

THE ROTATORIA FAUNA OF THE FLOOD-PLAIN OF THE BODROG AT SÁROSPATAK

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Abstract

It is an indispensable part of becoming acquainted with a river, to study also its tributaries and the water areas (stagnant water, dead arms, borrowing pits), getting into a seasonal connection with it. The fauna-composition of the Bodrog, and through that the composition of the Tisza fauna, as well, are considerably influenced by the rich Rotatoria fauna of the Bodrog-flood-plain in the period of floods. In springtime, we have to reckon with the planktonic species, in Autumn with the meta-phytic species getting into.

Introduction

In the course of investigating the Rotatoria fauna of the Tisza systematically, in respect of both the qualitative and the quantitative data, the effect of the tributaries and from time to time that of their flood-plain, too, can be observed well. The investigation of the tributaries and of the surfaces of the flood-plain belongs closely to studying the Tisza. Valuable investigations were carried out in several areas of the water system. The Rotatoria of the dead-arms of the Tisza are known on the basis of Mrs. Székely's (1954) and Megyeri's works (1961), the fauna of the borrowing pits, on that of Varga's works (1928 to 1930). The results of the investigations of tributaries were published by MEGYERI (1972). From among the dead-arms of tributaries, we have some data only on two dead-arms of the Körös (VARGA 1931). The investigation of the dead-arms and borrowing pits of the Bodrog was carried out by me in 1967—1970. On the oxygen-carbon-dioxide circulation, water-chemical conditions, floristic and faunistic studies of the water-surfaces investigated, a few earlier publications (DÉVAI *et al.* 1969—1970, DÉVAI *et al.* 1971, DÉVAI *et al.* 1972—1973) were giving some informations. Apart from the faunistic elaboration, I was striving to complete my work more and more with aetiological and ecological observations, as well.

Materials and Methods

My investigations were performed in the flood-plain of the Bodrog at Sárospatak—Végyardó, between 1967 and 1970. The dead-arm of the Bodrog, the rivulet Füzes-ér, and the borrowing pits along the four dams were investigated systematically.

The Bodrog dead-arm (Paptava) was separated in the time of the regulations, in the years 1860 to 1870. The depth of water is on average 1.5 to 2 m (max. 3 m), breadth is between 80 to 100 m. The

riverside zone, after a narrow, shallow strip suddenly deepens. The water is of b-limno-Ca-HCO₃ type, its pH is 7.05—8.30, the total saline content was between 190—250 mg/l. In the place of the investigation, a 25 to 30 m broad saligot stand (*Trapa natantis* MÜLLER-GÖRS) of 70 to per cent cover extended. An open-water surface can only be found in the middle, 8 to 10 m broad, streak of the dead-arm. In addition to the predominant saligot, there occurred the rough pool-weed (*Ceratophyllum demersum* L.), and water-soldier (*Stratiotes aloides* L.).

The rivulet Füzés-ér was, in the time of the investigations, the remainder of an ancient canal filled in, and being here and there swampy. In an about 0.8 ha area, the water depth is generally 0.6 to 15 m, but in a small part of the area there occurs a depth of 3.5 to 4.0, as well. The Füzés-ér is connected with the dead-arm of the Bodrog by a narrow canal. The water is here of b-limno-Ca-HCO₃ type, pH 6.5—8.1, total saline content 195—245 mg/l. The extremely rich reed-grass and uliginous vegetation growing here enables the Rotatoria fauna of the various plant-stands to be investigated.

The characteristic associations were the water-soldier hair-weed (*Hydrochari-Stratiotetum* LANGENDOCK (WESTHOFF), the saligot (*Trapa natantis* MÜLLER-GÖRS) and the association of the reed-grass and water-spike (*Polygona-Potamogeton natantis* Soó). Among the associations mentioned there were also mingled sporadically some elements of bladder-wort and duckweed (*Lemno-Utricularietum* Soó), as well as of water-fern (*Salvinio-Spirodeletum* Soó). At the northern fringe a thinly-scattered stand was formed by the great bulrush (*Schoenoplectus lacustris* PALLA). In the shallow marshy areas the marshy bulrush (*Eleocharis palustris* L. & f SCH.), the arrow-head (*Sagittaria sagittifolia* L.), and the "flower"-bulrush (*Butomus unbellatus* L.) were the stand-formers. (I am giving here the characterization of the macrovegetation by using Gy. Dévai's paper of 1972).

The brownish water of the four borrowing pits investigated and independent of one another was, similarly to the former ones, of b-limno-Ca-HCO₃ type. The muddy bottom of the borrowing pits was thickly covered by leaves fallen from the trees of the protective forest.

For investigating the Rotatoria fauna of the Bodrog dead-arm and the Füzés-ér, we have collected some samples from the physiognomically different parts of both areas. From the borrowing pits, there was only dipped out one sample on every occasion.

From the Bodrog dead-arm, the samples were collected out of seven places: at the riverside (A/1), at the open-water fringe with saligot 20 cm below the surface (B/1), at the vicinity of the bottom (B/2), at the middle of the open water from the surface (C/1), at the middle region of water (C/2), and near the bottom (C/3).

From the Füzés-ér, our samples were collected on occasions out of eleven places of different vegetation. Eight sampling sites (1, 2, 3, 4, 5, 6, 7, 8) were in places of different vegetations, while three of them (9/1, 9/2, 9/3) were in the layers of different depth (surface, middle, bottom) of the medial, open-water area of the Füzés-ér.

Our investigations began in the Summer of 1967. The first time only investigations of gathering information were carried out in order to establish how far the area is suitable for a systematical recording series. In 1968, on the basis of samples collected from the sampling sites appointed of the Bodrog dead-arm, the migration of the Rotatoria fauna in the part of the day was investigated at two dates differing in their meteorological conditions (from June 30 to July 1, and from July 6 to 7). For following the supposed vertical migration, we took samples in every six hours (02⁰⁰—08⁰⁰, 14⁰⁰, 20⁰⁰, 02⁰⁰). The systematical investigation of the Bodrog dead-arm and the Füzés-ér started in 1969 (IV.26, V.10, VI.23, VII.25, VIII.19., IX. 10), and was completed in 1970 (III.14). The fauna of the borrowing pits was studied on the basis of the samples taken on the days VI.22, 1969, III.4, V.5, VI.23, and VIII.28.

For quantitative investigations, the filtrate of 5 l water filtered through a 53 μ mesh net of 25 I/A quality was used. The living samples were systematically investigated, as well. Fixation took place with 37 per cent formalin. For studying living animals, Lidocain solution was used.

Taxons are denominated according to M. Voigt's taxonomical handbook.

Rotatoria fauna of the water mater surfaces of the flood-plain

The enumeration of the species found in the course of investigations is contained in a comprehensive paper dealing with the water surfaces of the flood-plain (DÉVAI *et al.* 1972, 1973). In the following I am treating of the species occurring in a higher individual density and being remarkable in ecological respect. At characterizing the species, I am dwelling on the data of their occurrence in this country and the comments of ecological reference by other authors, as well.

Anuraeopsis fissa (GOSSE)

It is regarded as in euplanktonic, "warm-stenothermous" animal (VARGA 1945), but it was occasionally collected from water-weeds, as well (VARGA 1945). In the waters of this country it is ubiquitous; in the dead-arms (MEGYERI 1965), in minor standing waters (MEGYERI 1965), and the waters of bogs (MEGYERI 1969) it occurs like.

In the dead-water Paptava it was found in sampling places C/3, resp. C/2, on July 21 and August 19, 1969. In the borrowing pits it was not found.

It was collected from all the sampling sites of the Füzés-ér. In sites 5, 7, and 8, the multiplication rhythm of the species was showing some similarity to those observed in the open water (9), while in the other sampling sites it was different from these. Its multiplication maximum — that took place in September, at 13 °C water temperature — it was most express in open water.

It was supposedly a result of the mass production at site 9 that, later on, it appeared as a dominant species in every sampling place in the midst of plants (except for site 5).

Its mass occurrence in Autumn in the Füzés-ér and its rapid early-spring multiplication observed in the borrowing pits at Sóstó (in April, at 14 °C water temperature) (BANCSI 1970), then its disappearance, as well as its presence observed in the Paptava at deep summer sampling sites are showing a good accord with the statement of PEJLER (1961) and VARGA—DUDICH (1939) that in the summer month it occurs in the deeper layers of the water. From this the conclusion can be drawn that *Anuraeopsis fissa* is not expressly a summer "warm-stenothermic" species but a planktonic organism preferring the colder waters of about 13 °C temperature, found in the spring and autumn months.

Ascomorpha saltans Bartsch

- A species widely distributed in the plankton of smaller or larger waters, found occasionally in algal coatings (VOIGT 1956). It is rare in faunas, known only from a few places (VARGA 1941). It was found in the stagnant water of the Bodrog, on June 30 — July 1, 1968 in a low individual number but only July 6—7 1968 in large numbers, in a water of nearly 25 °C temperature. Taking this into consideration, we have to designate the temperature limits of the presence of the species in 2.3 to 25 °C, instead of the 2.3 to 19.4 °C, measured by FINDENEGG (1953).

In the Füzés-ér, on May 10, 1969, a considerable number of them were found at sampling sites 5 and 8. The later disappearance of the species is probably caused by the expansion of the reed-grass vegetation submerged.

Aspachna priodonta GOSSE

It is a frequent member of the plankton of smaller or larger standing waters (VOIGT 1956), being present in large numbers from time to time. In our waters — in dead-arms, fish-ponds, saline waters (DADAY 1891, 1892, 1894, 1896, KERTÉSZ 1894, MEGYERI 1960, 1961, VARGA 1932, 1945) — it is generally present. It is a eurythermous (VARGA 1938; FINDENEGG 1953), eurytopic species (AURICH 1933), present in the course of the whole year. In the course of our samplings, it proved to be one of the dominant plankton-organisms of the Paptava and Füzés-ér.

On June 30 and July 1, 1968, in the stagnant water — supposedly owing to the unfavourable weather conditions — it was only present in a quite low individual

number. On July 6—7, however, we have already collected it in a more than twenty-fold amount, as compared to the previous occasion. The extremely intensive reproductivity of *Asplanchna priodonta* is proved by the quick change in its individual number.

It was found in the course of our samplings in 1969 almost on every occasion, primarily in the plankton, but — taking into consideration its size and predacity, too — mainly in the spring months, it is a considerable member of the metaphyton, as well. Its presence in the early-spring plant-covered places does not preclude our establishment, achieved by reason of our observations in the standing water, as the macrovegetation is in that time (April, May) still very undeveloped.

