FOLIA ENTOMOLOGICA HUNGARICA
ROVARTANI KÖZLEMÉNYEK
(SERIES NOVA)

XXXI. 2 1978 p. 19-24

Contribution to the knowledge of the feeding habits of some water boatmen: Sigara spp. (Heteroptera: Corixidae)

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(Received November 17, 1977)

Abstract: Investigations on the feeding habits of the most common Corixid species in Hungary. Data on the rate and frequency of several types of food of Sigara striata and S. falleni and on the temporary variability of the same of S. lateralis are given. The omnivorous character of the species is in harmony with their way of life.

Numerous papers have been published on the feeding of the water boatmen (Corixidae). Some papers discuss the feeding habits without any reference to the source of information (Table 1), while in others, the description of the experiments and the circumstances are also given (Table 2). On the basis of the two tables it is evident that there is quite a confusion on generic or family level as regards feeding habits. HUNGERFORD (1919) in his classical work described Corixids as feeding on detritus and algae, while JANSSON and SCUDDER (1972), on the basis of their rearing experiments, obtain the result: "It becomes clear that the Corixidae should no longer be regarded as mainly algae and detritus feeders".

Disregarding the insufficiency of identification, to see clearly in this question is in many cases troubled by the fact that generalizations are made on generic or family level after investigating only a few species. Nevertheless, there are considerable differences in the way of life of different genera as Micronecta - Corixa - Arctocorisa (SOÓS, 1963). The same is proved by JANSSON (1969) who reared several species of the subfamilies Micronectinae, Cymatiinae and Corixiinae on Enchytreus while the food was not adequate for the species of the genus Hesperocorixa. Considering the known data, SZABÓ's statement (1950) seems rightful "... it can be clearly stated that we must answer the question of their feeding biology regarding individual species". The statement seems especially justified, because some authors (e.g. KEUNEN 1939, KOSLUCHER - MINSHALL, 1973) made experiments on not precisely identified animals.

In the following the feeding habits of the three common Hungarian species of water boatmen are investigated without entering into detailed analysis of the components of their food.

MATERIAL AND METHODS

Specimens of Sigara lateralis (Leach, 1818) were collected during 1975 in a small lake with relatively standard water-level, on an alkali-steppe near Ujszentmargita, while specimens of S. falleni (Fieber, 1848) and S. striata (Linné, 1758) on the 5th of June 1975 in a shallow puddle at Tiszafüred. Both localities are on the Great Hungarian Plain. The insects were put into 90% alcohol. The alimentary canal was dissected under dissection microscope. After mixing gently the gut contents in 1-3 drops of water (considering its quantity) the preparation was covered and investigated under microscope at 640 magnification. On the basis of previous investigations four types of gut contents could be distinguished: algae, animal body fluid, detritus and unidentified materials. The animal body fluid - as it was visible

Table 1. Summary of literature data on the diet of Corixids giving no reference to the source of information

Author	Date	Herbivores	Omnivores	Carnivores
Weber	1930	Corixidae		
Horváth	1931	Corixidae		
Miller	1956	Almost all Corixidae		Some Corixid species with palae not widening
Soós	1963		Corixidae	
Martin	1970			Most Corixinae
Jordan	1972	Corixidae		
Istock	1973		Several North-American Sigara and Hesperocorixa species	
Dosztál	1974	Sigara lateralis Cymatia coleoptrata		
Pajunen	1977			Arctocorisa carinata Callicorixa producta

by dissecting the alimentary canal of starved specimens and those having sucked larvae of Ephemeroptera - will be precipitated by digesting enzymes and will be visible in a form of fine flakes in the preparation. Each preparation was investigated by the method of SCHILLING (BOROS, 1942). The relative frequency of the different components of food was determined by counting up their occurrence in 20 fields. This method is suitable for comparing own samples.

Table 2. Summary of literature data on the diet of Corixids given together with the description of experiments and the circumstances

Author	Date	Herbivores	Omnivores	Carnivores
Hungerford	1919	Corixidae		
Ekblom	x	Corixa sahlbergi		
Keunen	xx		Sigara sp.	
Walton	1943	Corixa lateralis		Cymatia bonsdorfi Cymatia coleoptrata
Lindberg	1944			Sigara carinata Sigara producta (First and second instar larvae herbivore)
Szabó	1950	Corixa hyeroglyphica Corixa falleni		
Sutton	1951		Corixa punctata, C. panzeri, Sigara striata, S. falleni, S. distincta, S. semistriata	
Benwitz	1956	Corixidae		
James	1966			Callicorixa audeni
Putschkova	1969		Sigara striata (With predominance of phytophagy)	
Jansson	1969			Several Corixid species, except Hesperocorixa species
Jansson-Scudder	1972			Sigara alternata, Cymatia and Glaenocorisa species
Koslucher-Minshall	1973	Sigara sp.		

