

Occurrence of amphibious bugs, water bugs and ground bugs in the catchment area of the Crișul Alb, Crișul Negru and Crișul Repede rivers

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Abstract

Research carried out so far on this subject demonstrates the presence of twenty bug species in the catchment area of the three Criș rivers. Due to our current studies we may add nineteen new species to the bug fauna of the region and confirm the existence of eighteen previously mentioned species.

The thirty-seven species found by us are represented by 1048 collected samples belonging to the following taxonomic categories/orders:

Hydrocorisae: 539 samples of thirteen species

Amphibiocorisae: 398 samples of thirteen species

Saldidae: 111 samples of eleven species

In this work we shall describe species living in rivers and we shall try to give a proper explanation to the frequency or infrequency of certain species. Our most important conclusion referring to the distribution of different species is that their diversity is much higher for natural reaches, the water-bugs are more numerous and represented by more species in stagnant waters, and the diversity of the amphibious bugs is the highest on middle and lower reaches. The greatest variety of ground bug species are to be found on upper reaches or stony river banks.

These species are not threatened by extinction, but their existence is closely connected with the natural conditions of rivers. They don't appear sensitive to industrial water pollution, as demonstrated by the high number of samples collected in polluted water near the city of Petru Groza.

Keywords: bugs, Criș rivers' valleys.

Introduction

The representatives of these bug groups are to be found in every type of water from the sub-alpine to the sea-zone. Some species may be present in such a high number that they are damaging to fisheries. Other species are considered bio-indicators. However numerous they are, data referring to their occurrence in Romania are very few and above all faunistic. There are no references to the quality of the living places; only the names of the localities or counties are mentioned.

Tab. 1.: Data concerning the catchment area of the three Criş Rivers
(based on Paina, 1975)

HYDROCORISAE:	BIHAR COUNTY	ARAD COUNTY
1. <i>Notonecta glauca</i>	Oradea	Ineu
2. <i>Plea minutissima</i>	Oradea	
3. <i>Corixa punctata</i>	Oradea	
4. <i>Hesperocorixa linnei</i>	Oradea	
5. <i>Sigara falleni</i>	Oradea	
6. <i>Sigara striata</i>	Oradea	
7. <i>Nepa cinerea</i>	Oradea	Ineu
8. <i>Ranatra linearis</i>	Oradea	
9. <i>Naucoris cimicoides</i>	Oradea	
10. <i>Aphelocheirus aestivalis</i> *	Tămaşda	
AMPHIBIOCORISAE:		
11. <i>Aquarius paludum</i>	Oradea	
12. <i>Geris lacustris</i>	Vadu Crişului, Oradea	Moneasa
13. <i>Geris odontogaster</i>	Oradea	
14. <i>Microvelia reticulata</i>		Moneasa
15. <i>Hydrometra stagnorum</i>	Vadu Crişului	
16. <i>Hydrometra gracilentia</i>		Moneasa
GEOCORISAE:		
fam. SALDIDAE		
17. <i>Macrosaldula scotica</i>	Oradea	
18. <i>Saldula arenicola</i>	Vadu Crişului	
19. <i>Saldula opacula</i>		Moneasa
20. <i>Saldula saltatoria</i>		Budeşti, Ineu

Bănărescu's data in Paina (1988)

Data restricted to the catchment area of the three Criș rivers are insignificant, so we had to use data referring to the closest place names. Thus, the data included in Tab.1.- mostly from Paina's work on the Romanian Fauna (1975), must be dealt with reservations.

Our data have been collected the Crișul Negru and Crișul Alb rivers and on the catchment area of the Tăcășele brook (in the vicinity of Avram Iancu village, Alba county) between the 6th-12th of August 1996, downstream the Crișul Repede river and its two affluents, the Drăgan and the Iad rivers between the 20th-27th of July 1995.

Materials and Methods

Contrary to the twenty species mentioned so far - 10 species of Hydrocorisae, 6 species of Amphibiocorisae, 4 species of Saldidae - we managed to determine 37 species - 13 species of Hydrocorisae, 13 species of Amphibiocorisae, 11 species of Saldidae - during our research on the three Criș rivers.

Our collected material contains:

539 samples of water-bugs, 398 samples of amphibious-bugs and 111 samples of ground bugs.