Two maxima of its reproductive cycle were observed; the one of these in May (at 18.4 °C water-temperature in the standing water, resp. 19 °C in the Füzés-ér); and another in July (at 20 °C, resp. 20.2 °C water temperature). The temperature values measured by us agree well enough with the data of B. Pejler (1961) who had observed the reproductive maxima of the species in month VI at 15 °C, and in month VIII at 20 °C water temperature. It is obvious that a mass production of the species is primarily depending not on the season but on water temperature.

Brachionus angularis GOSSE

It is a frequent species in our shallow waters, often being present in large numbers (VARGA—DUDICH 1939). It is primarily a dweller of free banks (DADAY 1891) but is also to be found in midst of water-plants (DADAY 1891), in the plankton of standing waters (MEGYERI 1965), and in river-waters (GÁL 1963).

In 1968, there were found only a few individuals. In 1969, on the other hand, a large enough number of theirs could be collected in the Paptava during the whole year, in the Füzés-ér in the spring months.

In the stagnant water of the Bodrog, two reproductive maxima were observed: one of them in Spring and the other in Autumn what agrees with M. Voigt's statement (1956) well. On the intensity of species propagation the presence of some algal species (*Chlorella*, *Chlamidomonas*) has a positive, while that of others (*Synura*) a negativ influence (POURIOT 1965). Its disappearance from the Füzés-ér, as well as the summer fall in the individual number in the mortlake and the regression of the maximum of autumn multiplication may have been, in our case, a result of the major multiplication of *Synura uwelli*.

Brachionus calyciflorus PALLAS

In the waters of our country it is a frequent enough species, often being present in large numbers (VARGA—DUDICH 1939). It occurs in dead-arms (MEGYERI 1961), in the reed- and reed-grass-covered bank-zone of the saline waters (DADAY 1894) and small waters alike (DADAY 1892).

It can generally be found in the months May—June and September in large individual numbers (VOIGT 1956). In the standing water of the Bodrog it could only be found in April, but in a very small individual number.

Brachionus calyciflorus var. *dorcas* (GOSSE)

Not too frequent in our fauna, it can be found sporadically in smaller standing waters (DADAY 1885, 1892), and dead-arms (MEGYERI 1961).

It was collected from sampling sites 4, 6, 7, and 9/2, in the spring months. In open

water it was present in considerably larger individual numbers than in the places covered with macrovegetation, from what the planktonic course in life of the species can be concluded.

Brachionus falcatus ZACHARIAS

This species is rather rare in our fauna, and was only collected on a single occasion, on August 19, 1969, from the open-water (9) sampling places of the Füzés-ér. The open water is specified as the biotope of the species by the literary data in this country, as well (MEGYERI 1961, 1965). Taking into consideration the masterly construction of its carapace — that is a fine example of the accommodation to the planktonic way of life — this seems to us understandable enough, as the free motion of the species in the midst of the vegetation would be made almost impossible by the strongly elongated and curved spikes.

Brachionus quadridentatus HERMANN

It is a species living in small waters, in the plant-covered in shore region of lakes (VOIGTN 1956).

In our fauna it is frequent. It was found among the vegetation of major standing waters (VARGA 1945), in saline waters (DADAY 1894), and in morassic waters (MEGYERI 1965) alike. It is considered by MEGYERI (1969) as a characteristic marshland species.

According to VOIGT (1956), it has three multiplication maxima (spring, summer, autumnal ones). From these, in 1969, only the summer "running up" (till July 21st) was observed in the ox-bow lake. In the spring months, not even a single individual of the species was found. In the sampling of June 23, however, there were found a great many individuals with 2 to 4 eggs.

The extremely rapid reproductive faculty of the species, and the existence of its summer multiplication maximum were supported by our investigations in 1963, as well: while namely on June 30 and July 1, 1968, only a few individuals of it could be found in various points of the section, a week later — on July 6—7 — during the day 230 individuals were collected, primarily from sites B/1, B/2, and C/2. The influence of weather on the formation of the Rotatoria fauna is unequivocally proved by the difference between the data of the two sampling points of time, as well. In the open-water and plant-covered surfaces of the Füzés-ér, it was only found in the summer months, in a comparatively small individual number.

It is shown by our investigations, that the presence of the forms of *Brachionus quadridentatus* can be used for denoting the total salinity of waters: In the waters of high total salinity e.g., in the natron lake Sóstó at Nyíregyháza (BANCSI 1970), and in other saline waters of the Great Hungarian Plain, the varieties of the species with short dorsal spines — var. *latissimus*, and var. *rhananus* — as well as the variety *cluniorbicularis* without dorsal spines occur, in the waters of lower total salinity, on the other hand (for instance in the marshy waters — Lake Baláta: 75 mg(l—), the form with long dorsal spines is dominant.

Cephalodella exigua (GOSSE)

It is a rare species in the Hungarian fauna, demonstrated so far only from Lake Balaton and its environment (VARGA 1941, 1945, 1957).

In the course of our samplings, it could only be found at sampling site 1, on a single occasion, in small individual numbers.

Cephalodella serrata WULFERT

It was collected at sampling sites 1 and 2, on March 4, 1970. It seems to be a ubiquitous species in the Carpathian Mountains and in Northern Europe (BARZINS 1967), as a dweller of the shallow, cold waters.

Cephalodella rotunda WULFERT

It was found in the Füzés-ér, in the winter samples taken from sampling sites 5 and 6 (March 4, 1970), in rather small numbers.

This species may supposedly be found in the cold waters richer in decomposing organic matters.

Colurella adriatica (EHRB.) (Picture 10)

It is frequent enough in the fauna of our country but in large individual numbers it is only present rarely (VARGA—DUDICH 1939). It was demonstrated from plankton (VARGA 1931), the surface of mud (ENTU—KOTTÁSZ—SEBESTYÉN 1937), among water-plants (VARGA 1939), from *Cladophora* network (VARGA 1941), in the midst of *Ceratophyllum* and *Hydrocharis* (VARGA 1945), from marshy waters (MEGYERI 1965, 1969), and from among the psammon of Lake Balaton (VARGA 1957) alike. On the basis of the data of its occurrence, the species may be classed among the eurytopic organisms.

It was found in the Füzés-ér, at any sampling site designated among plants. In the summer months, its individual density was higher than in the autumnal-winter and spring months. This is supposedly referring to that for a considerable multiplication a comparatively higher water temperature is also demanded by the species, apart from the presence of the vegetation.

Our establishment of the eurytopic character of the species is supported by its occurrence in all the plant associations. In the Bodrog stagnant-water, it was present in the riverside zone grown by plants richly.

In the borrowing pits it was not found, what may be explained univocally by a complete lack in a higher vegetation.

The presence of macrovegetation or an algal network, or possibly of both, may be regarded — taking into consideration the literary data, as well — as one of the important conditions of the occurrence of *Colurella adriatica*.

Colurella obtusa (GOSSE)

This species, occurring in the detritus, algal network, psammon, and among water-plants alike, has so far been known only from Lake Balaton and its environment (VARGA 1938, 1939, 1941, 1945, 1957).

In the Füzés-ér, it was found in the samples from September 25, at sampling site 2. The species is of southern distribution. Its presence in NE-Hungary seems therefore to be an interesting datum.

Colurella uncinata (O. F. MÜLLER)

It lives in waters rich in organic detritus, in the riverside zone of the waters covered richly by plants. In our waters it is a very common species (DADAY 1893, 1895, 1892, 1896, 1897, KERTÉSZ 1894, MEGYERI 1961, VARGA 1932, 1938, 1939, 1945, 1957, ENTZ—KOTTÁSZ—SEBESTYÉN 1937), casually occurring in large numbers (VARGA 1931, VARGA—DUDICH 1939).

In the Füzés-ér, it was found at any sampling site. Its multiplication maximum was observed at site 8 in July, and at the other sampling sites in August. The two maxima demonstrated at site 7 are striking.

The species is almost quite indifferent to the qualitative composition of vegetation. This is proved by that it occurred at any sites — except for that No. 6 — in a similar individual density.

On June 30 and July 1, 1968, it was found in the Paptava but in a small number. On July 6—7, on the other hand, more than four-fold of the individual number found on the previous occasion were collected. It was primarily found in the fringe at the bank, more rarely at sampling point C/3, in the open water. In 1969, it was collected but on July 21, at sites A/1 and C/3.

In spite of that the species was found at site C/3 even on more occasions, its presence in the plankton cannot be regarded as characteristic. In our case, its presence at site C/3 may be explained by the comparatively higher amount of the organic tripton there.

Conochilus unicornis ROUSSELET

It is a wide-spread species, being to be found in the plankton of smaller and larger waters, generally in the course of the whole year (VOIGT 1956). In the waters of this country it is not frequent.

In the plankton of the Füzés-ér it was only found in the months May and June, in a considerably smaller individual number, as compared to the individual density observed at the other sampling sites. In the spring period (April, May) it lived rather one by one, while in the summer months in colonies of 15 to 20.

At sites among plants, the maximum of the individual density was observed at dates differing from one another: thus, at sites 4, 5, and 6 in May, at sites 1, 2, and 8 in June, and at site 3 in July. The multiplication maxima observed in the months May and July correspond to the phenological rhythm of the species (BANCSEI 1970), and the smaller maxima in June may have been given from the temporal postponement of the distribution of the species.

In the stagnant water, it was found both in plankton and metaphyton from Spring to Autumn. Here two multiplication maxima were observed.

Dicranophorus epicharis HARRING-MYERS

It is a new species in our fauna. It is a species wide-spread in the whole world, with sporadic presence (BERZINS 1967).

In the Füzés-ér, it was collected in a quite small number, in April and August.

The animal carries on a predatory way of life so much so that for instance *Trichocerca*, *Bdelloidea*, and *Cephalodella* mastaxes were found in the content of intestines. The animal can be recognized well, even if the determination was carried out from a sample fixed.

Dipleuchis daranuoatpll (GOSSE)

It is a wide-spread species of sporadic presence, living in muddy pools and bog-waters (VOIGT 1956).

In this country, it was primarily found in bog-waters — in the bogs at Zsombó (MEGYERI 1969) and Bátorliget (VARGA 1953) — and in the waters of the Hanság (VARGA 1935). In the Füzés-ér, it was found in small individual number at some

sampling sites of a character differing from one another, namely at site 2 on July 21, at site 3 on August 19.

