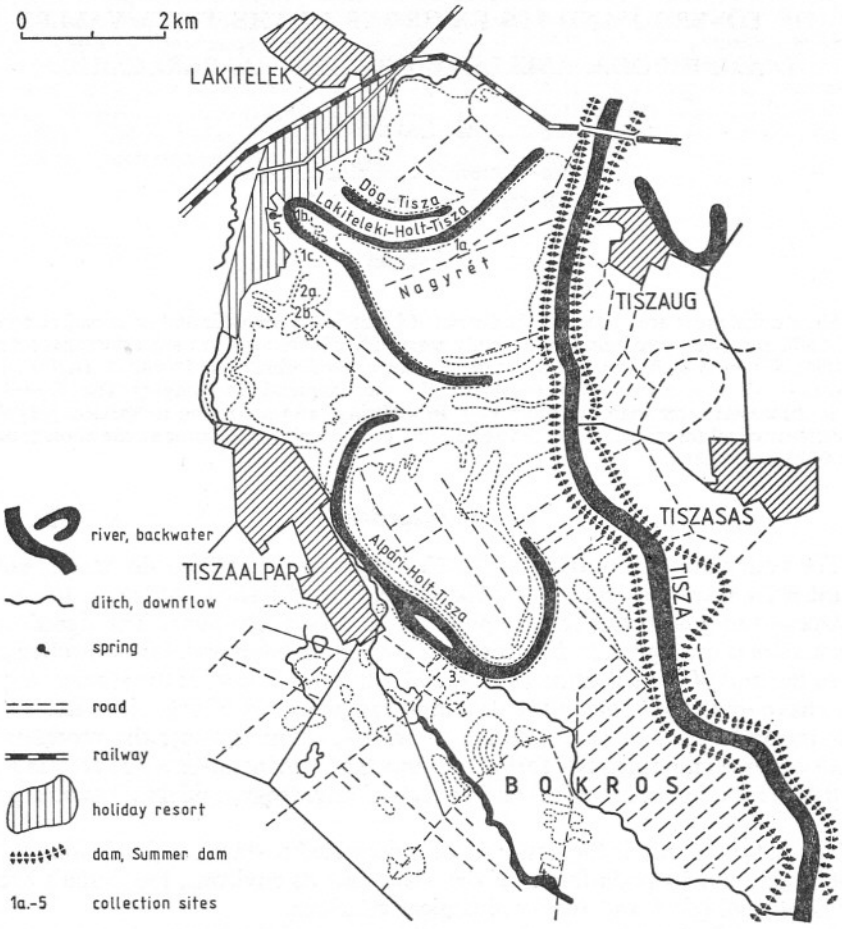

Fig. 1

1. Dead-Tisza at Lakitelek

Soft-stalked vegetation (few amount of *Utricularia* and *Trapa natans*) was not, or only hardly found in the littoral zone of the collecting sites (la., b. on the map). The ground was covered by fallen leaves from trees alongshore *(Salix, Populus Alnus)*. Constant water. Occurring species: *Niphargus mediodanubialis, Synurella ambulans, Asellus aquaticus.*

2. Lake Sulymos.

This is found between Lakitelek and Tiszaalpár, at the meadow at Alpár (2a. on the map). Its border is covered by *Salicetum albae-fragilis* with many *Amorpha fruticosa,* farther in *Caricetum gracilis,* then *Nymphaeetum albo-luteae* are found. Lake Sulymos is of marsh character, however, its marsh origin is not completely proved as yet. The water level strongly fluctuates, it may even completely dry out. Occurring species: *Niphargus mediodanubialis, Synurella ambulans, Asellus aquaticus.*

