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# Zoological Examinations in the Sphagnum-moor of Egerbakta

By

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## Introduction

The three main tasks of the research of the biosphere: to maintain and/or control the equililibrium of the environment more and more intensely influenced by man; to settle the already upset equilibrium conditions; and to protect as yet undisturbed areas of great value to humanity.

The examination of the *Sphagnum*-moor of Egerbakta is connected with the aim mentioned third. The area deserves attention in respect of science and environment protection alike. Among its points of interest and values there are – apart from the peat-mosses infrequent in Hungary – also species of northerly character and relict plants *(Lysimachia thyrsiflora, Eriophorum gracile, Calliergon cordifolium, Lactarius helvus)*.

On the Egerbakta *Sphagnum*-moor numerous botanical works of comprehensive character were published (Boros, 1924; Juhász, 1963; Pócs, 1963; Zólyomi, 1931). Up to now only two zoological studies were published on the moor. Soós (1938) reported on its threadworms (Nematoda) in a comparative work, and Megyeri (1965) informed on its Protozoa, Rotatoria and Cladocera.

The primary aim of the authors' examinations discussed here was to supply data on the Crustacea of the Egerbakta *Sphagnum*-moor. The material collected seasonally, by the parts of the day and from biotopes of different character also serves with information on the changes of the Crustacea in time and space.

## Description of the examined area

The Egerbakta *Sphagnum*-moor is situated in the Bükk Mountains (Northern Hungary), 4 km. to the south of the village Egerbakta, in the direction of Szarvaskő. The moor, located at a heigh of 280 m. above sea level on the side of Tó-hegy (Lake Hill), is surrounded by dry oak-forests. It is roughly elliptic,

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the major axis is about 90 m, the minor one about 60 m long. The basin of the moor was formed by a landslipe. The base rock is quartzite. According to POST's geomorphological classification it is topogeneous.

According to OSWALD's classification, the Egerbakta moor falls within the group of the sedgy transition *Sphagnum-moors* (MEGYERI, 1965; SOÓS, 1938; ZÓLYOMI, 1931). Its central part is formed by the Sphagnetum. In a considerable part of the latter an association of *Carex rostrata – Sphagnum recurvum* predominates (sampling spots 1 and 2). A transitional belt follows next, with shrubs of *Salix cinerea* and *Populus tremula* and *Juncus effusus, Thelypteris palustris* and *Lysimachia vulgaris* stands. There is no continuous moss carpet in this belt: clusters of *Sphagnum* and *Polytrichum strictum* alternate (sampling spots 3 and 4). The outermost zone is formed by lagg densely overgrown with *Salix cinerea* (sampling spot 5).

Apart from the local geomorphological and base-rock situation, the Egerbakta *Sphagnum*-moor could survice on account of the microclimatic, precipitation and ground-water conditions. As compared with the environment, a microclimate of lower temperature and high relative humidity prevails above the moor. All this is brought about by the joint effect of the relatively stable ground-water level, the high transpiration of the vegetation, the protective and shading influence of the *Salix cinerea* shrubbery surrounding the Sphagnetum and the lack of the drying effect of air currents. As a result of the same factors the temperature of the water of the moor is rather low: 12 °C on a yearly average. In its trend, this low water temperature follows the changes of air temperature, remaining, however, far below same at all times.

The water of the Egerbakta *Sphagnum*-moor – of both the Sphagnetum and lagg-zone – is of acid reaction and rather poorly supplied with oxygen. Its total salt content and the quantity of ions leading to it are rather slight even in themselves. Besides the extreme conditions of hydrogen ion concentration – as most conspicuous phenomenon – the low $Ca^{2+}$ –, $Mg^{2+}$ – and nitrogen-, as well as the relatively high iron content belong to the speciality of the water of the moor. More important than the said low values is the quantity of the accumulating organic matter resulting from peat formation. As a consequence, the dark brown water of the moor, rich in humic substances, is typically dystrophic. The extreme water climate brought about by the oecological factors is influenced also by seasonal and circadial changes. As regards detailed climatologic and hydrochemical data, the authors refer to OERTEL's (1974) work.