Epiphanes clavulata (EHRB.) (Picture 1)

Our experiences concerning the species agree with the literary data (VOIGT 1956) completely, both in respect of organizational peculiarities and of the data of occurrence.

In the Füzés-ér, they were collected in small individual number, in months August and September.

From among the borrowing pits along the dam, at sampling site R/3 it was already found in July. Its individual density was considerably higher as compared to that observed in the Füzés-ér.

Epiphanes senta (O. F. MÜLLER)

It is regarded as a wide-spread species (VOIGT 1956), but in the fauna of our country it is rare (VARGA—DUDICH, 1939). The origin of the latter statement may have been that it can only be found in large numbers in the spring months and, therefore, it was collected but rarely (VARGA—DUDICH, 1939). This opinion is confirmed by Gy. Dévai's data (1970), as well.

In the spring months, on April 26 and May 10, it occurred both in the Paptava and the Füzés-ér.

Euchlanis dilatata (EHRB.)

It occurs in large numbers among water-plants (VARGA 1939, 1945), in algal covers and often in planktons (DADAY 1897, VARGA 1932), as well (VOIGT 1956). It is common in the smaller and larger standing waters, dead-arms, bog-waters in this country (DADAY 1883, 1885, KERTÉSZ, 1894, ÁBRAHÁM—BENDE—HORVÁTH—MEGYERI 1952, 1954, ÁBRAHÁM—BICZÓK—MEGYERI 1961, 1965, 1969).

Its appearance in large numbers may be expected, according to B. Carlin's data (1943), from July to November, at 15 ° to 20 °C water-temperature.

In 1969, its presence in the Paptava was rather unsystematical. In the months May, August, and September it was mainly collected in the parts near the riversides.

In the Füzés-ér it was found at any sampling sites.— designated among the plants. In spite of its systematical occurrence here, there has not been observed any multiplication maximum.

On two occasions, at sampling place 1, the form-variety var. *lucksisna* Hauer 1930 was also found.

Euchlanis lyra HUDSON

This species, occurring but very seldom in our fauna, lives among water-papers (VARGA 1939). It was only collected at sampling site 8, on several occasions but in very small individual number.

Filina longiseta (EHRB.)

It is a euplanktical (VARGA 1932), cosmopolite species (VARGA 1931, VARGA—DUDICH 1939), to be found in smaller standing waters (MEGYERI 1965), dead-arms (MEGYERI 1961), saline waters (DADAY 1894), river-waters (GÁL 1963), and rain-water pools (Spandl 1926) alike.

According to O. SEBESTYÉN (1953), it generally occurs in larger individual numbers in eutrophic waters.

The temperature data of the habitat of the species are highly manifold: the temperature limits of its occurrence were located by I. FINDENEGG (1953) between 2.7 and 21.7 °C. L. VARGA (1928) regards it as a summer form, and G. ENTZ—O. KOTTÁSZ-SEBESTYÉN (1937) as cold stenothermous. In the course of our summer collections in 1968, they were only found in a small individual number.

In April, May, and June of 1969, they were found in large numbers in the mortlake. On the other occasions, however, it was only collected in small numbers.

In the Füzés-ér, in the spring months — April and May — it was found in a considerable number at any sampling sites. After the expansion of the macrovegetation, anyway, the presence of the species was limited but to the open-water, where in month August even another multiplication maximum was developing.

On the basis of its conditions of occurrence in the waters of the flood-plain, it is to be regarded as a spring-autumnal form of *Filinia longiseta*.

Filinia passa (O. F. MÜLLER)

syn. *Filinia mystacina* (EHRB.)

It was found in the plankton of lakes and in small mud-pools (VOIGT 1956).

In our fauna it is frequent enough. It was found by S. BARTSCH (1877) in the vicinity of Baja, and mentioned by K. KERTÉSZ (1894) in the fauna of the environment of Budapest, by L. VARGA (1928, 1930) in the borrowing pits along the Tisza at Szeged and (1934) in Lake Fertő.

In 1969, as a member of the spring and early-summer fauna, it was found by us in the mortlake in considerable numbers. From the samples of July and August it did not come to light but at the sampling on September 25 we again found it in the plankton. This species, too, will probably prove to be a spring-autumnal form.

Keratella cochlearis (GOSSE)

It is a euplanktonical, cosmopolite, eurytopic species, rich in forms and to be generally found in the smaller and larger standing waters in our country.

From among its forms, in the course of our collections, there were found its forms named var. *macracantha*, f. *typica*, f. *micracantha*, var. *tecta*, f. *connectens*, var. *angulifera*, f. *pustulata*, and f. *hispida*, found even together in the period of the multiplication maxima.

In the Bodrog-standing-water and the Füzés-ér, it was generally found in large numbers, and casually even in masses. From the borrowing pits it was only found in No. R/1, in a very small individual number.

In the course of samplings in 1969, in the Paptava and the Füzés-ér, two multiplication maxima of the species were observed. These anyway developed in the two places in a different way from one another. The first "running up" — represented by a different individual density in the two water-areas — was observed in May, the second maximum in the dead-arm in September and in the Füzés-ér in July and August. In the Füzés-ér, there was produced by the summer multiplication maximum more than three times as high an individual density as in the Paptava. It is absolutely worth mentioning that the maximum was most express in the places where in Summer a rich macrovegetation grew.

The Füzés-ér is less exposed to the rinsing effect of floods and, therefore, a considerable part of the detritus disturbed there is left over after the marching down of

flood-waves, offering a favourable feeding possibility to the detritophagous species. In the mortlake, the situation is similar with the difference that the flood washes away a large part of the organic detritus. Accordingly, it becomes understandable that in May *Keratella cochlearis* is present in the Füzés-ér in larger individual numbers than in the Paptava, because the former one is providing, besides the planktonical way of life, for the more favourable food conditions.

In bringing about the open-water maximum in the late Summer, early Autumn, a considerable part is also played by the large mass of organic tripton washed in from the riverside zone.

Keratella cochlearis is, therefore, a plankton-organism, the appearance of which in large numbers is very favourably influenced by the quantity of the organic detritus.

Keratella quadrata (O. F. MÜLLER)

It is a cosmopolite, euplanktonical species. They are to be found in the plankton of smaller or larger standing and fresh waters (VOIGT 1956), casually among water-vegetation (VARGA 1941). In larger waters it may be present in large numbers, as well (VARGA—DUDICH 1939). In our country, together with its form-varieties, it can mostly be collected during the whole year. It is a species of wide ecological valence: it was equally found in saline waters (DADAY 1894), bog-waters (MEGYERI 1965, 1969), dead-arms (MEGYERI 1961), small waters in the mountains (ÁBRAHÁM—BICZÓK—MEGYERI 1960) and the river water (GÁL 1963).

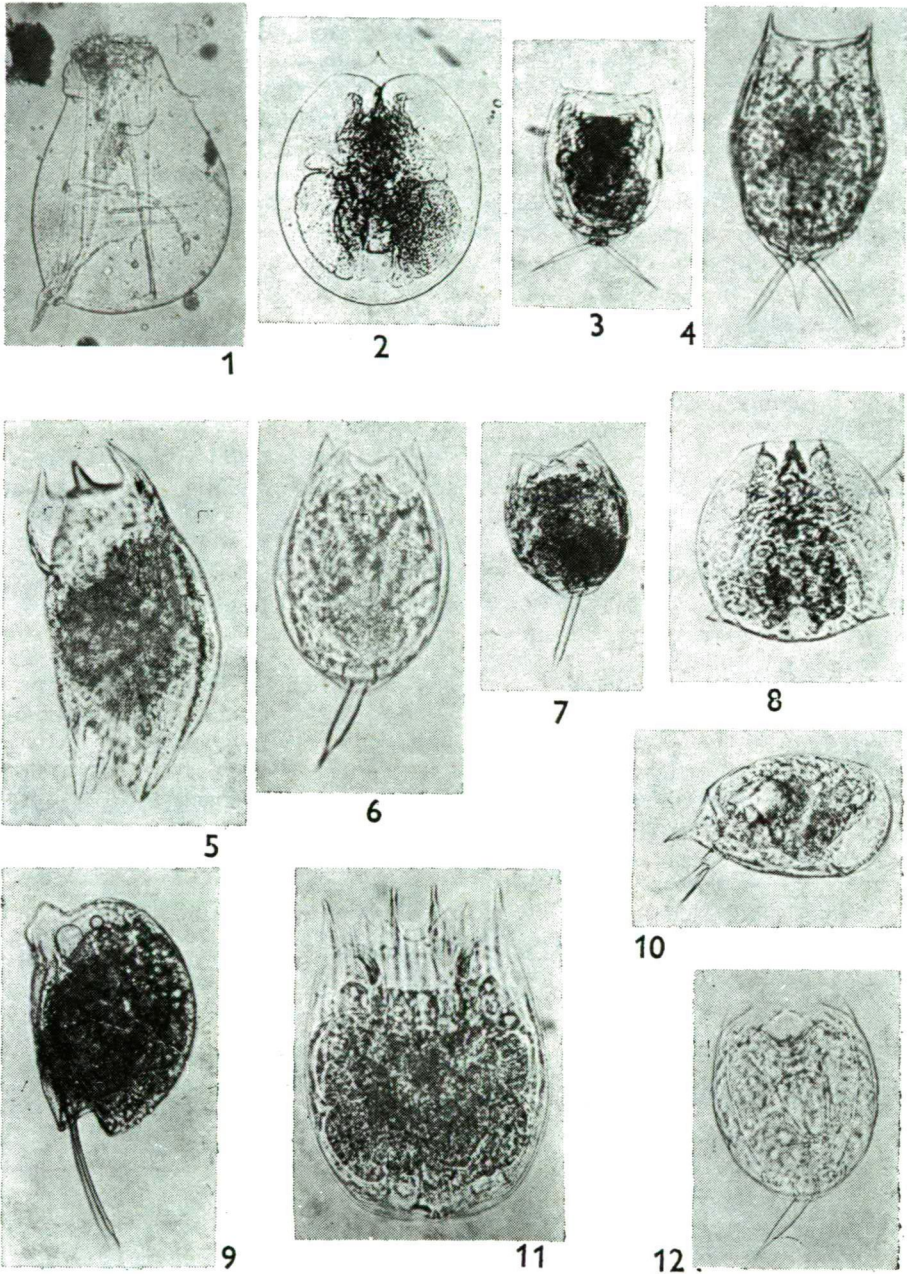
In 1969, it was found in the Füzés-ér in the course of the entire year, and in the stagnant water (except for one occasion August 19) on every occasion. In the borrowing pit, the presence of the species was only casual. In the Paptava three were observed three, in the Füzés-ér two multiplication maxima.

