

AQUATIC AND SEMIAQUATIC TRUE BUGS (HETEROPTERA: NEPOMORPHA) OF CEFA NATURE PARK (NORTH-WESTERN ROMANIA)

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Abstract: This study aims to complete the aquatic and semiaquatic Heteroptera (Hemiptera: Heteroptera: Nepomorpha) list of species for Cefa Nature Park. Specimens were collected by monthly monitoring different types of habitats in the protected area. The study reveals an addition of 17 species, along with the 8 species previously described for this area. Was noted the presence of *Aphelocheirus aestivalis* Fabricius, 1794 and *Cymatia rogenhoferi* Fieber, 1864 species that have a sporadic presence in the Romanian fauna, being reported few records for these species. These data complete the information on this group collected on the other side of the Romanian-Hungarian border, in Körös-Maros National Park, where a number of 28 species were identified. Because the goal is to create a protected area on both sides of the border, it is imperative to know this group in both protected areas, in order to create a common monitoring plan and common management measures.

Keywords: aquatic bugs, Cefa Nature Park, Crișana, faunistics, Heteroptera, Nepomorpha, true bugs.

INTRODUCTION

Heteroptera are a significant component of the aquatic fauna and play an important part in littoral food webs [23]. These insects are able to colonize all aquatic habitats, from small temporary ponds to lakes and rivers, from swamps to brackish waters, even if only temporarily during their migratory flights [15]. For decades, Heteropterologists have been searching for possibilities to use water bugs for biological monitoring purposes. Several efforts were made in the past to find the relationship between different characteristics of water-bodies and the composition of their aquatic and semiaquatic Heteroptera fauna [8]. Despite the wide spread of these species, data referring to their occurrence in Romania are scarce and above all faunistic. Few references are made to the quality of the living places; only the names of the localities or counties are mentioned [12]. Possible relations between habitat characteristics and Heteroptera communities structure have been recently studied by Olosutean and Ilie [18, 19].

For Cefa, only 8 species of aquatic Heteroptera have been recorded so far [9]. For Crișana, Paina mentions 16 species [20]; Davideanu noted about 17 species in Bihor county [7]. On the other side of the border, in Körös-Maros National Park (Hungary) 28 species have been described [11, 13].

In this paper, new additions to the Heteroptera fauna of Cefa Nature Park are summarized and discussed.

MATERIALS AND METHODS

Study area

The size of Cefa Nature Park is about 5002 ha. The north-western limit coincides with the Romanian-Hungarian border, the southern limit is defined by the canal that bounds the Rădvanî Forest and the eastern by Criș's Sewer. The altitude remains constant throughout the region, ranging from 90 to 110 m.

The main wet habitats are the ponds included in a fishing stock (approximately 700 ha of water surface), the network of canals of different sizes and water flow speed and marshes.

Sampling procedure

Sampling and observations were carried out by visual inspection and by sample collection using a limnologic net, once a month from December 2009 to August 2010, excluding January and July. To characterize the microhabitat types several variables are given below:

- ✓ average width and depth of water
- ✓ type of substrate
- ✓ presence or absence of aquatic vegetation
- ✓ GPS coordinates (N/E)

Variables were noted for most of the sampling sites. The collected material was stored in Eppendorf tubes and other containers with 70% ethyl alcohol. Samples were determined with the stereomicroscope using the work of following authors as identification keys: Andersen [1, 2, 3], Davideanu [7], Jansson [14], Poisson [22], Tamanini [25], Wagner [26].

Sampling stations

The investigations were carried out in 19 sampling sites, samples being collected once or more times from the same site. (Fig. 1). We reached every lake and stream present in Cefa Nature Park area, except those which had been drained.

Collecting canal (CC): 46°54'46" N 21°41'54" E; lotic ecosystem; marks the eastern limit of the Park at the exit of Cefa village. Substrate type rocks, average depth of water cca. 90 cm.

Drainage canal Ateş East (CEA): 46°54'58" N 21°37'24" E; lotic ecosystem; average depth cca. 2 m, width around 10 m, without visible aquatic vegetation; substrate consists of mud and sand.

Canton drainage canal (CEC): 46°54'14" N 21°39'43" E; lotic ecosystem; flows near the district; average

depth of water cca. 80 cm, width 6 m; substrate type mud.