Because of the life style of these bug-groups we could not realize a quantitative survey, only a qualitative one. At every sampling place we tried to collect samples proportionally to their frequency. We collected the water- & amphibious-bugs samples with a limnologic net from the bottom and the surface of the waters and the leaves of floating plants. Ground-bug samples were simply caught by wet hands, except the *Macrosaldula* species which couldn't be approached so close and therefore samples were caught with net.

The collected material, grouped according to the sampling-places and habitats, was stored in ethylalcohol strong of 70 degrees. Samples were determined with stereo-microscope on the basis of external morphological marks. If needed, we took into consideration genital characteristics as well.

Sampling Places

Tab. 2.: The list of the species collected downstream the Crișul Alb river
/R = river, S = stagnant water/

Species	Criș	before Brad pond	before Brad stream	after Brad	Aciuța	Aciuța	Almaș	Ineu	Chi-șineu Criș	Totally
	R	S	R	R	S	R	R	R	R	
<i>Plea minutissima</i>						5				5
<i>Micronecta scholtzi</i>		4	1			39				44
<i>Corixa punctata</i>						1				1
<i>Sigara nigrolineata</i>			4							4
<i>Nepa cinerea</i>	4				3					7
<i>Ranatra linearis</i>						1	1			2
<i>Aquarius paludum</i>	1				1		15	12	5	34
<i>Gerris thoracicus</i>	1									1
<i>Gerris lacustris</i>	4			7	3		5	1		20
<i>Microvelia reticulata</i>						5				5
<i>Hydrometra stagnorum</i>	8				2		11	7		28
<i>Chartoscirta cincta</i>					1					1
<i>Macrosaldula variabilis</i>					1					1
<i>Saldula arenucola</i>					7					7
<i>Saldula pallipes</i>								1		1
<i>Saldula palustris</i>									1	1
<i>Saldula opacula</i>								7		7
<i>Saldula saltatoria</i>								6		6
Totally:	18	4	5	7	18	51	32	34	6	175
Number of species	5	1	2	1	7	5	4	6	2	18

Criș R: river reaches above Criș village

The pool above Brad city S: a 10 m long and 0.5-1 m deep pool at a distance of several meters from the river, loamy bottomed, with muddy water, covered with spots of rush.

The brook above Brad city R: at a distance of 15 km from the Crișul Alb river, stony, loamy bottomed brook, with grassy banks.

Below Brad city R: river reaches below Brad city.

Aciuța R: river reaches near Aciuța village.

Aciuța S: a pool 25 m in diameter, 6-8 m deep, loamy bank and bottom, muddy water, on the surface rare marsh vegetation.

Almaș R: river reaches near Almaș village.

Ineu R: river reaches near Ineu city.

Tab. 3.: The list of the species collected downstream the Crişul-Negru River
/R = river, S = stagnant water (e.g.: pond)/

	Poiana	Petru Groza	Petru Groza (pond)	Borz	Borz (pond)	Tinca	Zerind	Criş-canal	Totally:
Species	R	R	S	R	S	R	R	S	
Notonecta glauca							1		1
Plea minutissima							1		1
Hesperocorixa linnei						1			1
Sigara lateralis			6		33	1			40
Sigara nigrolineata			9		6				15
Ranatra linearis								2	2
Naucoris cimicoides							1	2	3
Aquarius paludum		2				5			7
Geris lacustris		2				4			6
Mesovelia furcata								17	17
Hydrometra stagnorum		3							3
Chartoscita cocksi	3								3
Macrosaldula scotica		1							1
Macrosaldula variabilis		4							4
Saldula pilosella				1					1
Saldula arenicola		7		13			6		26
Saldula pallipes	1								1
Saldula palustris				1			1		2
Saldula opacula	1								1
Saldula melanoscela		1							1
Totally:	5	20	15	15	39	11	10	21	136
The number of species	3	7	2	3	2	4	5	3	20

Tab. 4.: The list of the species collected downstream the Crișul Repede River
(R = river, S = stagnant water)