It is interesting that the periods of the multiplication maxima are given by the different authors at different dates. The presence in large numbers was given by B. CARLIN (1943) to take place from June to August, and he demonstrated more maxima, as well. On the other hand, B. PEJLER (1961) was mentioning there dates, falling to January, June, and November.

In the formation of the multiplication maxima of *Keratella quadrata* the temperature of water has — in addition to other factors — probably a considerable part. Comparing B. Pejler's data (1961) with those observed by us, a good conformity may be demonstrated. At the date of the maxima described by B. PEJLER (1961), the temperature values were 6 °C, 20 °C, 6 °C, and the values measured by us were formed in the order of succession: 7.5 °C, 20 °C, 5 °C. It is shown by the data that the multiplication maximum of the species — if other factors are also suitable — may take place independently of the season, in case of a suitable formation of the temperature conditions.

From among the varieties of *Keratella quadrata*, var. *testugo* was present in the standing water, in the Füzés-ér, and in the borrowing pits alike, var. *crucicornis*, on the other hand, lived only in the Füzés-ér and the borrowing pits. In the Füzés-ér, the multiplication of var. *testudo* in large numbers was observed in November in the open water and the maximum individual density of var. *curvicornis* in March, at the sampling sites (1, 2, 3, 4) among the plants.

In the borrowing pits, the appearance of the species and its varieties was casual and unsystematical what may be connected with the estatic character of waters.



Pictures: 1 *Epiphanes clavulata* 2 *Testudinella mucronata* 3 *Lecane unguolata* 4 *Lecane ludwigi* 5 *Mytilina mucronata* 6 *Lecane hamata* 7 *Lecane lunaris* 8 *Testudinella parva* var. *bidentata* 9 *Mytilina mamilata* n.sp. 10 *Colurella adriatica* 11 *Notholca squamula* 12 *Lecane closterocerca*.

Lecane bulla (GOSSE)

It is frequently present in the plant-covered water-side zone of smaller or larger standing waters — namely dead-arms (MEGYERI 1961), saline waters (MEGYERI 1963), bog-waters (MEGYERI 1962, 1965) — and from time to time in their plankton, too, from Spring till Autumn (VARGA 1938, VARGA—DUDICH 1939, VOIGT 1956). It achieves its maximum individual number in Summer (VARGA 1939), but its occurrence in mass is rare. On June 30 and July 1, 1968, it was collected, in a comparatively small number at every sampling point of the profile (!).

At next sampling, on July 6—7, 1968, it was already found primarily in the waterside zone: A/1, B/1, B/2. The characteristic daily rhythm (!) of the motion of species was observed in the waterside zone of the standing water. At sampling sites A/1 and B/1, the fluctuation of individual numbers had the same tendency, while at point B/2 the tendency was contrary to the former ones (Fig. 1).

In the course of the samplings in 1969, it was found from June till September, primarily in the waterside regions, more rarely in the-open water (C/1, C/2, C/3).

In the Füzes-ér, it was found at any sampling sites among plants. There were generally observed two maxima of its individual density in the summer months. The tendency of the multiplication of species has shown a considerable temporary displacement in the plant-associations of similar character, as well. The interpretation of this phenomenon can only be solved by further investigations.

Lecane closterocera (Picture 12)

It is a dweller of waters covered by water-plants richly. Being a eurytopic organism, it may be found in most various habitats. It was obtained from dead-arms (MEGYERI 1961), bog-waters (MEGYERI 1962, 1965, 1969), saline waters (MEGYERI 1963), from small waters in the mountains (ÁBRAHÁM—BICZÓK—MEGYERI 1960), and from psammon alike (VARGA 1938, 1957).

It was collected at all the sampling sites of the Füzes-ér. The species was present at the morassic SE corners (sampling sites 5, 6, 8) in larger numbers than at the other places.

At the other water-surfaces of the flood-plain, it was not found at any samplings.

Lecane curvicornis (MURRAY)

It is a wide-spread, sometimes frequent bog-water species (VOIGT 1956). It is rare in the fauna of this country, collected so far but from three places — the small waters of the Bükk-mountains (ÁBRAHÁM—BICZÓK—MEGYERI 1960), a dead-arm of the Tisza: Dead-Tisza at Tiszazug (MEGYERI 1961), and the sphagnum-bogs at Nagybárkány (MEGYERI 1962).

In the course of our investigations, it was found on a single occasion in the water-side zone of the mortlake.

Lecane hamata (STOKES) (Picture 6)

It is a species living primarily among water-plants but appearing sporadically in the plankton, as well (VOIGT 1956).

In our fauna it is not too frequent. It was collected from the dead-arms (MEGYERI 1961), the bog-waters (MEGYERI 1962, 1965, 1969), and Lake Balaton (VARGA 1939, 1945, 1957).

It was found in the riverside region of the Bodrog-stagnant water, in a small individual number, in 1968 and 1969. In the Füzés-ér it generally occurs. In larger numbers it was collected in the summer months (20 ind./5 l — 280 ind./ 5 l), but a few individuals, at sampling site 8, were even found in a sample obtained from below ice. This occurrence is a very interesting datum because it is mentioned by several authors (e.g., WULFERT cit. VOIGT 1956) as living in thermal waters.

It will probably prove to be an extremely eurythermous species.

Lecane ludwigi ROCHSTEIN (Picture 4)

It lives in the waterside zone of smaller and larger standing waters, among water-plants (VOIGT 1956). In our fauna it is not frequent — it was found in the bog-shrubbery of the Small-Balaton (VARGA 1945) and Lake Baláta (MEGYERI 1965).

In the Füzés-ér, except for sampling site 1, it was found everywhere (in months July, August, and September). It is not present in large numbers but, with its characteristic shape, it is a remarkable member of the metaphyton.

Lecane luna (O. F. MÜLLER)

It is to be found in the plant-grown watersize zone of lakes, smaller standing waters, casually in their plankton, as well (VOIGT 1956). In the summer months, it often appears in large numbers (VARGA—DUDICH 1939). On June 30 — July 1, 1968, there were collected but a few individuals of it. On July 6—7, their number increased to more than twentyfold what was doubtless connected with the environmental factors becoming more favourable. It was found in larger numbers in the plant-covered strip of the waterside, although it occurred casually among the plankton, as well.

The daily rhythm may be observed at this species, too, but not so unequivocally as in case of the former two (*L. bulla*, *L. galesta*).

In the Paptava, in 1969 it was present from June to September. Its multiplication maximum was observed here in July. In the Füzés-ér, in the summer months, it was found at any sampling sites. Although its individual density was not uniform, there could be observed no connection between the quantitative distribution of the species and the quality of vegetation. Its multiplication maximum fell here to July and August.

The species may be considered, on the basis of our investigations, as a summer element occurring primarily among plants.

Lecane lunaris (EHRB.)

It is a frequent species, living primarily among water-plants but occurring casually in the plankton, as well (VARGA 1931, VOIGT 1956).

In the fauna of our country it is very common. But it does not occur generally in large numbers. (VARGA 1928, 1930).

In 1968, it was found at any collections, mainly in the waterside zone, and a few individuals were also demonstrated from the open water.

In 1969, it was present in the mortlake from June to September but not in large individual numbers. Its multiplication maximum was observed in July.

It was demonstrated from any sampling sites, designated among plants. Its individual density — similarly to that observed in the Paptava — was in July the highest.

Lecane stenroosi (MEISSNER)

It is a wide-spread species of sporadic appearance (VOIGT 1956). In Hungary, it was found in Lake Balaton (VARGA 1939) and in some dead-arms of the Tisza (MEGYERI 1961).

In the summer months, it occurred in the mortlake and, except for sampling sites 6, 7, in the Füzés-ér, as well. We found it, in comparatively larger individual numbers, in June and July.

Lecane unguolata (GOSSE) (Picture 3)

In spite of being a wide-spread species (VOIGT 1956), in the waters of our country it is rather rare. It does not occur generally in large numbers.

In the late-summer, early-autumnal months, it was found in the Füzés-ér, at any sampling sites, as a rule, in a small individual number (1 to 30 piece/5 l).

Lecane quadridentata (EHRB.)

It is a wide-spread species but often with a local appearance. It is thermophilous, preferring the warmer waters (VOIGT 1956). In our waters it is rare, being collected even in its habitats but in small individual numbers (VARGA—DUDICH 1939).

In the course of our samplings in 1968 it was found on both occasions. In windy weather, under unfavourable conditions, there could be collected not more than eight individuals, while on the next occasion — in a good weather — approximately 500 individuals were found.

In 1969, from June to September, they were collected mainly from the waterside zone of the mortlake and casually from the plankton, as well.

In the Füzés-ér, in the summer months, it generally occurred. Between the individual density of the species and the quality of macrovegetation no essential connection could be demonstrated. In larger individual numbers it was present in the summer months.

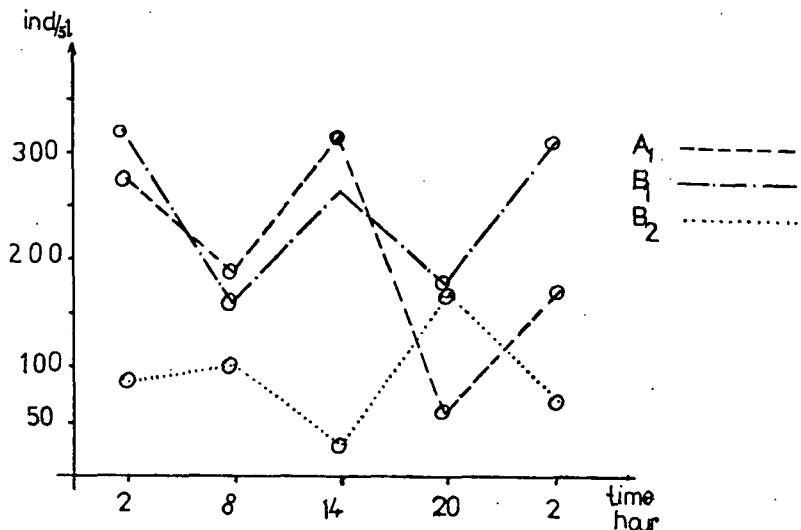


Fig. 1. Migration of *Lecana bulla* in the parts of the day, in the dead-arm of the Bodrog.

Lepadella acuminata (EHRB.)

It is to be found in sources, brooks, peat-boas, in the plant-grown waterside zone of standing waters (VOIGT 1956).

