COMPARATIVE STUDY OF THE WATER-BUG (HYDROCORISAE) POPULATIONS OF A DEAD-ARM OF THE TISZA AND SOME SODIC WATERS

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Abstract

The paper deals with the material collected over two years (1970—71) from a dead-arm of the Tisza and from some sodic waters. The Hydrocorita fauna of the collection sites is reported, and the individual developments of the most commonly occurring species are discussed in relation to the changes in the environmental factors in the annual period. The Hydrocorita species occurring in fresh waters and in sodic waters are compared.

Material and method

Collections were carried out monthly from May 1970 to October 1971. The collection sites were the dead-arm of the Tisza at Mihálytelek; Lake Rókus; and Lake Fehér. All of these are in the area of Szeged. The samples were taken from the sediment (one sample at each collecting site) with a mud-scoop measuring $20\times20\times4$ cm, i.e. with a volume of 4 dm^3, and from the surface water layers (from among the vegetation and from the open water) with a water-net. These latter samples were obtained by filtering the water from 50 castings. The samples were taken from 5 different areas along the entire length of the dead-arm:

a) From shallow bank-side zones:

1. from svampy parts
   (Phragmites communis TRIN.*)*
2. from water suurounded in a semicircle by reeds
   (Ceratophyllum demersum L., *Lemna minor* L., *Potamogeton* sp., *Myriophyllum* sp.*)*
3. from submerged bank-side zones
   (Phragmites communis TRIN., *Typha angustifolia* L., *Carex* sp., *Polygonum amphibium* L., *Lysimachia nummularia* L.*)*
4. from vegetation-free shallow bank-side water.

b) From a boat, from greater water depths
(Myriophyllum sp., *Potamogeton* sp.*)*

For Lakes Fehér and Rókus, collections were made on one occasion each in spring, summer and autumn, exclusively from bank-side zones. The vegetation unvaryingly gave:
Phragmites communis TRIN., *Carex* sp., *Ceratophyllum demersum* L., *Potamogeton* sp., *Lemna minor* L.

The samples were taken from three different sites:

a) vegetation rich bank-side zones
b) water covered exclusively by reeds
c) vegetation-free shallow bank-side water.

On all occasions recordings were made of the exact collecting site, the temperature of the water, the water-depth, the pH, the weather conditions, and the time of day. The collected samples were washed in a fine cloth with 200 µm apertures, and preserved in 6% formalin.

Collecting sites

Dead-Tisza at Mihálytelek

The Dead-Tisza at Szeged is 9—11 km long, and lies in a semicircle to the south of the town. It is divided up into several parts, and from these collections were made in the Dead-Tisza at Mihálytelek, to the left of and parallel with the road leading to the frontier. The side nearer the road has a steep, clayley bank, while the opposite side is characterized by a gentle slope from the cultivated land down to the water surface. It has no connection with the Tisza, there is no sewage inlet, and it is richly stocked with fish.

The collections were made up to at most 4 m in from the bank. In this zone the water was 10—80 cm deep, and the mud was a characteristic black colour.

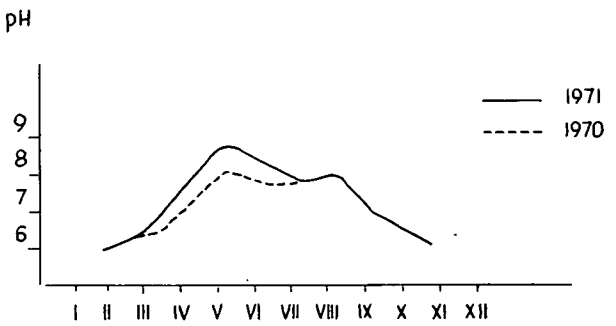

Fig. 1. Variations of the pH values in 1970—71.

The water contained sodium and magnesium carbonates and bicarbonates. Ions indicative of pollution could not be detected at all, or only in very small amounts: S^{2-} n.d.; NH_4^+ 0—3.0 mg/l; NO_2^- 0.02—0.2 mg/l. Oxygen consumption: 40—55 mg/l; dissolved oxygen content: 9—15 mg/l; percentage oxygen saturation: 100—130 %. These data refer to the period from May to September 1971. The course of the pH during the period of the investigations is shown in Fig. 1.

Sodic waters (Lake Rókus, Lake Fehér)

In parallel with the collections from the dead-arm of the Tisza, comparative examinations were also carried out of the Hydrocorita fauna in some sodic waters. The climatic conditions which predominate in these waters are completely different from those in the Dead-Tisza. They have shallow waters; there is an appreciable fluctuation of the water level; their average depth does not exceed 100 cm; and the sediment is extremely rich in decomposing organic matter.

Of the salts dissolved in the water the sodium salts (carbonate and bicarbonate) predominate. The course of the pH is extreme; in the event of a high water level (e.g. from May till August 1970) it was at most 8—8.5, while for a low water level in the same period it even attained a value of 10.