The quantitative changes in total salt-concentration and the ions it includes – $Ca^{2+}$, $Mg^{2+}$, $Na^{+}$, $K^{+}$, $Fe^{2+}$, $NH_4^{+}$, $NO_2^{-}$, $NO_3^{-}$, $SO_4^{2-}$, $Cl^{-}$-bear a close connection with the precipitation and ground-water conditions prevailing at any time. The seasonal and circadial values of $HCO_3^{-}$, pH, dissolved $O_2$, as well as the production of organic material similarly depend on these factors, still, their changes can be brought into connection in the first place with the activity of the living organisms.

Besides the base rock, the highly acid pH values of the water of the moor are determined primarily by the proportion of the peat-mosses and sedges in the actually present association and in the process of peat formation. The acid pH values „buffered" by peat formation are in some measure influenced by the change with time of $HCO_3^{-}$ (OERTEL, 1975).

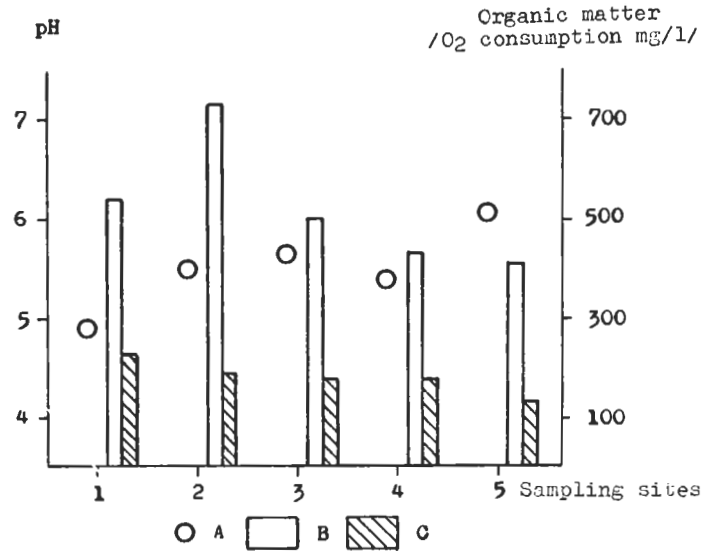


Fig. 1. The organic matter content and pH values of the filtered and unfiltered samples in the sampling spots. *A:* pH; *B:* organic matter content of unfiltered sample; *C:* organic matter content of filtered sample

The hydrochemical character of the moor displays horizontal differences in compliance with the various plant associations situated circularly round it. The difference appears most markedly in the conditions of conductivity, pH, $HCO_3^-$, dissolved $O_2$ and organic matter of the Sphagnetum and lagg zone. This follows from the different character and intensity of the utilization and/or decomposition of organic matter at the spots of sampling. There is a difference of smaller but demonstrable measure also between the Sphagnetum taken in the stricter sense *(Carex rostrata — Sphagnum recurvum* assotiations) and the transition zone, which mainly ensues from the character of the physiognomy of the compact tusks formed of peat-moss and the open-water fen windows. Naturally, the zonal changes come to pass through continuous transition, which is well respresented by the examples of pH and organic matter. Both change along regular gradients, with opposite tendencies: proceeding from the Sphagnetum towards the lagg zone the quantity of organic matter decreases at a simultaneous increase in the value of pH (Fig. 1).

## Sampling spots, material, method

Zoological collection took place on 24.4., 14.8., 31.10., 1971 and 23.1. 1972 from the following sampling spots (Fig. 2):

S p h a g n e t u m

Association of *Carex rostrata — Sphagnum recurvum:*

**1.** Bound tussock of *Sphagnum.* Apart from the peat-mosses, the stands consist of *Carex rostrata* and *Juncus effusus.* Also *Telypteris palustris* is frequent.