In our fauna it is no frequent element. It can be found within comparatively wide temperature limits, as well. Thus, it was collected by J. DADAY (1891) in the 32 °C water of the bath Püspökfürdő, by J. MEGYERI (1962) in bog-water at a site of 12.5 °C water-temperature. It is held by L. VARGA (1939) to be a eurytopic species!

We have only collected it in the Füzes-ér. It was found but in a small individual number but was a constant enough member of the plant-grown waterside zone.

A few individuals were found in the winter samples, as well. These had lived here at about 3 °C water-temperature.

Lepadella patella (O. F. MÜLLER)

It is a eurytopic organism, living in the vegetation of some small and large standing waters (VOIGT 1956). It is still mentioned by L. VARGA E. DUDICH (1939) as a rare species in the fauna of this country. Of late years, however, it was found in so many places — in small waters of the mountains (ÁBRAHÁM—BICZÓK—MEGYERI 1960), dead-arms (MEGYERI 1961), bog-waters (MEGYERI 1965, 1969), Lake Balaton (VARGA 1945, 1957) — that it is rather to be considered as a frequent species. On June 30 — July 1, 1968, we collected from any sites of the sampling section of the mortlake. On July 6—7, — when the weather conditions became normal — not a single individual of it was found any more. The unfavourable weather conditions observed on June 30 — July 1 and before that date, too, may have conducted to the transitory disappearance of the species; on August 31, 1968, it was namely again found in a considerable number.

In the Füzes-ér, it was present at any sampling sites but, apart from a few exceptions, not in large individual numbers. By reason of our data, the multiplication maximum of the species took place in June and July.

In the mortlake, on July 21, 1969, a species variety of it, *Lepadella patella* var. *similis* was found, in an almost identical quantity with the basic species. Var. *similis* is in our fauna rather rare (VARGA 1949, MEGYERI 1963).

Lepadella ovalis (O. F. MÜLLER)

It lives mainly in the vegetable detrius, rarer in the plankton (VARGA 1931, VOIGT 1956).

In our country it occurs systematically in very common smaller and larger standing waters (DADAY 1891, ÁBRAHÁM—BICZÓK—MEGYERI 1960, MEGYERI 1961, 1962). It achieves the peak concentration on of its amount in Summer (VARGA—DUDICH 1939).

In the course of our samplings, on August 19 and September 25, 1969, it was found in the mortlake, on both occasions in the zone of the waterside fringe.

In the Füzes-ér, except for sampling site 3, it occurred in any plant-covered places.

Its multiplication on maximum was not express, but in the summer months it was found in larger numbers than in winter.

Lindia torulosa DUJARDIN

It is a wide-spread species, to be found in the water-vegetation and at the surface of bottom-mud (VOIGT 1956). In our country it is rare. In the fauna, in the vicinity of

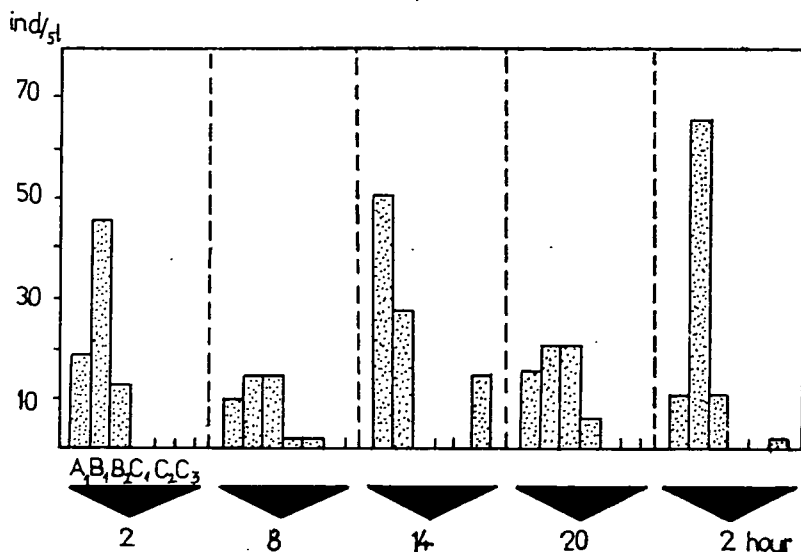


Fig. 2. Quantitative distribution of *Lecane luna* in the riverside zone the dead-arm of the Bodrog.

Budapest, it is made known by K. KERTÉSZ (1894), using the data of S. TÓTH (1861) and T. MARGÓ (1879), as well.

In August and September, it was found at sampling sites 3, 4, 5, and 8. The late-summer — early-autumnal occurrence of the species may have been influenced favourably by the considerable accumulation of the organic tripton.

Mytilina mucronata (O. F. MÜLLER) (Picture 5)

It can be found among the detritus of water-plants (VOIGT 1956), in the bottom deposit (FEJLER 1962).

In our country it is a species of frequent appearance (DADAY 1891, MEGYERI 1960, 1963, VARGA 1939, 1945) but without occurring in large numbers (Varga — DUDICH 1939). By reason of the occurrence data, it may be regarded as a column species of wide ecological valence.

In the mortlake, it was collected on June 23, 1969, at sampling site B/2. In the Füzes-ér, it was found at sampling sites 6, 7, and 8, on any occasion in a small individual number.

Mytilina mamillata n.sp. (Picture 9)

In the course of our samplings, this animal of strange shape that cannot be identified with any of the *Mytilina* species described so far, was found at the sites of the Füzes-ér, grown by water-vegetation richly (sampling sites 5, 7, and 8). It is most similar to *M. acanthophora*, described by J. HAUER from the Island of Java in 1931 but it is also showing some differences from that in respect of several considerable characteristics.

The surface of the carapace is made uneven by small protrusions (Fig. 3). In the anterior edge, shifted towards the ventral side, an eminence ending in a small protrusion is to be found. The side-feelers in the lower one-third of the carapace do not sit on an eminence. The leg is not covered by a semicircular lobe! The fingers are pointed. The eyespot is hardly perceptible. The length of the carapace is 164 μ , its breadth is 120 μ , the length of the toe is 88 μ .

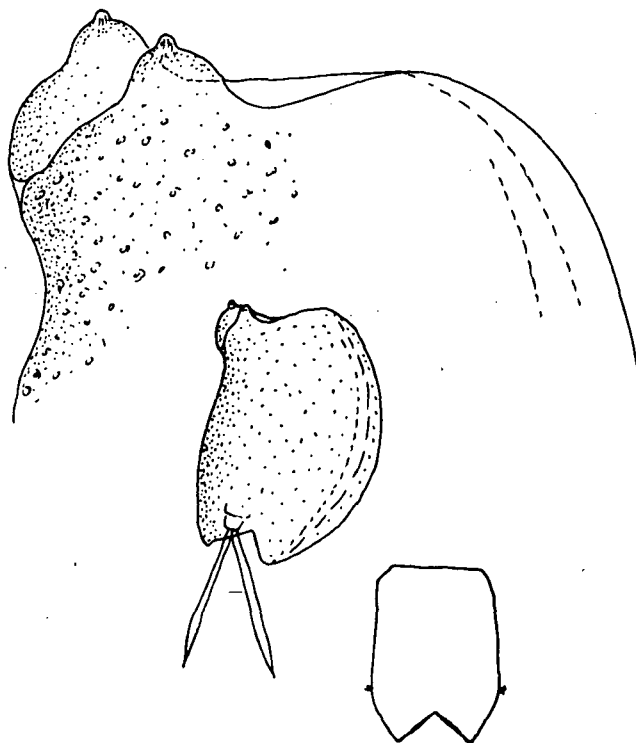


Fig. 3. *Mytilina mamillata* n.sp.

Notholca squamula (O. F. MÜLLER) (Picture 11)

It is a cold, stenothermous species (VARGA 1932), frequent in the plankton of lakes (VOIGT 1956). According to B. CARLIN (1943), its multiplication maximum falls to the early spring months. In the fauna of this country it probably occurs much more frequently than shown by the literary data. It was so far described but from a few sites — from the Balaton (VARGA 1932, 1939, 1941, 1957), from the small waters of the Bükk-Mountain (MEGYERI 1960), and from the Fürj-ér (DÉVAI 1970).

In the mortlake and the Füzes-ér, too, it was only found on April 26, 1969, at 8° C water-temperature. Its individual density at the single sampling sites was considerably different from one another.

It is shown by our data that *Notholca squamula*, apart from the cold waters, occurs in the places rich in decomposing organic matters, in larger individual numbers.

Pedalia mira (HUDSON)

It is a species being present in the plankton of the smaller and larger standing waters (VOIGT 1956).

It is a very frequent member of our fauna from June to October (VARGA 1931). It is considered by J. MEGYERI (1939) as the character-species of saline waters, although it was found, on more occasions in the dead-arms of the Tisza (MEGYERI 1961) and the bog-water (MEGYERI 1965), as well.

We found it in the course of the samplings in 1969, in the qualitative sample scooped out of the mortlake — what means the filtrate of about 50 l water — on July 21, as a single individual with eggs. On September 25, it was already found in the quantitative samples, as well, from the sampling points designated at the border of the open water and hair-weed. (B/1, B/2, B/3).

In the Füzés-ér, an individual was only found at site 3 (along the canal joining the dead-arm with the Füzés-ér).

Platyias quadricornis (EHRB.)

It is to be found in smaller standing waters, richly covered with plants (VOIGT 1956), in periodical pools of flood-plains (SPANDL 1926).

In our fauna, it is very frequent in dead-arms (MEGYERI 1961), bog-waters (MEGYERI 1965, 1969) — a typical summer species (VARGA 1939).

It occurred in any water-area investigated in the flood-plain, from June to September. But in large numbers it was found on no occasion.

Platyias patulus (O. F. MÜLLER)

It is wide-spread but often with a sporadic appearance (VOIGT 1956). It lives in smaller or larger standing waters, rain-water pools (SPANDL 1926), as a rule, among water-plants. In our waters it is a frequent species (KERTÉSZ 1894 MARGÓ 1879, DADAY 1892, 1883, 1885, VARGA 1953, MEGYERI 1961, 1965, 1969).

In the course of our samplings, it was found in the Paptava and the Füzés-ér, from June to September. Its multiplication maximum was observed in July and August, with 300 to 500 piece/5 l individual density.

It generally occurs together with *Platyias quadricornis* what is to be explained probably with the similar ecological demands of both species.

Polyarthra platyptera (EHRB.)