In March, at the time of the Spring high water level, *Niphargus mediodanubialis* and *Synurella ambulans* were also collected from some of the puddles in the wheel tracks of the earth road near the Lake (2b. on the map). These puddles are strongly of seasonal character, being dry most of the year. They cannot serve as the constant living place of the *N. mediodanubialis* and the *S. ambulans.* In County Baranya, at the border of the village Romonya, *Niphargus* sp. (its identification has not been performed yet), *Synurella ambulans* and *Asellus aquaticus* have also been found in water-ditches regularly drying out for longer periods during the Summer, nevertheless, the water here is almost completely covered by the *Caricetum gracilis,* and its bottom is muddy, thus the conditions are suitable for standing the dry periods. The puddles near Lake Sulymos are, however, devoid (free) of vegetation and mud, their bottoms are of sand. The most probable explanation to the occurrence of these two species here seems to be that during the time of high water level the larger passages in the soil suitable for the communication of the two species became covered by water and thus both species could travel (migrate) without restriction between Lake Sulymos and the puddles. Both species could not be found together in the various puddles, at most always one of them was present. However, the *Asellus aquaticus* which was also frequent in Lake Sulymos, was not observable in neither of the puddles.

3. Dead-Tisza at Alpár.

This is similar to the Dead-Tisza at Lakitelek, at the most sparse *Trapetum natantis* was found at the collecting sites. The occurring species were: the *Niphargus mediodanubialis, Synurella ambulans, Asellus aquaticus.*

4. Dead-Tisza at Bokros.

In contrast to the previous two backwaters, mostly continuous *Phragmitetum* borders are found along the bank. (*Phragmitetum* also occurs at the other two backwaters, but it is of essentially smaller expansion compared to the water surface). The leading species of the *Phragmitetum* here is alternately the *Typha* or *Phragmites.* Constant water. Occurring species: *Niphargus mediodanubialis, Synurella ambulans, Asellus aquaticus.*

5. Spring at Tőserdő.

This is an occupied spring, thus its direct examination is difficult. Shell-fish could not be demonstrated from the water-pipe, even after poking. However, large amounts of *Synurella ambulans* and *Asellus aquaticus* were found in the brook section directly below the spring.

With the exception of the Spring at Tőserdő and the puddles near Lake Sulymos, the *Niphargus mediodanubialis,* the *Synurella ambulans* and the *Asellus aquaticus* were

