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# QUANTITATIVE NUTRITIONAL CHARACTERISTICS OF SOME WATER MITE SPECIES

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The quality of the food and the feeding mechanism of water mites widely distributed in fresh water bodies are fairly well known. (MOTAS, 1928; UCHIDA, 1932; KUDRINSKAJA, 1950; BÖTTGER, 1962; 1969). However no data are available as to their exact feeding relations. They are regarded as predatory animals, consuming mainly crustaceans (Cladocera, Copepoda, Ostracoda) as well as young Chironomida and Ephemeroptera larvae. There are cannibalistic species, too.

In the present paper the quantitative characteristics of the food utilization of some water mite species are investigated.

## Materials and methods

In these experiments, water mites *(Eylais setosa, Limnesia undulata, L. maculata, Piona coccinea, Unionicola crassipes, Mideopsis orbicularis, Hydrodroma despiciens, Limnochares aquatica,* and *Lebertia* sp.) collected in Sept.—Oct. 1969 from small ponds rich in water plants in the environment of the storage-lake of Ribinsk (U.S.S.R.) were used. They were fed on Cladocera *(Ceriodaphnia quadrangula, Simocephalus vetulus, Bosmina longirostris, Daphnia longispina, Sida crystallina)* sampled from the same places. According to data in literature, water mites consume plants, e. g. algae, and perhaps detritus, too (SOKOLOV 1940; KUDRINSKAJA, 1950; BÖTTGER, 1966), we used therefore as food some plants *(Chlorella* sp., *Najas microdon, Riccia fluitans, Vallisneria spiralis)* and detritus too. Before the experiments, the water mites were kept in an aquarium and regularly fed with unlabelled animals.

SOROKIN's (1966; 1968) isotopic method to investigate the feeding relations of water invertebrates was employed. *Chlorella* sp. alga was kept for 2—4 days in CHU- 10 solution (CHU, 1942) containing $Na_2{}^{14}CO_3$. The pray animals got 3 times a day from this labelled alga for 2—3 days. The reciprocal specific activity of the carbon of the food-organisms was determined before each experiment. Radioactivity was measured by a thin mica window GM tube, working with a BFL-25 scaler. The radioactive material was plated in infinite thin layer. The organic carbon content of the food-organisms and of the consumers was determined by destruction with chromsulfuric acid (OSTAPENJA, 1965).

*The food-spectrum was determined as follows:* The water mites to be tested were placed in tap water (5—7 animals) then the food-organisms were added. After 3—6 hours the consumers were freed off the labelled food, the rest by repeated rinsing, then placed in clean tap water, where they consumed for two hours unlabelled food in order to remove the labelled food from their alimentary tract. They were then rinsed again and homogenized. The homogenate was plated on a glass slide of 2 cm diameter, dried off under air, and their radioactivity was measured. The radioactivity was converted into c.p.m. per one animal feeding for 24 hours ($r_1$). The $r_1$ and $C_r$ values and the $C$ content of the consumer enabled to calculate SOROKIN's assimilation-index ($C_a$ C%), i. e. the carbon content of the food, taken up by a single water mite, in per cent of the organic carbon content of the animal.

The dependence of the feeding rate of *Piona coccinea* from the food concentration and the optimal food concentration was determined as follows: into six glass vessels of the same size, containing 100 ml water 5—5 water mites were placed, and fed with labelled *Ceriodaphnia* for 4 hours. The number of *Ceriodaphnia* in the different vessels was 5, 10, 20, 25, 30, 40, 50. After the experiment, the water mites fed on unablabelled food for two hours. Other procedures as described above. The value obtained for the assimilation-index was converted into mg biomass/litre.

## Results

The reciprocal specific activity of the carbon of foodorganisms ($C_r=C/r$) was $1-1.5\times10^{-6}$ in algae and $15-30\times10^{-6}$ in crustaceans.