It is a polycyclic (DEIFFENBACH—SACHE 1911), eurytopic species (AURICH 1933), to be found in smaller or larger standing waters (DADAY 1885, 1896). The temperature-limits of its occurrence are given by I. FINDEREGG (1953) between 1.2 °C and 2 °C.

It was found on a single occasion, on July 21, 1969, at sampling site 1 in the Füzés-ér, in a water of 20 °C temperature.

Polyarthra remata SKORIKOV

It is wide-spread in small waters and lakes (VOIGT 1956). According to B. CARLIN (1943), its multiplication in large numbers is to be expected between 5 °C and 20 °C.

In the mortlake and the Füzés-ér, it was collected in larger individual numbers in Spring and Autumn, although a few individuals were present in the summer months, as well.

Popmholyx complanata (GOSSE)

It is a rare species (VARGA 1932) in the plankton of smaller and larger standing waters (WOYSAROVICH 1938) but appearing casually in large numbers, as well (VOIGT 1956).

It was found on a single occasion, in a small number, at sampling site 1.

Scaridium longisudum (O. F. MÜLLER)

It can be collected from among plants, out of smaller or larger standing water, from May to October (VOIGT 1956). According to B. PEJLER (1962), it can be found in the bottom deposit, as well.

In our fauna it is not frequent.

In 1969, it was collected systematically in the mortlake and the Füzés-ér, from July to September. But at sampling site 7, a few individuals were even found in November. It was present in the shallower places (A/1, 1) in larger individual numbers.

Stephanoceros fimbristus (GOLDFUSS)

Dwelling on plants, it lives in cold waters (VOIGT 1956). From the territory of our country, it was described first by K. KERTÉSZ (1894) in the fauna of the environment of Budapest, under the name of *Stephanocoeros sichorni* EHRB. 1832. An individual of it was found on March 4, 1970 (!), at sampling site 8, in a sample dipped out from below the ice.

Synchaeta oblonga EHRB.

In this country, it was only found in a few places — the Balaton (VARGA 1932, 1937, 1939), the vicinity of Orosháza (MEGYERI 1965), and the Fürj-ér (DÉVAI 1970). It is held to be a cold stenothermic animal (VOIGT 1956). In the mortlake, on April 26 and November 10, it was collected in a small number. In the Füzés-ér, however, except for sampling site 2, it was found in large numbers.

Synchaeta pectinata EHRB.

Similarly to *Synchaeta oblonga*, it is a cold-water species (VARGA 1932). In our country it is known but from a few places.

It is regarded by H. J. AURICH (1933) as eurytopic. The temperature limits of its occurrence are given between 2.5 °C and 13 °C — what keeps within narrow enough bounds the presence of species.

In the mortlake and the Füzés-ér it was found on April 26 in considerable individual numbers. In the Füzés-ér it was again present in September and November. Its individual density, however, except for site 6, did not achieve the spring level.

On a single occasion, on July 22, it was found in large numbers in borrowing pit R/1, as well, where the temperature of water was 20 °C.

Taphrocampa anguloca GOSSE

It lives in smaller lakes, pools, among water-vegetation (VOIGT 1956). It is a rare species (GUTTMANN 1962). In our fauna it is of sporadic appearance. It was found in the Balaton (VARGA 1939, 1941, 1945) and in the Fürj-ér (DÉVAI 1970).

On August 19, 1969, in the Füzés-ér, a few individuals of it were only found at sampling site 7.

Testudinella mucronata (EHRG.) (Picture 2)

It was found on a single occasion in a sample, dipped out of the mortlake of the Bodrog, from below the ice.

In the fauna of this country it is rare!

Testudinella parva (TERNETZ)

It is a wide-spread species, occurring sporadically in smaller and larger standing waters, among water-plants, and in bog-waters (VOIGT 1956).

In the mortlake and the Füzés-ér it occurred generally. The maximum of its individual density was observed in June. After that time, we collected it in more and more decreasing numbers, and in November we could find it no more.

In the Füzés-ér, we found a species-variety of it: var. *bidentatus* (TERNETZ 1892) (Picture 8), found in our fauna first by L. Varga (1932), in the water of the "Nagytómalom" lake at Sopron. It was present in the summer months.

Trichocerca bicristata (GOSSE)

It is a species living in the midst of water-vegetation but often occurring in the plankton, as well (VOIGT 1956).

In our fauna, it was collected so far from Lake Small-Balaton by L. VARGA (1945), and from the Dead-Tisza at Tiszazug by J. MEGYERI (1961). In the Füzés-ér, except for sites 1 and 6, it was found casually among the plants, in changing individual numbers, in the late-summer and autumnal months.

Trichocerca birostris (MINKIWICZ)

It is no frequent species. It is a member of the plankton of lakes and smaller standing waters (VOIGT 1956). In our fauna it is rare.

In 1969, in the course of our samplings in the mortlake, it was found in the plankton of the borderland between the open water and weed-hair from July to November.

Its multiplication maximum, correspondingly to the literary data (PEJLER 1961, NAUWERCK 1963) fell to September. In the Füzés-ér, it occurred both in the plankton and in the metaphyton (!). The maximum of its individual density, as distinct from the mortlake, could be observed in July and August. This may supposedly be brought into connection with the early formation of a large amount of organic detritus.

Trichocerca capucina (WIERZEJSKI u. ZACHARIAS)

It is wide-spread and to be found in the plankton of smaller and larger fresh waters (VOIGT 1956) and among the water-vegetation (VARGA 1932, 1945). In our fauna, it is rare, and was so far found only in the Balaton (Varga 1932, 1945).

In 1969, it was collected in the plankton and the waterside zone of the mortlake. It was only present in the autumnal months (August, September) in not large individual numbers.

Trichocerca longiseta (SCHRANK)

It is to be found in the midst of the vegetation of shallow waters (VOIGT 1956), in the plankton (VARGA 1931), in algal covers (PEJLER 1962).

In the waters of this country it is not frequent.

On June 30 — July 1, and July 6—7, 1968, it was collected in the same number, on the first occasion mainly from the plankton, for the second time from the border of the plant-grown zone (B/1, B/2).

In 1969, from June to September, it was mainly found in the borderzone of the open water and the hair-weed. It probably prefers the waters grown in rarely by plants. The multiplication maximum of the species was observed in July.

It was collected from any sampling sites of the Füzés-ér, being systematically found at sites 1, 2, and 3. At the other sampling points it occurred only casually. Its multiplication maximum took place here in June. It is interesting to observe how *Trichocerca longiseta* and *Trichocerca birostris* altercate with each other in the mort-lake (cf. Fig. 4). In the Füzés-ér, the situation is similar, but with the difference that the maxima of the individual density of the species mentioned develop a month earlier. It is probable that the ecology of both species is considerably identical, their phenomenological rhythm is however different.

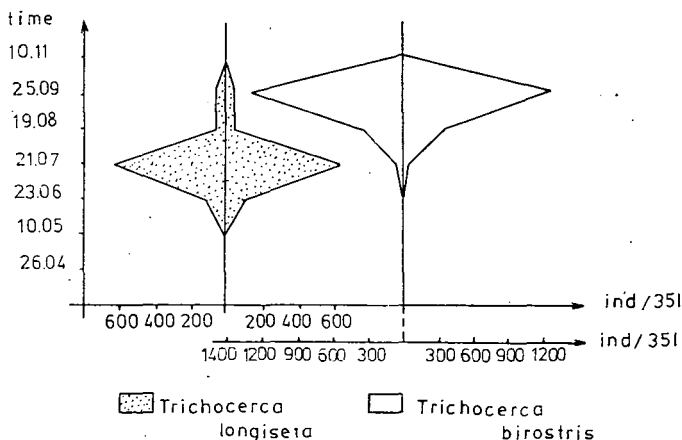


Fig. 4. Quantitative relation of *Trichocerca longiseta* and *Tr. bicristata* in the dead-arm of the Bodrog.

Trichocerca tigris (O. F. MÜLLER)

It is a wide-spread species, living among the vegetation of larger standing waters, smaller lakes, pools (VOIGT 1956, VARGA 1945). In our fauna it is very frequent. It was collected in the summer and autumnal months in the Füzés-ér, in a comparatively small individual number. In spite of its small individual density, it was a characteristic member of the metaphyton.

Distribution of the Rotatoria fauna in space and time and the factors influencing it

Spatial conditions of occurrence

We have tried to clear up — in first approximation — the spatial distribution of Rotatoria in the course of studying the Rotatoria fauna of the shelter forest at Sárospatak and the flood-plain of the Bodrog. At our investigations, we have followed

with attention what kind of effect is exerted and what changes are induced by the environmental factors in the composition of the species associations.

From among the water surfaces of the flood-plain, we have investigated in the mortlake of the Bodrog the Rotatoria stands of the water-area details, differing even habitually from one another — namely that close to the waterside A/1, the transitional zone between reed-grass and open water B/1, B/2, B/3, and the open water C/1, C/2, C/3.

Such a distribution of the water surface is primarily justified in the summer period when a rich macrovegetation is growing in the mortlake. In Spring and Autumn, there is no considerable difference between the species and individual number compositions of the zones. In the spring period, the characteristic plankton-dwelling Rotatoria — like *Keratella cochlearis*, *Keratella quadrata*, *Filinia longiseta* — occur in the whole section.

In the waterside samples A/1, the species preferring the shallow waters warming up fast, that are less sensitive to the fluctuation of temperature and having generally a rich vegetation, namely *Brachionus rubens*, *Buchlanis ovata*, *Mytilina ventralis*, *Lepadella patella*, *Colurella adriatica*, *Scaridium longicaudum*, are dominating.

At the border of the reed-grass zone, B/1, B/2, B/3, where the “saligot-carpet” begins to grow already much thinner, the majority of the Rotatoria species occurring in the section can be collected. This zone is most variable: the species composition of the fauna and the change in the individual numbers of the single species considerably depends upon the formation of the external environmental factors. Is, for instance, the open water touched by any disturbing effect, e.g. stirred up by a strong wind, then a considerable part of the plankton organisms gets even into the more protected zone of the “saligot-carpet”. It may occur, on the other hand, as well, that the animals, living otherwise among the plants, are casually drifted out, or get out of this zone by their own motion.

In this transitional zone can, therefore, both the species living in the metaphyton and those living in the plankton, be found, but the composition of the number of species and individuals is very changing.