2. *Sphagnum* tussock similar to site 1. Sedges are representes here by *Juncus effusus, Telypteris palustris* is present in great quantities. The plants of the fen windows round the tussock are *Cicuta virosa, Lysimachia vulgaris* and *Scutellaria galericulata*

Transition zone

3. Fen window of 1 – 2 m² open water surface. In it the peat-mosses are supplanted by *Carex pseudocyperus.*

4. Fen window intermittently broken up by smaller *Sphagnum* tussocks; on its edges there are Carex rostrata and *Juncus effusus,* in the tussocks *Lysimachia vulgaris, Lythrum salyceria* and *Glyceria aquatica.*

Lagg zone

5. Area densely overgrown with *Salix cinerea,* well shaded and covered with *Lemna minor.* The water is 1 – 1.5 m deep in spring, shallower in summer and at the time of the autumn drought; it is filled up to the bottom with rotting vegetal and animal remains. Intense processes of decomposition and rotting take place in it, which is also indicated by the pungent smell of bubbling-up hydrogen sulphide.

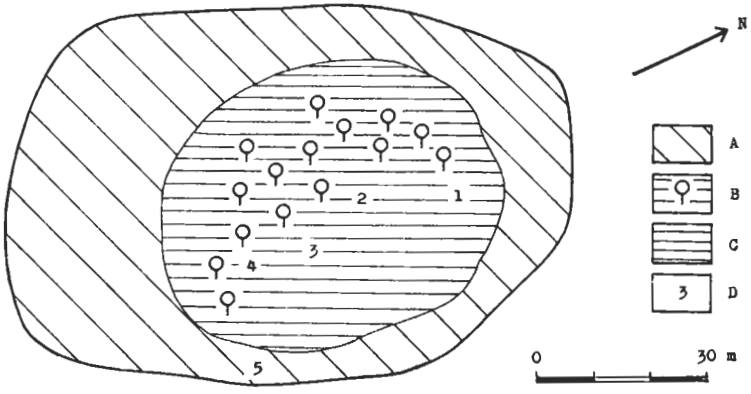


Fig. 2. The Sphagnum-moor of Egerbakta. *A:* lagg zone; *B:* transition zone; *C:* Sphagnetum; *D:* sampling spot

At all times and from each sampling spot uniformly 10 l of water were taken and filtered through a No. 25 plankton net. In sites 1 and 2 the samples were taken from water pressed out from among the *Sphagnum* clusters and, in sites 3, 4 and 5 from the open water of the fen windows and/or the lagg zone. On the 15th 8. 1971 samples were also taken from four points of the Sphagnetum in a way that the part of the peat-mosses over the water were collected, throughly washed in a pail, and the water thus obtained was filtered through a plankton net. (By this method the authors could take the capillary water among the peat-mosses into consideration.) On the 14th and 15th 8. 1971 also circadial collections were performed every six hours. On the 23rd 1. 1972 samples could

be collected only from site 5 of the lagg zone as the shallow water mass of the Sphagnetum broken up into smaller areas was frozen to the bottom.

Of each plankton sample $5 \times 1$ cm$^3$ were counted. Table 1 includes the numerical data got in this way, suited to relative comparison. The data were not referred to larger units of volume since the shallow depth and the intensely broken-up water mass would have rendered this irreal.

In the course of the circadial examinations the authors found no significant difference at the various times.

## Taxonomic survey

In the series of examinations the following Crustacea turned up in the sampling spots (Tab. 1.)