The organic-matter production of the small water mass is considerable in the early spring, summer and autumn months. The intensive processes of decomposition

of the organic matter at the time indicated may easily swing over from the oxidative aerobic stage to a reductive anaerobic stage; the effect of this on the life in the lake may be accompanied by serious consequences (BERCZIK 1962, VÁMOS—ZSOLT—RYBIÁNSZKI 1963).

Discussion of the material collected

The species detected were the following:

Mesovelia furicata MULS & REY
Naucoris cimicoides L.
Plea Leachi MCGREG. & KIRK
Cymatia coleoptrata FABR.
Cymatia Rogenhoferi FIEB
Sigara lateralis LEACH
Sigara striata L.
Sigara falleni FIEB
Corixa affinis LEACH
Hesperocorixa Linnei FIEB
Micronecta meridionalis COSTA
Notonecta glauca L.
Gerris sp. (Geocorisae subordo)
Nepa cinerea L.
Ranatra linearis L.
Hydrometra gracilenta HORV.

From a comparison of the present results with those obtained by CSONGOR (1958) in a study of the dead-arms in the reaches of the Tisza between Szolnok and Csongrád, it can be established that there is a considerable degree of similarity in the dominant species:

Naucoris cimicoides L.
Plea Leachi MCGREG. & KIRK
Sigara lateralis LEACH (less so)

while the frequencies of

Micronecta meridionalis COSTA
Notonecta glauca L.
Gerris sp.

as found in the material collected from the Dead-Tisza at Mihálytelek are much lower.

The material from Lakes Rókus and Fehér contains mainly the Corixidae species:

Sigara lateralis LEACH
Sigara striata L.
Sigara falleni FIEB
Corixa affinis LEACH
Hesperocorixa Linnei FIEB
Cymatia Rogenhoferi FIEB
Micronecta meridionalis COSTA

The other species occurred only in extremely low numbers of individuals, but in 1970 the extreme climatic condition characteristic of these sodic areas were changed as a consequence of the unusually high water level, and the following non-dominant species were also collected in high numbers of individuals:

Naucoris cimicoides L.
Notonecta glauca L.
Ranatra linearis L.

Comparison of the fauna from the sodic waters with that from the Dead-Tisza at Mihálytelek shows that the Corixidae species predominate in the sodic waters, while other species, which are predominant in the dead-arm of the Tisza, are very much rarer. It is striking, however, that *Sigara lateralis* is predominant in both types.

In the course of the collections during the two years, the times of appearance of the larvae and imagos of the individual species were recorded, as were the times of their mass-occurrence and their recession. The results are summarized in groups as shown in Fig. 2—4.

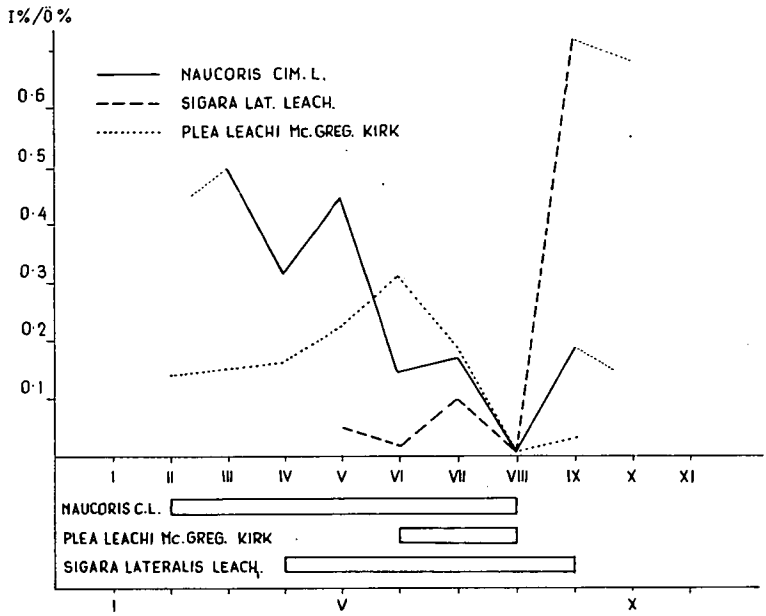

Fig. 2. Developmental rhythms of *Naucoris cimicoides*, L., *Sigara lateralis* LEACH and *Plea Leachi* MCGREG. & KIRK, as a function of the quotient of the imago % and the total bug %, supplemented with the collection cycle of the larvae of the species (1970—71).