Species	Ș a u l a		B o l o g a				The Valley of the Drăgan Creek				C I u c e a		The Valley of the Iad Creek		The Criș-Strait		A l e ș d		The cistern at Aleșd		F u h i u		After O r a d e a		Totally
	R	R	R ₁	S ₁	R ₂	S ₂	R	S	R	S	S ₁	S ₂	R	R	S	R	R	R	R	S					
Notonecta glauca	1		2			10							11								4				28
Notonecta viridis						1																		1	
Plea minutissima																		3					1		4
Micronecta poweri			15													2		3							20
Corixa punctata						2																		2	
Sigara falleni	2																1						21		24
Sigara striata																	1						4		5
Sigara nigrolineata						67						24													91
Sigara lateralis																	1	1					37		39
Nepa cinerea	3	2							5				1												11
Ranatra linearis																						1	1	2	4
Naucoris cimicoides																							6		6
Limnoporus ruf.														3		2									5
Aquarius paludum			2								1		6	1	1										11
Gerris lacustris	12	1	1			12		8			6	11	30		3			1							85
Gerris odontogaster	5		4								5	6						1							21
Gerris argentatus																	2	1							3
Gerris costae	1		2			1																			4
Gerris thoracicus	1		2			6		1				3			2	4	4								23
Microvelia reticulata													11				1				2				14
Microvelia pymaea																	9								9
Velia saulii	10				11										1										22
Mesovelia furcata																	7		3	1					11
Hebrus ruficeps								2																	2
Hydrometra stag.		2						1	3				17				3	2							28
Chartoscirta cocksi							1																		1
Macrosaldula scotica														5											5
Saldula arenicola							7									5									12
Saldula pallipes	7			3			4							1		1									16
Saldula opacula	1						1												2						4
Saldula saltatoria	1	1		1					2					2											7
Totally:	44	6	28	4	11	99	14	19	2	12	56	67	9	13	15	32	5	4	78						518
Number of species:	11	4	6	2	1	7	5	5	1	3	6	5	4	8	7	9	3	2	9						31

Chişineu Criş R: reaches near the city.

Poiana R: reaches above Poiana locality.

Petru Groza R: reaches near Petru Groza locality.

Petru Groza S: a pool immediately at the river, stony-muddy bottom, turbid-brown water, no vegetation at all.

Borz R: reaches above Borz locality.

Borz S: pool next to river, slightly turbid water, sony-loamy bottom, without vegetation.

Tinca R: reaches near Tinca locality.

Zerind R: reaches near Zerind locality.

The Criş Channel S: the channel near Salonta city, linking the Crişul Negru and Crişul Repede rivers, its whole surface being covered with floating plants.

Şăula R: reaches near Şăula locality.

Bologa R: reaches near Bologa locality.

The Valley of Drăgan

R1: reaches near Tranişu locality.

S1: the cistern of the Drăgan river.

R2: the brook near Valea Drăganului locality.

S2: pool near Valea Drăganului locality resulted from moisture, far from any river, with slightly turbid water, loamy bottom, a few marsh-plants.

Ciucea F: reaches near Ciucea locality.

Ciucea S: pools immediately at the river, stony and loamy bottom, clear water, diving water-plants in it.

The Valley of Iad

R1: reaches below Remeţi locality.

R2: reaches close to the Iad rivers flowing into the Crişul Repede river.

The Strait of the Crişul Repede river

S1: pools in a loamy brook bed, with rare herbaceous vegetation on the surface.

S2: eutrophic pools permanently filled with water, with a loam-layer of about 30 cm on the bottom, with muddy water covered with spots of *Fontinalis* sp., marsh plants (reed-grass) and tree trunks fallen into the water.

R: reaches in the defile.

Aleşd R: reaches below Aleşd city.

The cistern of Aleşd S: pools on a promontory in the lake covered with grass, fitted with muddy water.

R: the original river bed below the cistern, 20-25 cm deep water, stony bottom, along the banks the water surface covered with seaweed.

Fughiu R: reaches below Fughiu locality.

Tab. 5.: The list of the species collected on the catchment area of the Tăcășele Creek

<i>Species</i>	<i>Number. of specimens</i>
1. Notonecta viridis	5
2. Notonecta glauca	27
3. Corixa punctata	37
4. Hesperocorixa linnei	1
5. Sigara lateralis	10
6. Sigara striata	1
7. Sigara nigrolineata	88
8. Nepa cinerea	4
9. Gerris odontogaster	12
10. Microveria reticulata	24
11. Hydrometra stagnorum	3
12. Saldula opacula	1
13. Saldura saltatoria	1
Totally:	214

Oradea R: reaches below Oradea city.

S: pools far from the river, covered with reach marsh-vegetation (reed, bulrush, sedge rush), slightly turbid water, loamy bottom, on the banks spots of flooded grass.