RESULTS

No difference has been found (P=0.05) between the composition of the food of striata and falleni (Table 3). The main component was at both species animal body fluid occurring in each specimen. Definitely less but not negligible was the quantity of algae in the gut (striata 4.5%, falleni 10.25%) with a rather high frequency in falleni (70% of the specimens). A great variety of alga species was discovered here and during the following dissections. Both the

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[x] after WEBER 1930; [xx] after SZABÓ 1950.

rate and the frequency of detritus was negligible when compared with those of the other two. This picture shows a momentary situation. There may be deviation from it as it will be visible in the following.

No significant difference can be found at the results of dissections made on specimens of lateralis collected on the 4th of February, 22nd of April, 29th of July and 25th of August (Table 4). Only the rate (0.5-2%) and frequency (10-22%) of algae were somewhat lower.

Table 3. Rate of different gut content components in the samples of Sigara striata and S. falleni (5th June, 1975). The numbers in parenthesis show the frequency of individuals

	Alga %	Detritus %	Animal body fluid %	Unidentified %	Number of guts examined
Sigara striata	4.5 (39)	0.3 (6)	95.3 (100)	-	18
Sigara falleni	10.3 (70)	0.3 (0.5)	89.5 (100)	-	20

Nevertheless, the composition of the food of the population on the 3rd of June was distinctly changed when compared to former ones. The rate of algae has grown significantly (38.5%) to detriment of the animal body fluid (61%). The frequency of the two types of food was just the same (algae: 80%, animal body fluid: 95%).

Table 4. Temporary variability of the rate of different gut content components of Sigara lateralis. The numbers in parenthesis show the frequency of individuals

		4 February	22 April	1975 3 June	29 July	25 August
Alga	%	1 (18)	0.5 (10)	38.5 (80)	2.2 (22)	1.5 (15)
Detritus	%	-	0.3 (5)	-	1 (11)	1 (5)
Animal body fluid	%	99 (100)	99.3 (85)	61 (95)	96.8 (100)	97.5 (100)
Unidentified	%	-	-	0.5 (20)	-	-
Number of guts examined		11	19	20	9	20

EVALUATION OF THE DATA

On the basis of the results of dissections we must regard these Sigara species as omnivorous, feeding mostly on food of animal origin. Their main food is body fluid of lower invertebrates (JANSSON and SCUDDER, 1972, ZWART, 1965, MARTIN, 1970, etc.). There are precedents of substantial increase in the rate of herbic food under natural circumstances (lateralis on the 3rd of June). If these results are added to the statement of SZABÓ (1950) who regards lateralis and falleni distinctly as herbivorous and to the results of PUTSHKOVA (1969) who found striata to be mainly herbivorous, then it is most likely that these species have the ability to accommodate themselves to the food supply given. This statement is in ac-

cordance with the way of life of the species, therefore, it seems acceptable from evolutionary point of view, too. All three species have two intensive migration periods a year (BENEDEK and JÁSZAI, 1973). However, on hot days they often leave their living place. It depends on several factors partially unknown, that what will be the new biotope like they find and especially that how much and of what quality will be the food supply available. It will be very probably different from those in the original biotope. The advantage of omnivorous feeding habits is obvious at such a way of life.

The species mentioned often happen to migrate into periodic waters, fresh puddles, plashes where food supply especially of animal origin can be meagre. In such cases the euryecious, e.g. omnivorous species have an advantage (SCHÖNER, 1969). If we suppose that the three species investigated were accomodating to the environment also in feeding during their evolution, their feeding habits seem to be moved (to move) from the archaic predator (RIEGERT, 1976) to omnivorous type.

The facts mentioned above put the data of the respective literature in another light. The main cause of the contradictions must thus be that the majority of the authors have not considered in the desirable extent the possibility of omnivorous feeding habit. It is clearly imaginable that one of the species can be reared or even propagated under experimental conditions exclusively on foods of herbic or animal origin. However, the possibility of difference in feeding habits on specific or generic level is not precluded by this statement and inadequate identification seems to play a role in the development of contradictions.

Acknowledgement: The author is deeply indebted to Dr. T. VÁSÁRHELYI for reading the manuscript and for his helpful criticism.

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