Canal Southern limit (CLS): 46°53'36" N 21°39'33" E; lotic ecosystem; average width 6 m, depth of water cca. 70 cm, substrate type mud.

Drainage canal Ateaş West (CEAP): 46°54'43" N 21°37'02" E; lotic ecosystem; average width 12 m, depth of water cca. 1 m; 90 % covered with *Lemna sp.*; banks with anaerobic fragmentations; substrate type mud.

Canal near Hut (CCAB): 46°54'17" N 21°39'22" E; small stream; substrate covered with leaves fallen from the trees; width 2.5 m, depth of water cca. 40 cm.

Canal 1 (C1): 46°54'28" N 21°39'40" E; lotic ecosystem; located to the left side of the road to Ateaş village. Substrate type mud, average depth of water cca. 1.2 m, width 2.5 m, rare fields with aquatic macrophytes.

Canal 2 (C2): 46°55'03" N 21°40'45" E; lotic ecosystem; at the edge of fishery, right side of the road. Substrate covered with leaves fallen from the trees, average depth of water cca. 60 cm, width 2.5 m.

Canal 3 North (C3N): 46°54'46" N 21°38'36" E; lotic ecosystem; marks the end of fishery towards Ateaş village; average depth of water 1 m, width 3 m, substrate type mud, with *Phragmites sp.* and *Lemna sp.*.

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Canal 3 South (C3S): 46°54'14" N 21°38'53" E; lotic ecosystem; continuing C3N.

Canal 4 (C4): 46°53'52" N 21°37'31" E; lotic ecosystem; at midway between Cefa and Ateaş villages; average depth of water 1 m, width 6 m, substrate type mud.

Lake 2 (L2): 46°55'01" N 21°40'44" E; lentic ecosystem; the second lake of the fishery on the right side of the road.

Lake 3 (L3): 46°55'14" N 21°40'05" E; lentic ecosystem; the third lake of the fishery on the right side of the road.

Lake 7 (L7): 46°54'25" N 21°39'06" E; lentic ecosystem; the last lake of the fishery placed also on the right side besides the road to Ateaş village.

Lake 8 (L8): 46°54'24" N 21°39'02" E; lentic ecosystem; placed between lake 3 and the 7th lake.

Lake 9 (L9): 46°55'11" N 21°40'01" E; lentic ecosystem; behind the 3rd lake.

Lake 14 (L14): 46°54'22" N 21°39'24" E; lentic ecosystem; the last lake of the fishery placed on the left side of the road.

Pool 5B (H5B): 46°55'11" N 21°40'46" E; lentic ecosystem; the fifth lake is divided into 3 small ponds this being the middle one; almost drained with mud as substrate.

Temporary pond (BT): 46°54'51" N 21°38'31" E; small temporary pond in Ateaş meadow.