*Table 1*

| | Sphagnetum | | | | Lagg zone |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| CLADOCERA | | | | | |
| *Acroporus elongatus* G. O. Sars | + | | | | + |
| *Ceriodaphnia laticaudata* P. E. Müller | + | + | + | + | |
| *Simocephalus exspinosus* Koch | + | | + | | + |
| *Daphnia atkinsoni* Baird | | | | | + |
| COPEPODA | | | | | |
| *Eucyclops serrulatus serrulatus* Fischer | | | + | | + |
| *Cyclops strenuus* Jurine | | | | + | + |
| *Acanthocyclops viridis* Jurine | + | | + | + | + |
| *Acanthocyclops languidus* G. O. Sars | + | + | + | + | |
| *Acanthocyclops languidoides languidoides* Lillj. | + | + | + | + | + |
| Copepodite | + | + | + | + | + |
| OSTRACODA | | | | | |
| *Cyclocypris ovum* Jurine | + | + | + | + | |
| *Candona marchica* Hartwig | + | + | + | + | |

Numerous *Aedes*, Tabanidae and Chironomida larvae turned up besides the Cladocera in spring, and a considerable number of aquatic Coleoptera, Collembola, Oligochaeta and Araneida over the whole year. On the ocassion of the summer collection also two small snail species — *Segmentida nitida* and *Gyraulus cristata* — were found in one of the fen windows.

Out of the Crustacea 53% of all individuals were Copepoda, 31.5% Ostracoda and 15.5% Cladocera.

### Cladocera

*Acroporus elongatus:* the leading form of oligotrophic and slightly eutrophic waters. It endures extreme conditions of environment, in certain areas e. g. it shows acidophilia; it is a species of northerly character. The authors collected

it only during the summer season both in the Sphagnetum and in the lagg zone. The males found in small numbers and the mostly ephippial females formed 10% of all Cladocera. It seems probable that this species of northerly character preferring cold water appears but for a short time of the year, and that the summer period already means the end of its yearly cycle.

*Ceriodaphnia laticaudata:* the species, preferring small waters densely overgrown with vegetation is often to be found also in transition- and real *Sphagnum*-moors. The authors collected it in the area examined by them only in summer, in the Sphagnetum. Out of the total Cladocera 70% of all individuals were the parthenogenetic and partly ephippial females. Also in the case of this species the appearence of the subitaneous eggs is indicative of the disappearance of the animals from the association. MEGYERI (1958, 1970) reports its occurrence in similar Hungarian biotopes: in the water of the *Sphagnum*-moors „Bábtava" and „Tólak".

*Simocephalus exspinosus:* the species which, besides the other small waters also prefers the flat- and transition moors, was found in notable quantities only in the lagg zone, in the summer samples. The population was in a state of active parthenogenesis, which ensured the further presence of the animals in the biotope.

*Daphnia atkinsoni:* a typical inhabitant of temporary small waters. Its occurrence in the examined area seems sporadic and accidental.

## Copepoda

*Eucyclops serrulatus:* a small number of mainly ovigerous female individuals of this cosmopolitan organism of wide oecological valence was found in the transition and lagg zones in summer. In Hungary it was also found in the lagg zone of the „Nagymohos" *Sphagnum*-moor (MEGYERI, 1965).

*Cyclops strenuus:* this species finds favourable living conditions even in highly dystrophic waters. The authors collected it in greater numbers from the lagg zone; in winter mainly juvenile male individuals of exclusively this species turned up. Relying upon this fact it can be supposed that this species passes over the resting stage, and lives through winter in the outer, marshy part of the moor where the water is not frozen to the bottom. It is one of the inhabitants of the lagg zones of several other Hungrian *Sphagnum*-moors, as well (MEGYERI 1958, 1962).

*Acanthocyclops viridis:* the species is spread over a rather wide range, it prefers, in the first place, areas densely overgrown with plants. It was found in the highest number of individuals (45%) among the Copepoda in all seasons of the year; in winter and spring in smaller numbers and only in the lagg zone, in summer and autumn in great quantities and over the whole area of the moor. On the other hand, ovigerous females turned up only from the lagg zone at all times. All this refers to the circumstance that the animals spread inwards from the outside, from more open water towards the highly overgrown area spotted with tussocks. It is one of the most general species of the Hungarian *Sphagnum*-moors (MEGYERI, 1958, 1962, 1965, 1970).