In the open-water zone C/1, C/2, C/3, the real planktonical species (*Keratella cochlearis*, *Keratella quadrata*, *Filinia longiseta*, *Asplancha priodonta*, *Polyarthra remata*) are dominant. The dynamism of the change in the composition of species and individual numbers — apart from the drastic, unseasonable conditions met with from time to time — has developed seasonably.

In open water, besides the possibility of the planctonic way of life, a good food-supply is also provided for. As a food partly a large mass of the organic detritus washed in from the waterside zone, partly the algae living there are to be taken into consideration.

We are trying here to outline the similarities and differences, observed between the Rotatoria communities of the water-areas with different macrovegetations, by reason of analysing the faunas found in the various plant stands of the Fűzes-ér.

On the basis of our preliminary investigations and literary studies, we have started from the supposition that in the different plant stands there are different Rotatoria communities to be found. It is, however, shown by the results of our annual fact-finding series that the conclusion drawn on the basis of our preliminary investigations and literary studies was not quite exact.

In the Summer of 1967 and 1968, the samplings were carried out casually. We observed, therefore, some qualitative and quantitative differences between the Rotatoria

stands at the different sampling sites. But investigating our systematic data from 1969 contracted, these differences became blurred completely.

The Rotatoria living in the midst of vegetation were treated of, even on a world scale, but by few authors (HAUER 1952, MÜLLER-LIEBEHAU 1956, MÜLLER 1961, KOCH-ALTHAUS 1963, STRASKRABA 1965).

In domestic relation several investigations of this character were performed (ENTZ 1947, VARGA 1931, 1941, MEGYERI 1961, 1962, 1965, NÓGRÁDI 1962) but without any concrete referring to what kind of Rotatoria communities can be found in the plant-stands given. The composition of the macrovegetation was generally only given in a list of species, although in some cases (VARGA 1941, MEGYERI 1965) the plant species were also given where the Rotatoria were collected from. And the data of all the sampling sites marked out in the water-area were frequently dealt with, contracted in a uniform list of species.

In spite of that the investigations were performed by the authors mentioned in geographically different places, in various watertypes and in waters having casually similar but often also different plant stands: the dominant genera agreed in any case with one another, and at species level, a high degree of similarity manifested itself. The differences, observed in the species composition of the Rotatoria-stands in the single areas, could equally be derived from the different geographical situation of the sites of investigation or from the differences in the water-type as from the differences of the macrovegetation.

Our investigations were carried out in identical water-types and geographical places but on different plant-stands. We could therefore observe unequivocally the effect of macrovegetation on the Rotatoria fauna.

Investigating the data of the systematical investigation-series in 1969, as contracted according to sampling sites, we could not observe any essential and consistent difference in the single plant associations, in the composition of the species and individual numbers of Rotatoria — taking into consideration mainly the dominant species.

Independently of water-depth and the quality of vegetation (reed-grass; submerged natant plant; uliginal vegetation), the fauna of the Füzes-ér proved to be homogeneous enough. On the basis of the results of investigations, it does not seem justified to establish some characteristic species communities in case of Rotatoria that would only occur in the given plant associations.

To be sure, Rotatoria do not follow the plant associations because these ensure primarily but a substratum for their species and, owing to their small stature, the quality of vegetation (species-combination, leaf-proportions, gnarled or smooth surface of the stalk, etc.) is not determinant for them. Those of the species, living among plants, which can remain in the plankton by swimming for a long enough time (*Testitudinella patina*, *Lecane quadridentata*), could systematically be found in the plankton samples, as well. Our former statement, namely that for the Rotatoria living in the waterside zone the reed-grass and uliginal vegetation do primarily count but as a substratum, is proved by this circumstance, as well. There may be considered as a similarly important proof, too, that the typical metaphyton species (*Lecane*, *Trichocerca* species) appear together with the vegetation (in May), their multiplication follows, however, only late in Summer when the food-requirements of the species appearing in a higher individual density are already satisfied by the amount of the organic detritus coming from the vegetation decayed, but there are still enough plants serving for a substratum, too.

It is to be supposed by reason of the data of investigation that it is similarly not

of crucial importance for Rotatoria, at what kind of plant species the detritus or organic tripton, serving for their food, came about.

At the different plant-stands, as seen above, we have found some Rotatoria communities that were very similar to one another. In the layers of different depth of the water-area, on the other hand — in spite of the shallow water of the flood-plain — the vertical articulation of Rotatoria could be observed. This is demonstrated in any sampling section of the Bodrog mortlake, on the basis of our experiences. The bed of the mortlake was divided with sampling points into a surface A/1, B/1, C/1 zone, a 1 m deep B/2, C/2 zone, and a B/3, C/3 zone, near to the bottom.

In the surface region of the open-water area, apart from the enormous multiplication of one of the species from time to time (e.g., that of *Keratella cochlearis*), the species and individual numbers of Rotatoria are generally small. At sampling sites A/1 and B/1, in the course of Summer, owing to the overshadowing effect of the saligot-carpet covering the water surface almost continuously, there were sometimes to be found some species, as well — mainly from the neighbourhood of sampling point B/1 — which do otherwise occur in larger numbers in the deeper layers of the open water (*Platytas patulus*, *Testudinella trilobata*, *Lecane luna*). The middle zone of the water-area, in 1 to 1.5 m depth (B/2, C/2) is the richest one in Rotatoria. In this place, namely, besides the species characteristic of this depth-level (*Keratella cochlearis*, *Polyarthra remata*, *Polyarthra longiromis*, *Asplanchna priodontna*) the species preferring the water-layer close to the bottom (*Platytas patulus*, *Platytas quadricornis*, *Brachionus quadridentatus*, *Lecane lunaris*) may also be found. It seems so that in this zone most species do find the living conditions they need for surviving and multiplying.

The organisms living in the deeper water-layers, B/3, C/3, are least affected by the momentary changes of the external environment. Accordingly, here generally stay the species which are supposedly more sensitive to a quick change in the ecological factors, for instance temperature, the intensity of mingling and consume primarily detritus as food. *Platytas patulus*, *Platytas quadricornis*, etc. are to be found here almost constantly.

The spatial distribution of Rotatoria is also under the influence of environmental factors as, for instance, apart from being stirred up by the wind, of the migration of species according to the parts of the day.

The investigation and elucidation of the spatial distribution of Rotatoria and generally of plankton-organisms are, as seen above, nearly indispensable for the exact causal cognition of the biological processes taking place in the aquatic ecosystems.

The knowledge of the spatial distribution of the Rotatoria fauna is also at the planning of samplings a very important point of view to be taken into consideration. At food-biological investigations, it also furnishes practicable data of good informative character for exploring the conditions of occurrence of the consumer organisms to be expected in the given water-area.

The composition of the species and individual number of the Rotatoria fauna is highly changing. Corresponding to their changes according to the parts of the day and seasons, there are to be distinguished daily and annual rhythms.

The problem of the migration of plankton-organisms according to the parts of the day is generally treated of within the domain of the vertical distribution of species. This standpoint is justified by the notion of migration according to the parts of days, allowing a conclusion concerning the migration of species from their individual density observed at the different sampling points at various points of time.

According to BAYLOR-SMITH, 1957, the vertical migratis is fundamentally a real complex composition of geotaxis and phototaxis, as influenced by the number of the

environmental parameters. Under the parameters of the environment are the light-conditions, temperature, air pressure, pH, oxidation-reduction potential, etc. to be understood. The latter formulation is referring to the causes of the migration of plankton-organisms, as well.

In my opinion, it is justified by the latter formulation to deal with the problem of the migration of plankton-organisms in the domain of the changes in time because the spatial arrangement of species is influenced by the changing environmental factors (in compliance with the changes in the parts of the day).

There are but few data to be found, even on a world scale, concerning the problem of the migration of Rotatoria according to the parts of the day [BARTHELMESS 1960, HAUWERCK 1963, HUBICEK 1964, GEORGE-FERNANDO 1969]. But even these data are, unfortunately, not comparative ones, because partly the time passed between the sampling points of time is different, partly the environmental data published are not detailed enough.

The migration of *Lecane bulla*, *Lecane luna*, and *Mytilina ventralis* according to the parts of the day, in the waterside zone of the mortlake was observed in the course of our 24-hr recordings carried out on July 6—7, 1968 (we were sampling in every 24 hours). There have, supposedly, several Rotatoria species a daily rhythm of the same, or similar, character but it has not become known, as yet, due to the low number of the 24-hour investigations.

The migration of Rotatoria according to the part of the day is known, for the time being, but a little. In spite of this, the existence of this phenomenon is anyway to be taken into consideration at planning the samplings.

At the annual survey of the Rotatoria fauna in the flood-plain of the Bodrog we have obtained an unequivocal connection between the species and individual number composition of the Rotatoria communities from the samples drawn from the water in different seasons, as well as between the development and perishment of the macro-vegetation.

On the occasion of the spring floods, the beds of the water-areas in the flood-plain became completely washed through (!), and the large amount of the organic detritus accumulated there in the previous year or season was washed out. After the withdrawal of flood, a broad open water-surface was left over in the bed. After the deposition of the organic and inorganic detritus materials stirred up by the flood-wave, there were produced favourable essential conditions for the multiplication of the planctonical Rotatoria in all the water-areas.

There cannot be demonstrated any essential differences between the species compositions of the Rotatoria fauna in the waterside and open-water samples, originating from this period (May 26) and drawn from the same depth. Apart from the species preferring colder waters (8 °C) (*Motholca squamula*, *Synchaeta oblonga*, *Synchaeta pectinata*), real plankton-organisms (*Keratella cochlearis*, *Keratella quadrata*, *Asplanchna priodonta*, *Polyarthra longiromis*, *Epiphanes senta*) were dominant both in the mortlake and the Fűzes-ér.

The full-development of the aquatic macrovegetation takes place in late May — early June. The above-detailed species-communities of the water-areas, separable well even physiognomically, (waterside, reed-grass, open water), are obtained from the samples of June, July, and August. In June, simultaneously with the development of the rich vegetation, do appear the species of genus *Lecane* (*L. bulla*, *L. luna*, *L. lunaris*), genus *Trichocerca* (*Tr. longiseta*, *Tr. alangata*, *Tr. agnatha*), as well as the species of genera *Testudinella*, *Colurella*, *Lepadeka*, and *Mytilina*.

To the multiplication of the species of the genera mentioned may have contribu-

ted favourably the rise in temperature, as well. The occurrence of their majority is nevertheless connected primarily to the presence of the macrovegetation. If these perish, simultaneously they disappear, as well, even from a biotope of an otherwise still favourable water-temperature.