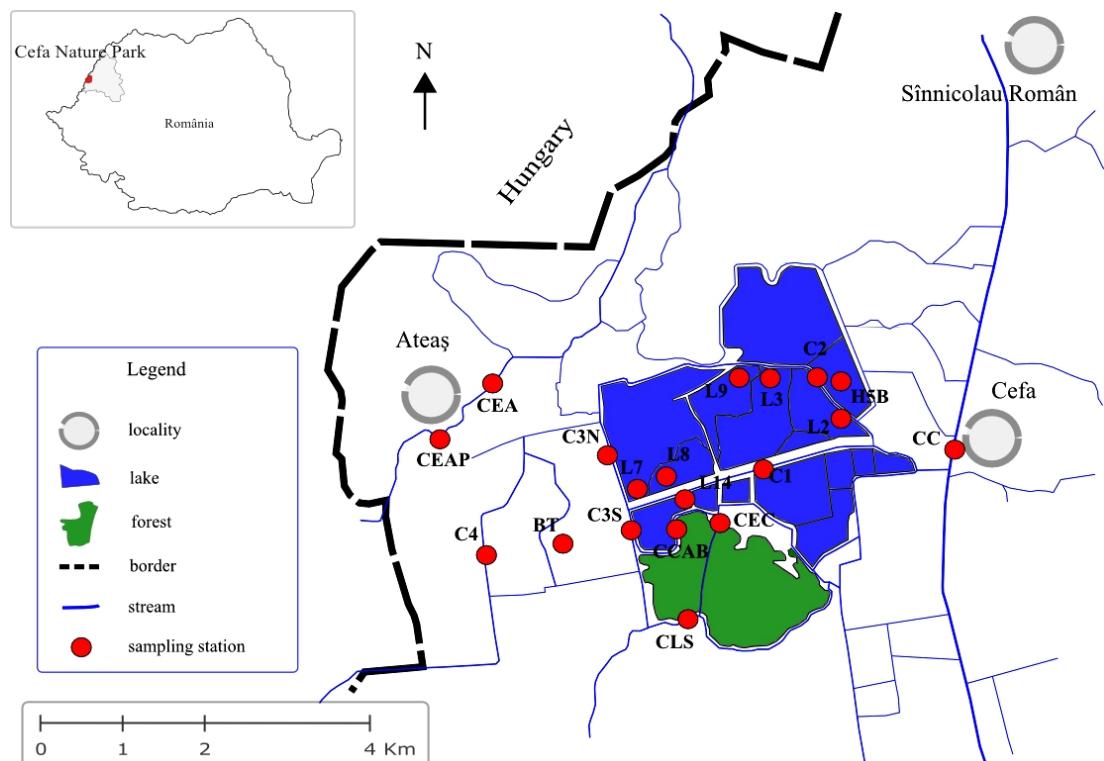


Figure 1. Sampling stations in Cefa Nature Park.

RESULTS

As a result of the present study a total of 23 Heteroptera species were found in this area, which means that at least 36.76% of Romanian true bug fauna occur in Cefa Nature Park, including in the percentage

the other two different species (*Corixa affinis* Leach, 1817 and *Mesovelia furcata* Mulsant & Rey, 1852) noted in the past by Ilie in 2005, but not founded this time. The species belong to the following families: Corixidae, Gerridae, Hydrometridae, Aphelocheiridae, Naucoridae, Nepidae, Notonectidae and Pleidae, 35

samples being collected with 265 individuals. There were five samples without Heteroptera species. Next to the species the frequency (%) values are indicated in Table 1. The most frequent species are *Plea minutissima* (18.32%), *Sigara striata* (11.83%), *Notonecta glauca* (11.45%), *Ilyocoris cimicoides*

(9.16%) and *Micronecta scholtzi* (8.39%). Rare species can be considered *Corixa punctata*, *Gerris odontogaster*, *Aphelocheirus aestivalis* and *Hydrometra stagnorum* all having a low frequency (0.38%).

Table 1. Species distribution at sampling sites and the frequency (%).

Species	Sampling stations															f%		
	BT	H5B	L14	L9	L8	L7	L3	L2	C4	C3S	C3N	C2	C1	CCAB	CEAP	CLS	CEC	CEA
<i>Corixa punctata</i> Illiger, 1807	•																	0.38
<i>Cymatia rogenhoferi</i> Fieber, 1864		•																1.14
<i>Hesperocorixa linnaei</i> Fieber, 1848	•																1.14	
<i>Paracorixa concinna</i> Fieber, 1848		•	•														1.9	
<i>Sigara falleni</i> Fieber, 1848	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	5.72	
<i>Sigara striata</i> Linnaeus, 1758	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	11.83	
<i>Sigara lateralis</i> Leach, 1817	•	•	•	•	•	•											7.25	
<i>Sigara iactans</i> Jansson, 1983		•															1.9	
<i>Micronecta scholtzi</i> Fieber, 1860																	8.39	
<i>Aquarius p. paludum</i> Fabricius, 1794																	4.58	
<i>Gerris argentatus</i> Schummel, 1832	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	5.34	
<i>Gerris lacustris</i> Linnaeus, 1758																	1.52	
<i>Gerris odontogaster</i> Zetterstedt, 1828																	0.38	
<i>Gerris thoracicus</i> Schummel, 1832		•															1.14	
<i>Hydrometra gracilenta</i> Horvath, 1899									•	•	•	•	•	•	•	•	2.67	
<i>Hydrometra stagnorum</i> Linnaeus, 1758																	0.38	
<i>Aphelocheirus aestivalis</i> Fabricius, 1794																	0.38	
<i>Ilyocoris c. cimicoides</i> Linnaeus, 1758	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	9.16	
<i>Nepa cinerea</i> Linnaeus, 1758		•															1.52	
<i>Ranatra linearis</i> Linnaeus, 1758			•	•	•	•											3.43	
<i>Notonecta glauca</i> Linnaeus, 1758	•	•															11.45	
<i>Notonecta viridis</i> Delcourt, 1909																	1.14	
<i>Plea m. minutissima</i> Leach, 1817	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	18.32	

Below we list the species that we have found, including the location, date and number of individuals. Species new for Crișana fauna are marked with *:

Family CORIXIDAE:

Corixa punctata Illiger, 1807: BT – 3.VI.10 (1).