*Acanthocyclops languidus:* the characteristic species of dystrophic *Sphagnum* waters; also frequent in other waters of high organic matter content. Of its extremely narrow oecological valence it is characteristic that in greater num-

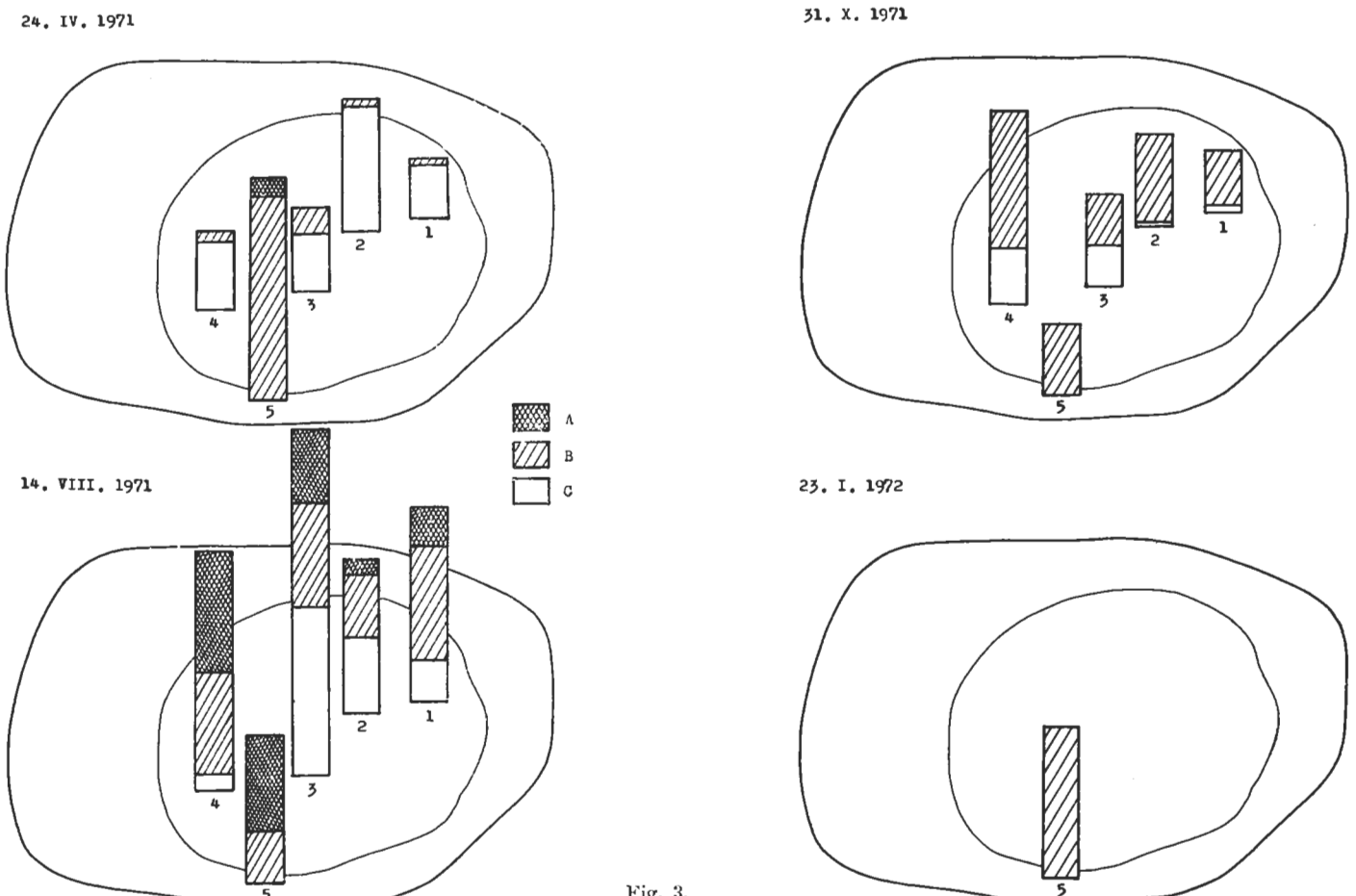


Fig. 3.
Distribution of Crustacea in the Egerbakta *Sphagnum*-moor by seasons of the year and biotopes. *A:* Cladocera; *B:* Copepoda; *C:* Ostrcoada

bers it was found exclusively in the central peat-moss tussocks of the Sphagnetum and completely avoided the water of the lagg zone. Among the Copepoda it is the second-widest spread species (25%). It is also frequent in other Hungarian *Spahgnum*-moors (MEGYERI, 1965).