The catchment Area of the Tăcășele Brook in the vicinity of Avram Iancu village (Tab. 5.). Pools quickly drying up, 1-2 m in diameter, 10-20 cm deep, muddy water, loamy bottom, no vegetation at all, sometimes buffaloes are bathing in them.

Results and Discussion

According to earlier data, as Table 1. and 6. show, the following species aren't mentioned as present in the waters of the catchment area of the three Criș rivers: Notonecta viridis, Sigara nigrolineata, Gerris costae, G. thoracicus, G. argentatus, Velia saulii, Mesoveliea furcata, Chartoscirta coxi, Macrosaldula variabilis, Saldula pilosella, Saldula palustris, Saldula melanoscela.

Tab. 6.: The summarized list of species collected
at the three Criș Rivers

Species	Crișul Alb	Crișul Negru	Crișul Repede	Tăcășele
Hydrocorisae:				
<i>Notonecta viridis</i>			1	5
<i>Notonecta glauca</i>		1	28	27
<i>Plea minutissima</i>	5	1	4	
<i>Micronecta scholtzi</i>	44			
<i>Micronecta poweri</i>			20	
<i>Corixa punctata</i>	1		2	37
<i>Hesperocorixa linnei</i>		1		1
<i>Sigara fossarum</i>				
<i>Sigara falleni</i>			24	
<i>Sigara lateralis</i>		40	39	10
<i>Sigara striata</i>			5	1
<i>Sigara nigrolineata</i>	4	15	91	88
<i>Sigara limitata</i>				
<i>Nepa cinerea</i>	7		11	4
<i>Ranatra linearis</i>	2	2	4	
<i>Naucoris cimicoides</i>		3	6	
Totally (Hydrocorisae):	63	63	235	173
Total number of species:	6	7	12	8
Amphibiocorisae:				
<i>Limnoporus rufoscutellatus</i>			5	
<i>Aquarius paludum</i>	34	7	11	
<i>Gerris costae</i>			4	
<i>Gerris lateralis</i>				
<i>Gerris thoracicus</i>	1		23	
<i>Gerris lacustris</i>	20	6	85	
<i>Gerris odontogaster</i>			21	12
<i>Gerris argentatus</i>			3	
<i>Microvelia reticulata</i>	5		14	24
<i>Microvelia pygmaea</i>			9	
<i>Velia saulii</i>			22	
<i>Mesovelia furcata</i>		17	11	
<i>Hebrus ruficeps</i>			2	
<i>Hydrometra stagnorum</i>	28	3	28	3
Totally (Amphibiocorisae):	88	33	238	39
Total number of species:	5	4	13	3

Species	Crișul Alb	Crișul Negru	Crișul Repede	Tăcășele	Someș	Total
Saldidae:						
<i>Chartoscirta cincta</i>	1					1
<i>Chartoscirta cocksi</i>		3	1		1	5
<i>Macrosaldula scotica</i>		1	5		7	13
<i>Macrosaldula variabilis</i>	1	4				5
<i>Saldula pilosella</i>		1				1
<i>Saldula arenicola</i>	7	26	12		49	94
<i>Saldula pallipes</i>	1	1	16		18	36
<i>Saldula palustris</i>	1	2				3
<i>Saldula opacula</i>	7	1	4	1	2	15
<i>Saldula saltatoria</i>	6		7	1	6	20
<i>Saldula melanoscela</i>		1				1
Total (Saldidae):	24	40	45	2	83	194
Number of species:	7	9	6	2	6	11
Total:	175	136	518	214	461	1539
Total number of species:	18	20	31	13	25	41

Most of these can be considered rare, as demonstrated by our research, but three of them turned out to be quite common in the studied area: *Sigara nigrolineata*, *Gerris thoracicus*, *Mesovelia furcata*.

We did not find two species mentioned in earlier works: the *Aphelocheirus aestivalis*, found in the Crișul Negru river, near Tâmașda locality, data published by Paina in 1988, based on the collection of Bănărescu; and the *Hydrometra gracilentia* mentioned as present near Moneasa in 1916 (Paina, 1988). However, we cannot state that these two species have completely disappeared, as being rare they are hardly noticeable. The defective research in this field in Romania also diminishes the possibility of a sure statement.