The feeding selectivity of 9 water mite species was determined related to 5 Cladocera and 4 plants. According to the quality of food and the quantity, incorporated in 24 hours, the water mites were divided into two groups:

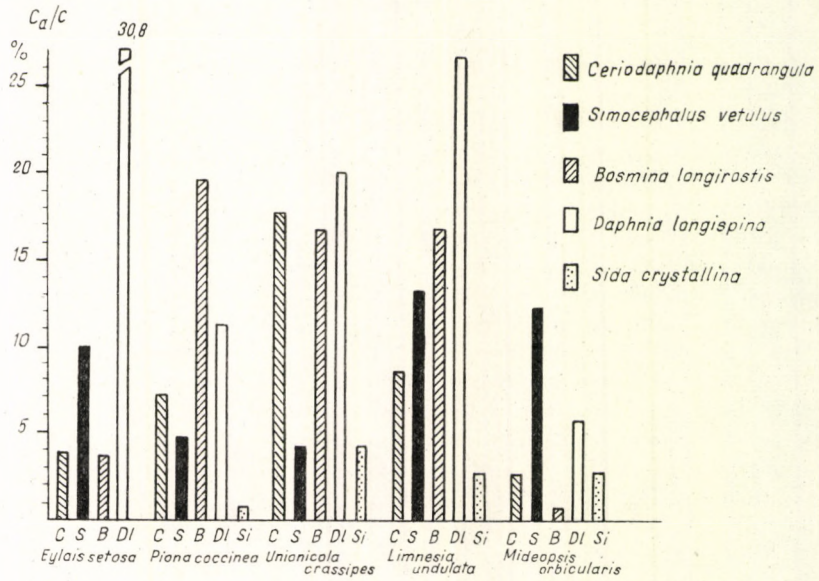


*Fig. 1.* Daily food utilization of some water mite species feeding on different cladocraens

1. The species, belonging to the first group consume intensively the cladocerans of their environment, but they show a high selectivity in their feeding habits, too. They utilize and incorporate the 5 cladoceran species to different degrees. In the feeding of *Eylais setosa* and *Limnesia undulata* the *Daphnia longispina;* in the feeding of *Piona coccinea* the *Bosmina longirostris* and in the feeding of *Mideopsis orbicularis* the *Simocephalus vetulus* were the most important food-organisms. The *Unionicola crassipes* utilized *Daphnia longispina, Bosmina* and *Ceriodaphnia* about in the same degree *(Fig. 1).* The other crustaceans are of second-third grade importance in the feeding of water mites. On the whole the cladocerans were consumed in the following sequence: 1. *Daphnia-Bosmina,* 2. *Simocephalus-Ceriodaphnia,* 3. *Sida.* None of the five species consumed plants.

2. The species belonging to the second group *(Hydrodroma despiciens, Limnochares aquatica, Limnesia maculata, Lebertia* sp.) did not eat neither the offered animals nor plants. The food uptake of water mites is greatly influenced by:

1. suitability of the mouth organs for killing and sucking out the given pray,

2. the differences between the speed of motion of the pray and the predatory animal,

3. the food concentration of the biotop.

This last one was examined in the case of *Piona coccinea* feeding on *Ceriodaphnia* and the optimal food concentration was found to be 40—50 *Ceriodaphnia*/100 ml i. e. 40—50 mg biomass/litre *(Fig. 2).*

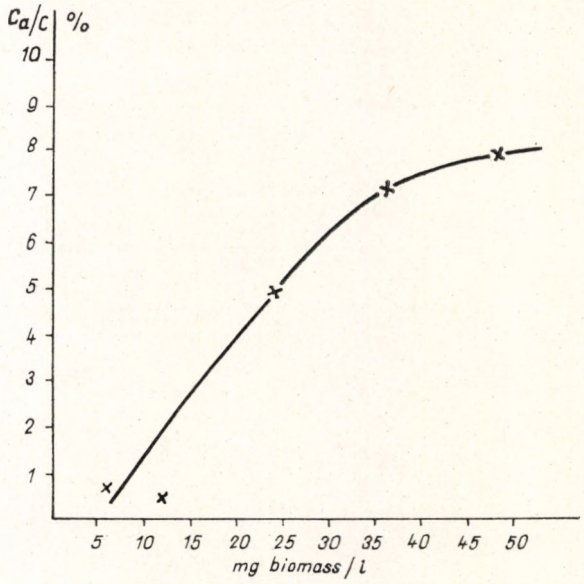


*Fig. 2.* The food utilization of *Piona coccinea* as a function of the *Ceriodaphnia* concentration

## Discussion

Other authors' observations on the quality of food refer only to the higher units of food-animals (e.g. Cladocera, Copepoda etc.). Our experiments however demonstrated the sharp food selection within the Cladocera group.