*Acanthocyclops languidoides languidoides:* similarly to the species just mentioned it is an inhabitant of the humic *Sphagnum* waters. In notable quantities it was collected by the authors only in autumn. Although some specimens were found also in the lagg zone, the majority was in the Sphagnetum, in the tussocks of the peat-moss. In Hungarian *Spahgnum*-moors it has not yet been found.

Ostracoda

*Cyclocypris ovum:* a rather frequent eurytopic organism. A species spread in large numbers in the Sphagnetum, also frequent in numerous Hungarian *Sphagnum*-moors (MEGYERI, 1962, 1965).

*Candona marchica:* common species of the shallow waters densely overgrown with vegetation. It occurs in a relatively even distribution in the various biotopes of the Sphagnetum.

Both Ostracoda species avoided the water of the lagg zone, they found favourable living conditions only in the Sphagnetum; the authors have collected them in relatively great quantities in the capillary water in the parts of the mosses above the water surface.

**Distribution by seasons and biotopes**

The moor begins to become populated early in spring by young Copepoda larvae, from the direction of the lagg zone. The continuous water mass is the most extensive here of all habitats, it does not freeze solid even in winter and so the possibility of wintering is ensured. Copepoda can be found at that time only sporadically in the central zone of the Sphagnetum.

Cladocera are represented then only by one species, *Daphnia atkinsoni* in the lagg zone, later on it does not appear any more.

The Ostracoda found most favourable living conditions in the Sphagnetum even early in spring, still they kept away from the more open water of the lagg zone both at that time and later on.

On the occasion of the summer collections all three groups of Crustacea were represented in the greatest number of species and individuals. Still, while for the majority of the Cladocera this period meant the end of the vegetation period, the Copepoda and Ostracoda were active members of the association even late in autumn.

Progressing from the lagg zone towards the central Sphagnetum, the abundance of the Copepoda shows a decreasing tendency — in the order of the sampling spots: 31, 23, 16, 14 and 16%. Also this indicates that the animal group spreads starting from the lagg zone. The distribution of Cladocera was about equal in the transition and lagg zones. On the other hand, the Ostracoda turned up exclusively from the Sphagnetum.

In the capillary water accumulated in the parts of the *Sphagnum* mosses above the water surface only the Ostracoda, in the first place *Cyclocypris ovum* could find adequate living conditions. Apart from a few Copepodite larvae no other organisms were found by the authors in this biotope.

*Table 2.* The relative quantitative data of the Crustacea of the Egerbakta *Sphagnum*-moor

(The figures in brackets indicate the number of animals found in the capillary water among the Sphagnums; Sph = Sphagnetum; L = lagg zone)