As Tab. 6. shows, the following water-bug species, here presented in decreasing order of their frequency, can be considered rare: *Hesperocorixa linnei*, *Notonecta viridis*, *Sigara striata*, *Ranatra linearis*, *Naucoris cimicoides*, *Plea minutissima*.

The only very infrequent species is the *Notonecta viridis*. The other rare species may be in a great number if the conditions are suitable: in pools and lakes covered with rich vegetation, but they appear only accidentally in rivers.

The *Ranatra linearis* species is characterized by a small number of the samples. Therefore it may appear rare, but it is to be found in different places: deep river reaches rich in vegetation and stagnant waters covered with plants as well.

As Tab. 2, 3, 4, 5 show, water-bugs generally appear in greater number and are represented by more species in stagnant waters than in rivers. The water-bugs species characteristic of the rivers are: *Nepa cinerea*, *Ranatra linearis* and *Micronecta poweri*.

From among the amphibious bugs the species *Hebrus ruficeps*, *Gerris argentatus*, *G. costai*, *Limnoporus rufoscutellatus*, *Mivrovelia pygmaea* were represented by very few samples. The presence of these species mostly characteristic stagnant waters, thus in the studied area they can be considered infrequent.

The other collected amphibious-bug species, save the infrequent *Hebrus ruficeps*, can be found in rivers as well. This fact demonstrates that amphibious bugs accommodate themselves better to rivers than water-bug species do.

Moreover, some amphibious bug species give preference to rivers, like the *Velia saulii*, *Aquarius palludum*, *Hydrometra stagnorum*, *Gerris lacustris* species, which are to be found in the bays of mountain-brooks. They usually avoid strong currents and linger in little bays, close to the banks and the plants hanging down in the water.

Most species of ground-bugs (*Saldidae*) must be considered infrequent, especially the species *Chartoscirta cincta*, *Saldula pilosella*, *S. melanoscela*, *S. palustris*, *Chartoscirta cocksi*, *Macrosaldula variabilis*, *M. scotica*. The *Saldula pilosella* and the *S. palustris* species, being attached to salty waters, appear along and on the Criș rivers only occasionally.

Most rare ground bug species live in the stony banks of quick rivers in the mountains, a fact also proven by our other research.

Frequent species, including *Saldula arenicola*, *S. pallipes*, *S. saltatoria* and *S. opacula* usually inhabit all types of banks (sandy, loamy, stony). These frequent species which live

on stony banks may present a challenge to rare species living in the same place, thus diminishing the rare species chance to survive.

Examining the quality of the rivers (Tab. 6.) in connection with the variety of species, we conclude that far more water and amphibious bug species inhabit the Crișul Repede river than the other two rivers. However, concerning the number of the ground bug species, the Crișul Negru and Crișul Alb river lead.

In our opinion, the explanation of this phenomenon lies in the fact that along the Crișul Repede river we found a greater variety of habitats and we took samples from more places.

Conclusion and Proposals

At the sampling sites below Brad, the Crișul Alb river and near Petru Groza locality the Crișul Negru river the water was polluted with mining-industry and urban outlet water. At the place first mentioned we found only one bug species, but at the second place the greatest number of bug species along the Crișul Negru river was collected. This fact allows us to conclude that the variety of water, amphibious and ground-bug species is influenced by pollution only to a slight degree. We rather think that the variety of species is especially determined by the variety of living places.

The least number of species was found in cisterns: we did not succeed in collecting even one species of water- or amphibious bugs there. From among the ground-bugs we found only three species on the banks of the cisterns (see Tab. 4.).

According to our observations, the diversity of the water-bug species is greater on upper and middle reaches than on the lower river reaches, but their greatest diversity is to be found in the stagnant waters.

The diversity of the amphibious-bug species on the middle river reaches is quite similar to that found in stagnant waters covered with plants and banks scalloped with bays. The diversity of the ground-bugs is the greatest on the upper river reaches.

Our opinion is that species found by us are not threatened by extinction, but in order to preserve the actual diversity of the species the natural state of the rivers must be maintained.