The decay of vegetation began to be vigorous in late September and ended till the end of October. The species characteristic of this period, like e.g. *Lepadella ovalis*, *Lecane hamata*, *Trichocerca birostris*, *Trichocerca capucina*, *Testudinella trilobata*, prefer the waters that are rich in breaking up organic substances. The fact that their presence is determined primarily by the rich organic detritus content of the water and not, e.g. by temperature, is proved suggestively by the occurrence data of *Trichocerca birostris* (Fig. 4) and *Trichocerca capucina*. These could not be observed in Spring; in Autumn, however, they multiplied in large numbers. Parallel to the change in the environment, casually to the development and the decay of vegetation, the formation of the multiplication maximum of *Trichocerca longiseta* and *Trichocerca birostris* in the mortlake (Fig. 4) was striking. It is probable that not only the phenologic rhythm but, to a certain extent, also the ecology of the two species are different. The multiplication maximum of *Tr. longiseta* fell to July, the main growing season of the macrovegetation, that of *Tr. birostris* fell, however, to September, the period of the decay of vegetation.

The multiplication of Rotatoria, as touched already before, is also influenced by the formation of water-temperature. The primary cause of the appearance, multiplying and disappearance of Rotatoria is seen by several authors (GARLIN 1943, NIPKOW 1961, PEJLER 1961, 1962, NAUWERCK 1963) in the favourable formation of water-temperature.

Comparing the results of my investigations with the data of GARIN (1943) and PEJLER (1961), apart from the general similarities, in case of *Asplanchna pridonta* and *Keratella quadrata* I came to the conclusion that the multiplication maximum of the species is not necessarily connected to a given season but, supposing the optimum existence of other factors (macrovegetation), too, primarily to the favourable formation of water-temperature.

At the macrovegetation-covered sampling sites of the Fűzes-ér, between April 26 and September 25, 1969, the relation of the species and individual numbers of Rotatoria developed in any case in a contrary direction — corresponding to the literary data: there belonged a large individual number to the small species number, and a small individual number to the large species number (Figs. 5, 6).

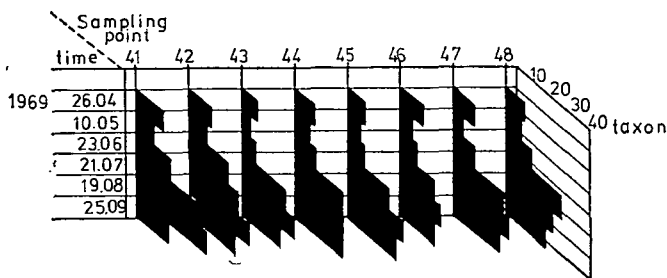


Fig. 5. Formation of the species number of Rotatoria in the dead-arm of the Bodrog, in 1969.

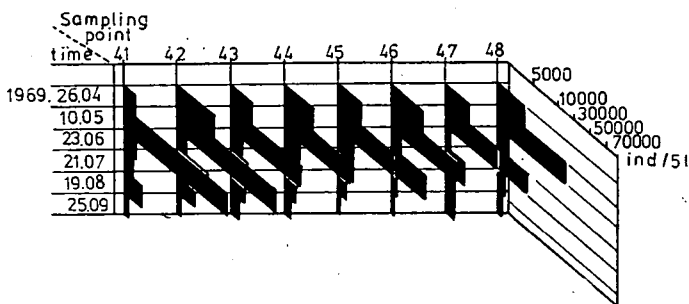


Fig. 6. Formation of the individual density of Rotatoria in the dead-arm of the Bodrog, in 1969.

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Taking into consideration the descriptions above, the Rotatoria fauna of the mortlake, the Füzes-ér, and the borrowing pits may be characterized as follows:

Of the Rotatoria fauna of the mortlake and Füzes-ér the species preferring standing waters are characteristic. In the borrowing pits, there are rather dominant the species of a short life-cycle, tolerating the changes in the environmental factors well, with an inclination to dry up.

Owing to the considerable expansion of the macrovegetation, the number of the real plankton-organisms in the mortlake were more or less agreeing with, — in the Füzes-ér always considerably lower than — that of the metaphyton species.

Our observations concerning the character species of the eutrophic waters have resulted in a similar statement. In the mortlake there were found several such species, but their individual numbers manifested themselves to be considerably lower than in the Füzes-ér.

From the mortlake there were demonstrated 69, from the Füzes-ér 117 Rotatoria taxons. The difference manifested in the species number and the qualitative composition of the Rotatoria fauna in both water-areas can be explained, in some degree, with the difference in the macrovegetation of the two water-areas, with the peculiar form of the bed-structure, and the degree of difference in eutrophization. While namely in the mortlake the nearly homogeneous stands of *Trapa natans* are to be found, the vegetation of the Füzes-ér is characterized by variety. The Rotatoria fauna of the mortlake and the Füzes-ér — supposedly because of the identical origin of, and the constant connection between, their waters — is showing, apart from differences, a considerable similarity, taking also into consideration the individual number of the 53 species which are present in both water-areas.

The Rotatoria fauna of the borrowing pits is decisively determined by the complete lack of macrovegetation, by their being overshadowed, and by a large mass of the allochthonous organic matter that had got into their water. The 15 species demonstrated from the borrowing pits, with the exception of one species, occurred in the Füzes-ér, as well, and eight of them were also present in the mortlake. The large number of the common species in the water-areas of the flood-plain, in addition to the common origin of waters, are referring to a food-supply being quantitatively similar in these waters.

In the spring and autumn months — before and after the main growing period of the macrovegetation — when the whole watet-area may be considered as having

the character of a uniform open water, the planctonic species (*Asplanchna priodonta*, *Filinia longiseta*, *Keratella cochlearis*, *Keratella quadrata*, *Synchaeta oblonga*, etc.) were dominant. Simultaneously with the expansion of macrovegetation, the plankton-dwelling species were driven into the background and, both in respect of the species and of the individual numbers, the metaphyton-organisms (*Lecane bulla*, *Lecane hamata*, *Lecane unguolata*, *Colurella uncinata*, *Testudinella bicristata*, etc.) have come into prominence.

In the physiognomically different parts of the water-area, during the period of investigations, the individual density of Rotatoria was formed variously. In the period of the spring multiplication maximum their number were considerably larger in the places where in the summer months a rich macrovegetation was growing. On the other hand, on the occasion of the late summer maximum, in the deeper parts of the bed, we observed a higher individual density in open-water. This phenomenon can be brought, in our case, into connection with the food-supply that was different in the various parts of the water-area.

The Rotatoria communities living in different vegetation water-organisms have shown in the Füzés-ér, considerable similarity in respect of species and individual numbers. It seems that for Rotatoria the macrovegetation is primarily important as a substratum serving for settling place. And as Rotatoria are organisms of very small size (50 μ —150 μ), in their case the quality of plant surfaces is not determinant. They are not particular about the origin of the organic detritus, either, serving as food for them. It may have been caused by these two facts in our case that in the different plant-stands very similar Rotatoria communities were found.

The lesson to be drawn from our fact-finding investigations is that the temporal (seasonal) appearance and multiplication of Rotatoria of large numbers must have been considerably determined — in addition to the endogenous factors — from among the environmental complex investigated: by water-temperature, the favourable food-conditions, as well as by the presence, resp. absence of the substratum.

In the course of our 24-hour investigations, the migration according to the parts of the day of four species (*Lecane bulla*, *Lecane galeata*, *Lecane luna*, and *Mytilina ventralis*) was observed.

It can be established by reason of our data that the plankton-members to be found during the whole year, namely the species *Keratella cochlearis*, *Keratella quadrata*, *Asplanchna priodonta*, and *Polyarthra*, are characteristic of the Rotatoria fauna of the Bodrog-dead-arm and the Füzés-ér. And in the waterside zone, the species connected to the presence of the macrovegetation: *Philodina megalotrocha*, *Lecane bulla*, *Colurella adriatica*, *Lepadella patella*, *Mytilina ventralis*, *Scardium longicaudum*, are dominant.

The composition of the species and individual numbers of the Rotatoria fauna in the borrowing pits is determined decisively by the astatic character. Here, correspondingly, the species inclined to be dried up, with a rapid multiplication cycle, can be found.

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A sárospataki Bodrog-hullámtér Rotatoria faunája

BANCSI I.

Alsó Tisza-vidéki Vízügyi Igazgatóság Szolnok, Tiszaliget

Kivonat

A Tisza Rotatoria faunájának rendszeres vizsgálata során mind kvantitatív, mind kvalitatív viszonylatban jól érzékelhető a mellékfolyók hatása. Ezért szerző megvizsgálta az egyes mellékfolyók és a velük időszakosan kapcsolatos holtágak és kubikgödrök Rotatoria faunáját is. Megállapítást nyert, hogy a Bodroghullámtér e fauna elemekben igen gazdag s az áradások időszakában nagymértékben befolyásolják a Bodrog és ezen keresztül Tisza faunájának összetételét is. Megoszlásukat tekintve a tavaszi időszakban a planktonikus-, ősszel a metafitikus fajok bejutásával kell számolni.

ROTATORIA ФАУНА ПОЙМЫ БОДРОГА В ШАРОШПАТОКЕ

И. Банчай

Водное управление Нижнетисайских районов, Сольнок, Тисалигет

Резюме

В ходе систематического исследования Rotatoria фауны р. Тисы как в количественном, так и в качественном отношении явно заметно влияние притоков. Поэтому автор занимался исследованием некоторых притоков и одновременно фауны мёртвых русл и земляных ухаб. В результате установлено, что пойма Бодрога очень богата элементами этой фауны и это в период наводнений оказывает значительное влияние на состав фауны Бодрога а через него и Тисы. Что касается их разделения, в весенний период следует ожидать появления планктонических, а в осенний — метафитических зидов.

Fauna Rotatoria plavnog područja reke Bodrog kod Sárospatak-a

BANCSI I.

Vodoprivredna uprava donje Tise, Szolnok—Tiszaliget

Abstrakt

Kvantitativna i kvalitativna sistematična ispitivanja faune Rotatoria Tise ukazuju na uticaj njenih pritoka. Stoga je autor analizirao faunu Rotatoria pojedinih pritoka, mrtvaja i u kubicima koji su sa njima povremeno povezani. Utvrđeno je da plavno područje Bodroga ima veoma bogatu faunu Rotatoria i u vreme visokog vodostaja umnogome utiče na sastav faune Bodroga a samim tim i Tise, i to: u toku proleća se javljaju planktonske, a u toku jeseni metafitičke vrste.