BÖTTGER (1962) studied the feeding mechanism of *Eylais infundibulifera meridionalis* and the qualitative characteristics of the food. He found this species to have been specialized as Cladocera consumer. According to his observations, the adult animal kills five or more specimens of *Daphnia* a day, but probably does not suck them out completely. In our experiments, *Eylais setosa* fed mainly on *Daphnia longispina*, consuming three times more from this species than from the other cladocerans.

The members of the *Piona* genus are generally regarded as the most voracious predators. According to UCHIDA (1932) *Piona carnea* feeds mainly on *Daphnia*. As BÖTTGER (1962) has described the most important food of *Piona nodata* consists of different species of small and big-sized Cladocera and Copepoda. In addition to this, our experiments demonstrate certain food specificity of *Piona coccinea*, as it takes up nearly twice as much *Bosmina* than *Daphnia longispina* from the five Cladocera species offered. No references are available on the nutrition of the species belonging to the *Unionicola*, *Mideopsis* and *Hydrodroma* genus. According to our results *Unionicola crassipes* similar to *Piona coccinea* and *Limnesia undulata* is a voracious predator; however its food selectivity related to cladocerans is smaller. According to the assimilated food *Mideopsis orbicularis* does not consume cladocerans at high rate.

A great difference was found between the alimentation of the two *Limnesia* species. The *L. undulata* fed intensively on all offered cladocerans, while *L. maculata* took up no labelled food at all. According to literary data, members of the genus *Limnesia* consume mainly Cladocera and Chironomida larvae (BÖTTGER 1969) but some times they attack certain water mites of soft integument (VIETS 1936), and even the carp larvae fall victim of their voracity (KUDRINSKAJA, 1950). The feeding mechanism and the quality of food of *L. maculata* was thoroughly examined by BÖTTGER (1969). He found this species to feed mainly on cladocerans and chironomids, preferring the latter. In our experiments no nutritional relation was found between *L. maculata* and the cladocerans.

BÖTTGER (1969) investigated the feeding mechanism and the quality of food of *Limnochares aquatica*, too, revealing that it consumed mainly Chironomida larvae, and only occasionally the unmoving Odonata larvae and the dead crustaceans sank to the bottom. In our experiments with this species and with a *Lebertia* sp. negative results were obtained.

## Summary

The food spectrum of nine water mite species was investigated by the $^{14}C$ method, and it was found:

1. None of the nine species consumed plants or detritus, and only five species fed on cladocerans.

2. Among the species feeding on cladocerans a high degree of food selectivity was observed. Of the five crustacean species offered as food the *Daphnia*

*longispina* and *Bosmina longirostris* were preferred most. No species consumed *Sida crystallina* at a high rate.

3. Feeding *Piona coccinea* on *Ceriodaphnia quadrangula* the optimum food concentration was 40—50 mg biomass/litre.

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## NÉHÁNY VÍZIATKA FAJ TÁPLÁLÉKFOGYASZTÁSÁNAK MENNYISÉGI JELLEMZÉSE

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### Összefoglalás


9 víziatka faj táplálékspektrumát vizsgálták $^{14}C$ módszerrel és megállapították:

1. A 9 faj közül egyik sem táplálkozott növényi szervezettel vagy detritusszal, és csak 5 faj fogyasztott táplálékként Cladocerat.

2. A Cladocerakat fogyasztó fajok csoportjában nagyfokú táplálékszelektivitást figyeltek meg. A táplálékul felkínált 5 rákfaj közül legszívesebben a *Daphnia longispinat* és *Bosminat* fogyasztották. A *Sida crystallinat* egyetlen faj sem fogyasztotta nagy intenzitással.

3. *Piona coccineat Ceriodaphniával* táplálva az optimális táplálékkoncentráció 40—50 mg/l biomasszának adódott.