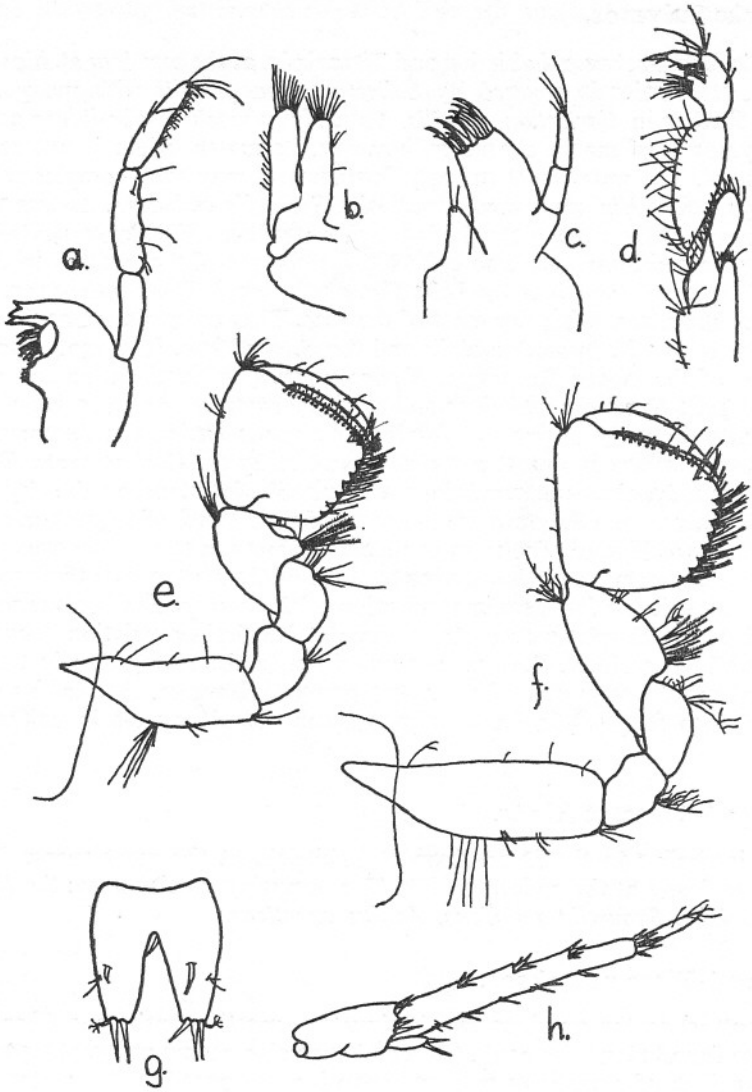

Fig. 2

demonstrable at every collection site. The *Niphargus mediodanubialis* was missing from the Spring at Tőserdő and the *Asellus aquaticus* could not be found in the puddles near Lake Sulymos (Fig. 2).

The demonstrated species

From the studied areas two Amphipoda- and one Asellotaspecies could be demonstrated: *Niphargus mediodanubialis, Synurella ambulans, Asellus aquaticus.* This species number and these species are characteristic to most of the areas of the

Lowlands. The occurrence of the *Niphargus mediodanubialis* is rarer than the other two species.

At the same time, a further Amphipoda species can also be found at certain areas of similar nature (e.g. Zsombó, County Csongrád); the *Orchestia cavimana* HELLER, which has partly taken up terrestrial habits. The occurrence of this species is theoretically expectable at the studied area, however, it has not been demonstrated so far.

The demonstrated three species occur together at most of the Hungarian flat- and hill-country sites, respectively, the *Niphargus mediodanubialis* is missing more frequently.

1. *Synurella ambulans* FR. MÜLLER.

This mainly flat- and hill-country species is general in Hungary, and is also not rare in highlands in case of adequate environment. It is found almost everywhere in permanent and rarely drying out watrs. In general, it is missing from scant vegetational or vegetation-free highland springs and brooks, and from other waters of stronger current, resp.

It is polyphage, but mainly lives on detritus and algae. It can be found on the bottom of the waters in, or on the surface of the detritus, but its more characteristic habitation is on the vegetation. It often even swims. It was found at every collection site discussed here.

2. *Niphargus mediodanubialis* DUDICH.

Mainly a species of the lowlands, described in Hungary. It is less wide-spread than the other two species and is fond of the waters more rich in detritus. It is polyphage, being essentially more carnivorous than the other two species (e.g. it attacks the *Tubifex,* the *Chironomus*-larvae). Ordinarily it does not leave the bottom, dwelling in the detritus or on is surface. It was found at every collection site, except the Spring at Tőserdő.

DUDICH reported on the species in 1941 on the basis of his many site material from Hungary. Since as the supplement to the original description only the various variants were sketched, it seems expedient to give a figure of the important limbs also of importance (significance) in identification, on the basis of the samples collected at the discussed areas (Fig. 3). By the way, the species is in need of revision, which will be accomplished by author after further collection of samples.

3. *Asellus aquaticus* (L.) RACOV.

Its spread throughout Hungary is similar to that of the *Synurella ambulans,* but is more frequent in highland waters. Its environmental demand is also similar to that of the Synurella. It is polyphage, but like the *Synurella ambulans,* it mainly feeds on detritus and algae. It mostly lives on the vegetation, but is also frequent on the bottom. It is unable to swim, occasionally (mostly only during flight) it changes its place from higher spots by sinking with "gliding swim". It was found at every discussed collection site, with the exception of the puddles at Lake Sulymos.