* *Cymatia rogenhoferi* Fieber, 1864: L9 – 30.IV.10 (2); CEC – 12.XII.09 (1).

Comment: holarctic, oriental distribution [24]. In Romania it is rare [7].

Hesperocorixa linnaei Fieber, 1848: BT – 23.VI.10 (1); CC – 12.XII.09 (1); CEC – 12.XII.09 (1).

* *Paracorixa concinna* Fieber, 1848: L9 – 30.IV.10 (4); L14 – 26.III.10 (1).

Comment: palearctic distribution [24]. In Romania it is noted in east, south-west and center of the country [7].

Sigara (Subsigara) falleni Fieber, 1848: L3 - 30.IV.10 (1); CC – 12.XII.09 (2); H5B – 30.IV.10 (1); CEC – 10.II.10 (2); CEAP – 23.VI.10 (1); L2 – 30.IV.10 (1); C3N – 4.VIII.10 (3); L14 – 26.II.10 (4).

Sigara (Sigara) striata Linnaeus, 1758: CC – 12.XII.09 (4); CEC – 12.XII.09 (3), 10.II.10 (4); L8 – 23.VI.10 (3); C4 – 27.III.10 (1); C1 – 23.VI.10 (3); C3N – 4.VIII.10 (1); L14 – 26.III.10 (3), 23.VI.10 (4); BT – 3.VI.10 (3), 23.VI.10 (1); L7 – 23.VI.10 (1).

Sigara (Vermicorixa) lateralis Leach, 1817: L9 – 30.IV.10 (2); BT – 3.VI.10 (3), 23.VI.10 (2); L7 – 23.VI.10 (1); H5B – 30.IV.10 (4); L8 – 23.VI.10 (7).

Sigara (Subsigara) iactans Jansson, 1983: L14 – 26.III.10 (1); L7 – 23.VI.10 (1); CC – 12.XII.09 (1); CEC – 12.XII.09 (2).

* *Micronecta (Dichaetonecta) scholtzi* Fieber, 1860: L7 – 23.VI.10 (17); L8 – 23.VI.10 (5).

Comment: distributed in eastern hemisphere [24]. In Transilvania occurs in all kind of habitats [10].

Family GERRIDAE:

Aquarius paludum paludum Fabricius, 1794: C3N – 4.VIII.10 (1); CLS – 3.VIII.10 (9); C2 – 30.IV.10 (2).

Gerris (Gerris) argentatus Schummel, 1832: CEA – 26.III.10 (1); L14 – 23.VI.10 (1); BT – 26.III.10 (1); H5B – 30.IV.10 (3); C2 – 26.III.10 (1); C4 – 27.III.10 (3); C1 – 26.III.10 (3); C3S – 30.IV.10 (1).

Gerris (Gerris) lacustris Linnaeus, 1758: C2 – 26.III.10 (3); CCAB – 27.III.10 (1).

Gerris (Gerris) odontogaster Zetterstedt, 1828: CEA – 26.III.10 (1).

Gerris (Gerris) thoracicus Schummel, 1832: L14 – 23.VI.10 (2); L8 – 23.VI.10 (1).

Family HYDROMETRIDAE:

Hydrometra gracilenta Horvath, 1899: C3N – 4.VIII.10 (1); H5B – 30.IV.10 (1); C2 – 30.IV.10 (4); C4 – 5.VIII.10 (1).

Hydrometra stagnorum Linnaeus, 1758: CEC – 1.V.10 (1).

Family APHELOCHEIRIDAE:

Aphelocheirus aestivalis Fabricius, 1794: CC – 12.XII.09 (1).