Factors that may cause the disappearance of several bug species and thus the decrease of the diversity are the draining of the flood-areas, the

Tab. 7.. The summarized list of species mentioned and collected till nowadays

Fam. Hydrocorisae		
1. Notonecta viridis		R
2. Notonecta glauca		C
3. Plea minutissima		rC
4. Micronecta sp. (scholtzi/poweri)		rC
5. Corixa punctata		rC
6. Hesperocorixa linnaei		rC
7. Sigara falleni		rC
8. Sigara lateralis		C
9. Sigara strata		rC
10. Sigara nigrolineata		C
11. Nepa cinerea		C
12. Ranatra linearis		rC
13. Naucoris cinicoides		rC
14. Aphelocheirus aestivalis		Ex.?
Fam. Amphibiocorisae		
15. Limnoporus rufuscutellatus		R
16. Aquarius paludum		C
17. Gerris costai		R
18. Gerris thoracicus		rC
19. Gerris lacustris		C
20. Gerris odontogaster		rC
21. Gerris argentatus		R
22. Microvelia reticulata		rC
23. Microvelia pygmaea		R
24. Velia rautii		K
25. Mezovelia furcata		rC
26. Hebrus ruficeps		R
27. Hydrometra stagnorum		C
28. Hydrometra gracilentia		Ex.?
Fam. Saldidae		
29. Chartoscirta emcta		R
30. Chartoscirta cocksi		R
31. Macrosaldula scotica		R
32. Macrosaldula variabilis		R
33. Saldula pilosella		R
34. Saldula arenicola		C
35. Saldula pallipes		C
36. Saldula palustris		R
37. Saldula opacula		rC
38. Saldula saltatoria		rC
39. Saldula melanoscelsa		R

reduction of their surface, the building up of concrete treated banks, the strengthening of the river-beds and the appearance of quarries.

Fortunately, the water pollution must be of a very high degree - caused by strong poisons or crude oil - to considerably effect the state of studied bug species.

References

- Benedek, P. (1969): Heteroptera VII, Fauna Hungariae XVII Heteroptera - Homoptera, Budapest
- Benedek, P. (1969): Faunánkra új partipoloskák (Heteroptera, Saldidae), (Saldids new to Hungarian fauna) - Folia Entomologica Hung., 1, XXII:253-255
- Jordan, K.H.C. (1952): Wasserlaufer-Die Neue Brehm-Bücherei, Heft 52
- Macan, T.T. (1956): A revised Key to the Britishh Water Bugs (Hemiptera-Heteroptera). - Freshwater Biological Association 16
- Paina, I. (1975): Lista heteropterelor acvatice și semiacvatice (O. Heteroptera) din R.S.R. (List of aquatic and semiaquatic Heteroptera from S.R.R.) - Nymphaea III,:99-115
- Paina, I. (1976): Cheia de determinare a fam. De Heteroptere acvatice (Ins.Het.Aq.) (Key to the Water Bugs families (Ins.Het.Aq.) of the fauna from the S.R.R.) - Nymphaea VII:413-420
- Paina, I. (1986): Observații asupra speciei Hydrometra stagnorum L. 1758. (Ins.Het.) din Rezervația Naturală de la Vadul Crișului (Observations about the species Hydrometra stagnorum L. 1758. (Ins.Het) from Natural Reservation from Vadul Crișului)-Crisia XVI
- Paina, I. (1988): Câteva colectări ale speciei Aphelocheirus aestivalis Fabr. (Ins.Het.) (Quelques collectages de l'espece Aphelocheirus aestivalis Fabr. (Ins.Het.))-Crisia XVIII
- Péricart, J. (1990): Hémipteres Saldidae et Leptopodidae D'Europe Occidentale et du Maghreb-Faune de France 61
- Poisson, R. (1957): Hétéropteres aquatiques-Faune de France 61
- Schneider, E. (1973): Catalogul heteropterelor din colecțiile Muzeului de Istorie Naturală din Sibiu (Verzeichnis der Heteropteren aus den Sammlungen des Naturwissenschaftlichen Museums in Sibiu) - Studii și com. Muz. Bruckenthal št. Nat. 18:139-145,164
- Sienkiewicz, I. (1962): Heteroptere noi pentru fauna R.P.R. (New species of Heteroptera for the Romanian fauna) - Stud. și cerc. De biol. Ser. Biol. Anim., XIV:79-80
- Soós, Á. (1963): Heteroptera VIII. - Fauna Hungariae XVII. Heteroptera-Homoptera
- Stickel, W. (1960): Illustrierte Bestimmungstabellen der Wanzen II. Europa (Hemiptera-Heteroptera Europae),III:209-263

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