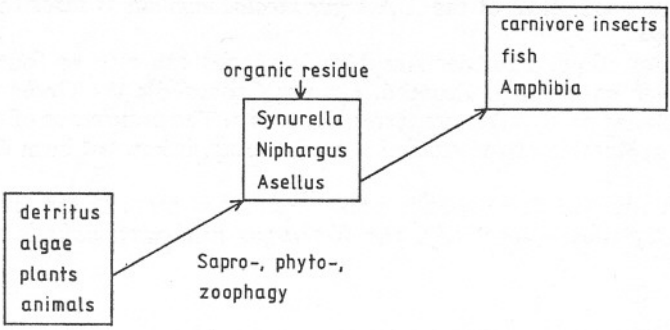

Fig. 3

Trophic regards

In respect to the energy level represented in the trophic system all three species are close to similar in value, due to its greater carnivorous feeding habits the *N. mediodanubialis* slightly rises above the rest. At first approach polyphagy characterizes their nutrition. However, the various feeding habits play role with different emphasis in the case of the various species. The *Synurella ambulans* and the *Asellus aquaticus* mainly live on detritus and algae, while in the case of the *Niphargus mediodanubialis* — as already mentioned — the carnivorous feeding habit has rather significant role. At the same time all three species serve as the aliment of higher trophic levels, too. Accordingly, they are firstly captured by Amphibia (newts), fish and certain carnivore insects and their larvae.

Table 1

Species collection site	1	2a	2b	3	4	5
Niphargus mediodanubialis	+	+	+	+	+	
Synurella ambulans	+	+	+	+	+	+
Asellus aquaticus	+	+		+	+	+

References

CĂRĂUŞU, S., DOBREANU, E., MANOLACHE, C. (1955) Amphipoda forme salmastre si de apă dulce. Fauna R.P.R. IV. 4.

DUDICH E. (1941) *Niphargus mediodanubialis* sp. nov., die am weitesten verbreitete *Niphargus*-Art des mittleren Donaubecken. — Fragm. Faun. Hung. *4*, 61—73.

WÄCHTLER, W. (1937) Isopoda. Die Tierwelt Mitteleuropas II. 2b. 1—317. Leipzig

WAGLER, E. (1932) Crustacea. Die Tierwelt Mitteleuropas II. 2.a. 198—213. Amphipoda, Leipzig

Adatok a Tőserdő és környéke rákfaunájához 1. Amphipoda, Asellota (Crustacea, Peracarida)

LANTOS G.

Tiszakutató Munkacsoport Szeged

Kivonat

A vizsgált terület Lakitelek, Tiszaalpár és Bokros községek körzetébe esik. Öt vizsgálati helyről 2 Amphipoda- és 1 Asellota-faj került elő: *Synurella ambulans, Niphargus mediodanubialis, Asellus aquaticus*. Magyarországon mindhárom faj együtt és elég elterjedten fordul elő. A *Niphargus m.* valamivel ritkább a másik kettőnél. Fajonként eltérő arányban mindhárom fajra a polyphagia jellemző. Ugyanakkor a magasabbrendű szervezetek táplálékaként is jelentősek.

Свегения фауны раков из «Tőserdő» и его края 1 Amphipoda, Assellota (Crustacea, Peracarida)

Лантош Г.

Резюме

Исследовательная территория находится в окрестности «деревнь «Lakitelek», «Tiszaalpár» и «Bokros С пями исследовательных мест нашли две расы Amphipoda и одна раса Asellota: Synurella ambulans, Niphargus mediodanubialis, Asellus, aquaticus В Венгрии все три расы находятся вместе и довольно распространено. Раса Niphargus m. немного режа, чем другиедве расы. Полифагия характерно для всех трёх рас, но в разном соотношении. В то же времяони значительны и для пищи вышеотрядных организмов.

Podaci o fauni rakova iz „Tőserdő" i iz njegove okoline 1. Amphipoda, Asellota (Crustacea, Peracarida)

G. LANTOS

Izvod

Istraživana teritorija spada u rajon sela „Lakitelek", „Tiszaalpár" i „Bokros". Sa pet istraži vanih mesta pronaoteno je dve pasmine Amphipoda i jedna pasmina Asellota: *Synurella ambulans Niphargus mediodanubialis, Asellus aquaticus*. Sve tri vrste žive zajedno i dosta su rasprostranjene li Maotarskoj. *Niphargus m.* je reoti od ostale dve. Karakteristično je kod ovih vrsta poligfaija, an razmer kod svake pasmine je drugaičji. Istodobno su važne kao hrana za razvijenije organizme.