Family NAUCORIDAE:

Ilyocoris cimicoides cimicoides Linnaeus, 1758: CEA – 26.III.10 (7); C3N – 4.VIII.10 (2); L14 – 23.VI.10 (1); BT – 26.III.10 (2); L3 – 30.IV.10 (1); H5B – 30.IV.10 (1); C2 – 30.IV.10 (1); C4 – 27.III.10 (3); CCAB – 27.III.10 (2); C1 – 26.III.10 (3); C3S – 30.IV.10 (1).

Family NEPIDAE:

Nepa cinerea Linnaeus, 1758: C3N – 4.VIII.10 (1); L14 – 23.VI.10 (1); CEC – 1.V.10 (1); C4 – 11.XII.09 (1).

Ranatra (Ranatra) linearis Linnaeus, 1758: L3 – 30.IV.10 (3); C4 – 27.III.10 (2), 5.VIII.10 (1); C3S – 30.IV.10 (1); CEA – 26.III.10 (1); C3N – 4.VIII.10 (1).

Family NOTONECTIDAE:

Notonecta (Notonecta) glauca Linnaeus, 1758: CEA – 26.III.10 (2); C3N – 4.VIII.10 (5); L14 – 26.III.10 (1); BT – 23.VI.10 (6); CLS – 3.VIII.10 (1); CEAP – 23.VI.10 (14); C4 – 11.XII.09 (1).

Notonecta (Notonecta) viridis Delcourt, 1909: C3N – 4.VIII.10 (2); CLS – 3.VIII.10 (1).

Family PLEIDAE:

Plea minutissima minutissima Leach, 1817: CEA – 26.III.10 (3); L9 – 30.IV.10 (2); C3N – 4.VIII.10 (8); L3 – 30.IV.10 (3); L7 – 23.VI.10 (7); H5B – 30.IV.10 (1); L8 – 23.VI.10 (4); L2 – 30.IV.10 (5); C2 – 30.IV.10 (1); C4 – 27.III.10 (3); CCAB – 27.III.10 (1); C1 – 26.III.10 (6); C3S – 27.III.10 (4).

DISCUSSIONS

The European water bug fauna is relatively poor as compared to the aquatic and semiaquatic fauna worldwide [21]. In Romania, 67 species of aquatic and semiaquatic Heteroptera have been noted so far [5, 10]. A new species of this group has been recently reported in Romania, but data have not been published yet (Berchi, unpublished data).

The studies shows the existance of 25 aquatic and semiaquatic Heteroptera species within a relatively small surface (5002 hectares) of Cefa Nature Park, which stands for a percentage of 36.76% out of Romania's aquatic and semiaquatic Heteroptera species.

Among the 23 species of aquatic and semiaquatic Heteroptera identified this time, the following 17 species are new for Cefa Nature Park: *Corixa punctata*, *Cymatia rogenhoferi*, *Hesperocorixa linnaei*, *Paracorixa concinna*, *Sigara falleni*, *Micronecta scholtzi*, *Aquarius paludum*, *Gerris lacustris*, *G. odontogaster*, *G. thoracicus*, *Hydrometra gracilenta*, *H. stagnorum*, *Aphelocheirus aestivalis*, *Nepa cinerea*, *Ranatra linearis*, *Notonecta glauca* and *N. viridis* [9]. Three of these species, *Cymatia rogenhoferi*, *Paracorixa concinna* and *Micronecta scholtzi* are new for Crișana Region [7, 20]. *Corixa affinis* and *Mesovelia furcata*, species mentioned by Ilie in Cefa, in 2005 were not reported in the present study.

Among the species of the present study, *Notonecta viridis* Delcourt, 1909 and *Cymatia rogenhoferi* Fieber, 1864 were not reported on the other side of the border, in Körös-Maros National Park [11, 13, 16]. 28 species

were identified on the Hungarian side of the protected area, six of which (*Hebrus ruficeps* Thomson, 1871, *H. pussilus* Fallen, 1807, *Microvelia buenoi* Drake, 1920, *M. pygmaea* Dufour, 1833, *Cymatia coleoptrata* Fabricius, 1777, *Sigara (Pseudovermicorixa) nigrolineata* Fieber, 1848) were not found on the Romanian side (Cefa Nature Park) [11, 13]. Likewise, considering the family as reference point, the dominant family as far as number of species is concerned is Corixidae family with 10 species on both sides of the protected area.