| | 24. IV. 1971 | | | | | 14. VIII. 1971 | | | | | 31. X. 1971 | | | | | 23. I. 1972 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sph. | | | | L. | Sph. | | | | L. | Sph. | | | | L. | L. |
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 5 |
| CLADOCERA | | | | | | | | | | | | | | | | |
| *Acroperus elongatus* G. O. Sars | – | – | – | – | – | 4 | – | – | – | 5 | – | – | – | – | – | – |
| *Ceriodaphinia laticaudata* P. E. Müller | – | – | – | – | – | 5 | 4 | 20 | 32 | – | – | – | – | – | – | – |
| *Simocephalus exspinosus* Koch | – | – | – | – | – | 1 | – | – | 1 | 21 | – | – | – | – | – | – |
| *Daphnia atkinsoni* Baird | – | – | – | – | 5 | – | – | – | – | – | – | – | – | – | – | – |
| COPEPODA | | | | | | | | | | | | | | | | |
| *Eucyclops serrulatus serrulatus* Fischer | – | – | – | – | – | – | – | 4 | – | 3 | – | – | – | – | – | – |
| *Cyclops strenuus* Jurine | – | – | – | – | 7 | – | – | – | – | – | – | – | – | – | – | 38 |
| *Acanthocyclops viridis* Jurine | – | – | – | – | 9 | 10 | – | 8 | 20(1) | 11 | 4 | – | – | 37 | 15 | 4 |
| *Acanthocyclops languidus* G. O. Sars | 1 | – | 6 | – | – | 12 | 14 | 10 | 6 | – | – | 6 | 10 | – | – | – |
| *Acanthocyclops languidoides languidoides* Lillj. | – | 1 | – | – | – | – | – | –(3) | – | – | 2 | 15 | 3 | 1 | 4 | – |
| *Copepodite* | – | – | – | – | 40 | 9(1) | –(3) | 1(2) | – | – | 10 | 4 | 1 | 1 | – | – |
| OSTRACODA | | | | | | | | | | | | | | | | |
| *Cyclocypris ovum* Jurine | 14 | 7 | 16 | 2 | – | 9 | 11(8) | 16(7) | – | – | – | – | 6 | 2 | – | – |
| *Candona marchica* Hartwig | 1 | 28 | 1 | 17 | – | 1(1) | 2 | 22(2) | 6 | – | 1 | 1 | 5 | 13 | – | – |

## Summary

In the Egerbakta *Sphagnum*-moor of most extreme aquatic climate the authors examined five different biotopes, which had been produced by the plant associations and by effects of the micro-environment, as resultants. Upon environmental influences and as a consequence of the activity of the living organisms the hydrochemical factors show circadial and seasonal changes.

In seasonal zoological samplings the authors determined 4 species of Cladocera *(Acroperus elongatus, Ceriodaphnia laticaudata, Simocephalus exspinosus, Daphnia atkinsoni)*, 5 species of Copepoda *(Eucyclops serrulatus, Cyclops strenuus, Acanthocyclops viridis, Acanthocyclops languidus, Acanthocyclops languidoides languidoides)* and 2 species of Ostracoda *(Cyclocypris ovum, Candona marchica)*. These species which were also able to adapt themselves to the extreme environmental conditions of the moor, are in part organisms of narrow oecological valence, in part they prefer the areas densely overgrown with vegetation, they are cosmopolitan.

ZUSSAMENFASSUNG

**Zoologische Untersuchungen am Spagnummoor von Egerbakta**

Verfasser untersuchten die auf die Einwirkung von Pflanzengesellschaften und verschiedener Faktoren des Mikrobiotops auftretende extreme Wasserqualität an fünf verschiedenen Biotopen im Sphagnummoor von Egerbakta. Es wurden die tägliche und die saisonmäßige Periodizität der chemischen Bestandteile untersucht, die die Umweltsverhältnisse und die Aktivität der Lebenswesen determinieren.

Die zoologischen Probeentnahmen erfolgten saisonmäßig: es wurden 4 Cladocera- *(Acroperus elongatus, Ceriodaphnia laticaudata, Simocephalus exspinosus, Daphnia atkinsoni)*, 5 Copepoda- *(Eucyclops serrulatus, Cyclops strenuus, Acanthocyclops viridis, Acanthocyclops languidus, Acanthocyclops languidoides)* und 2 Ostracoda-Arten *(Cyclocypris ovum, Candona marchica)* bestimmt. Diese Arten, die sich gut an die extremen Umweltsverhältnisse des Moores anpassen konnten, sind größtenteils stenöke Organismen (sphagnophyl, psychrophyl), zum Teil Kosmopoliten, die die mit Wasserpflanzen bewachsenen Stellen bevorzugen.

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