In spring it is primarily the predatory species less sensitive to the fluctuations in temperature of the water which appear (*Naucoris cimicoides* L., *Notonecta glauca* L., *Gerris* sp., *Sigara striata* (phytophagous) L.). The breeding of these species takes place in the early spring months (e.g. *Notonecta* gl., *Gerris* sp., *Sigara* str.), or lasts from early spring until the middle of summer (e.g. *Naucoris* cim.). At oviposition the females of these species seek out the vegetation-rich sites. The

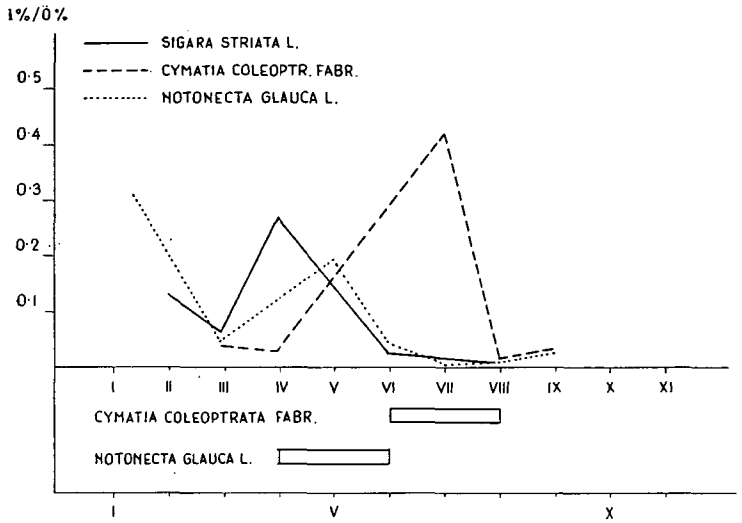

Fig. 3. Developmental rhythms of *Sigara striata* L., *Notonecta glauca* L. and *Cymatia coleoptrata* FABR. as a function of the quotient of the imago % and the total bug %, supplemented with the collection cycle of the larvae of these species (1970—71).

ova are laid into the stems and leaves of the plants *(Naucoris cim., Notonecta gl.)* or on the surfaces of the stems and leaves *(Sigara str., Gerris* sp.).

Different behaviour is exhibited by the similarly predatory *Nepa cinerea* L. and *Ranatra linearis* L., the developmental conditions too of which differ. The

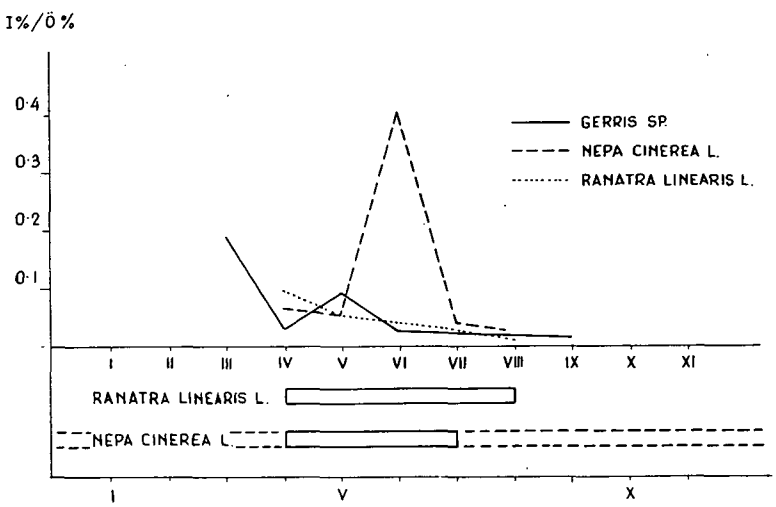

Fig. 4. Developmental rhythms of *Gerris* sp., *Nepa cinerea* L. and *Ranatra linearis* L. as a function of the quotient of the imago % and the total bug %, supplemented with the collection cycle of the larvae of these species (1970—71)

breeding period of *Nepa cinerea* L. lasts from September until July of the following year, but its ova are deposited only from early spring until the middle of summer, similarly to *Ranatra linearis*. In displaying this long breeding period, *Nepa cinerea* L. is unique among the water-bugs. The larval stage of *Nepa cinerea* L. is long, and the undeveloped larvae hibernate. For *Ranatra linearis* the breeding period is shorter (May—July), and specimens hibernating in the larval stage were not found.

By the end of May and in June the water gradually becomes warmer, its temperature becomes nearly constant, and the production of organic matter is accelerated. The conditions emerge for the development of water-bugs requiring more steady water temperature, which are primarily phytophagous (e.g. *Sigara lateralis* LEACH, *Cymatia coleoptrata* FABR., *Plea Leachi* MCGREG. & KIRK (only partially phytophagous)).

It was striking that larvae and imagos of practically every species were collected in general 4—5 weeks earlier than would be expected from the literature data. It may be assumed that the favourable climatic conditions necessary for their development were already given earlier.

In subsequent investigations it is necessary to learn the connection between the environment and developmental stages of this group of animals, and also their nutritional biology. Research must be made into the complex effects of the biotic and abiotic factors controlling the limits of their extents, which may presumably be completely different from species to species.

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