The density of aquatic macrophytes positively affects the occurrence of aquatic and semiaquatic Heteroptera species in the present study as well as is described in the literature, by a higher number of available food resources and shelters [16]. Vegetation structure clearly influences different developmental stages of waterstriders (Gerridae) [17] and backswimmers *Notonecta* sp. [4].

Among the 23 species identified in the present study, 16 species are aquatic 7 are semiaquatic. At a small scale, the spatial pattern of the Heteroptera species is determined by environmental factors, such as current velocity and macrophyte density. Aquatic Heteroptera species prefer habitat with standing, or slow flowing water, while the semiaquatic species seem to be tolerant of current velocity [16].

The number of aquatic Heteroptera species is equal in the two parks (16 species), whereas the number of semiaquatic Heteroptera species varies (7 species on the Romanian side and 12 species on the Hungarian side). One explanation arises from the fact that on the Hungarian side the aquatic habitats are of greater variety than those on the Romanian side. Therefore, there are certain habitats which are present only in Körös-Maros National Park: natural pools of different sizes and depths which may be temporal or permanent, ponds where fishing is not as intensive anymore (unlike Cefa Nature Park), moors with different water depths. Another explanation could be that these semiaquatic species might have not been found in Cefa Nature Park so far, which calls for further studies and investigations.

We may also remark the presence of *Aphelocheirus aestivalis*, widely distributed in Romania, but rarely collected because of its habitat of not surfacing the water [6].

Due to the large number of common species for both protected areas, Cefa Nature Park and Körös-Maros National Park, a common management plan (for wetlands conservation) is necessary to be implemented for biodiversity protection.

REFERENCES

- [1] Andersen, N.M., (1990): Phylogeny and taxonomy of water striders genus *Aquarius* Schellenberg (Insecta, Hemiptera, Gerridae), with a new species from Australia. *Stenstrupia*, 16: 37-81.
- [2] Andersen, N.M., (1993): Classification, phylogeny and zoogeography of the pond skater genus *Gerris* Fabricius

- (Hemiptera: Gerridae). Canadian Journal of Zoology, 71, (12): 2473-2508.
- [3] Andersen, N.M., (1996): Heteroptera Gerromorpha, Semi-aquatic Bugs, pp. 77-91. In Anders, N. Nilsson (ed.): Aquatic Insects of North Europe, Apollo Books, Stenstrup.
- [4] Bennett, D.V., Streams, F.A., (1986): Effects of vegetation on *Notonecta* (Hemiptera) distribution in ponds with and without fish. Oikos 46: 62-69.
- [5] Cantoreanu, M., (2007): Ordinul Hemiptera, Subordinul Heteroptera, pp. 244-257. In Moldovan, O.T., (ed.): Lista faunistica a Romaniei (specii terestre si de apa dulce) / Checklist of Romanian fauna (terrestrial and freshwater species). Casa Cartii de Stiinta, Kolozsvar, Romania.
- [6] Cojocaru, I., (2005): A new record of *Aphelocheirus aestivalis* Fabr. (Insecta: Heteroptera) for Romania. Analele Stiințifice ale Universității "Al. I. Cuza" Iași, s. Biologie animală, Tom LI: 81-83.
- [7] Davideanu, A., (1999): Contributii la studiul heteropterelor acvatice din Romania. PhD Thesis, Al. I. Cuza University of Iasi, pp. 84-247.
- [8] Hufnagel, L., Bakonyi, G., Vásárhelyi, T., (1999): New Approach for Habitat Characterization Based on Species List of Aquatic and Semiaquatic Bugs. Environmental Monitoring and Assessment, Netherlands, 58: 305-316.
- [9] Ilie, D.M., (2005): Heteroptere acvatice și semiacvatice din zona Cefa, Bihor. Studii și comunicări, Muzeul Brukenthal Sibiu, Științele naturii, 30: 109-112.
- [10] Ilie, D.M., (2009): Heteropterele acvatice și semiacvatice (Heteroptera: Nepomorpha, Gerromorpha) din bazinul mijlociu al Oltului. Altip Press, Alba Iulia, 279 p.
- [11] Juhász, P., Kiss, B., Olajos, P., (1998a): Faunisztkai kutatások a Körös–Maros Nemzeti Park területén. Crisicum, I: 105–125.
- [12] Kecskés, A., (1997): Occurrence of amphibious bugs, water bugs and ground bugs in the catchment of the Crisul Alb, Crisul Negru and Crisul Repede rivers / [Kételtű, vízi és parti poloskák a Fehér-Körös, a Fekete-Körös és a Sebes-Körös mentén]. pp. 275-286. In Sárkány-Kiss, A., Hamar, J., (eds.): The Criș/Körös Rivers' Valleys. Tiscia monograph series 2, Szolnok – Szeged - Târgu Mureş, Hungary - Romania.
- [13] Kiss, B., Juhász, P., Olajos, P., (1999): Contribution to Aquatic and Semiaquatic bug fauna of the Körös-Maros National Park (Heteroptera: Nepomorpha and Gerromorpha). Folia entomologica hungarica, 60: 115-123.
- [14] Jansson, A., (1996): Heteroptera Nepomorpha, Aquatic Bugs. pp. 91-104. In Nilsson, A.N., (ed.): Aquatic insects of North Europe. Apollo Books, Stenstrup.
- [15] Nieser, N., (1978): Heteroptera, pp. 280-285. In Illies, J., (ed.): Limnofauna europaea, G. Fischer Verlag, Stuttgart.
- [16] Nosek, J.N., Vásárhelyi, T., Bakonyi, G., Oertel, N., (2007): Spatial pattern of water bugs (Nepomorpha, Gerromorpha) at different scales in the Szigetköz (Hungary). Biologia, Bratislava, Section Zoology, 62(3): 345-350.
- [17] Nummelin, M., Vepsäläinen, K., Spence, J.R., (1984): Habitat partitioning among developmental stages of waterstriders (Heteroptera: Gerridae). Oikos, 42: 267-275.
- [18] Olosutean, H., Ilie, D.M., (2010): Relationships between habitat characteristics and aquatic and semi aquatic Heteroptera community structure in romanian mountainous regions: a preliminary report. Romanian Journal of Biology-Zoology, 55(2): 139-148.
- [19] Olosutean, H., Ilie, D.M., (2010): Influence of anthropic impact on aquatic and semi aquatic Heteroptera distribution from Repede River (Rodna Mountains National Park), Transylvanian Review of Systematical and Ecological Research. 9, Universității "Lucian Blaga" Press, Sibiu, 149-158.
- [20] Paina, I., (1975): Lista heteropterelor acvatice si semi-acvatice (O. Heteroptera) din R. S. Romania, Nymphaea, III. Muzeul Tarii Crisurilor, Oradea, pp. 99-115.
- [21] Papáček, M., Džisová, D., Hodinová, V., Jandová, L., Janochová, K., Kment, P., Smejklová, R., Škrna, P., Valtr, J., Ziková, L. & Ziková, P., (2002): Water bugs (Heteroptera: Gerromorpha, Nepomorpha) of the Novohradské Mountains, pp. 233-236. In Papáček, M., (ed.): Biodiverzita a přírodní podmínky Novohradských hor [Biodiversity and environmental conditions of the Novohradské hory Mts], Sborník příspěvků z konference 10. a 11. ledna 2002. Jihočeská univerzita a Entomologický ústav AV ČR.
- [22] Poisson, R., (1957): Hétéroptères aquatiques. Faune de France, Paris, 61: 1-263.
- [23] Skern, M., Zweimüller, I., Schiemer, F., (2010): Aquatic Heteroptera as indicators for terrestrialisation of floodplain habitats, Limnologica, 40: 241-250.
- [24] Štys, P., Jansson, A., (1988): Check-list of recent family-group and genus-group names of Nepomorpha (Heteroptera) of the world, Acta Entomologica Fennica, 50: 1-44.
- [25] Tamanini, L., (1979): Eterotteri acquatici (Gerromorpha, Nepomorpha). Guide per il riconoscimento delle specie animali delle acque interne Italiane, Consiglio Nazionale Ricerche, AQ/1/45, Roma, 6: 1-106.
- [26] Wagner, E., (1959): Heteroptera Hemiptera, pp. 1-187. In Brohmer, P., Ehrmann, P., Ulmer, G. (eds.): Die Tierwelt Mitteleuropas, IV, 3 (Xa), 173 S., Leipzig.

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