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DATA ON THE FRESHWATER MOLLUSCS FROM ROMANIAN TRIBUTARIES OF THE UPPER TISA RIVER BASIN

*Ioan SÎRBU *, Zoltan FEHÉR **,*
*Peter GLÖER **** and *Monica SÎRBU *****

* Lucian Blaga University of Sibiu, Faculty of Sciences, Department of Environmental Sciences and Physics, 5-7 Raţiu St., RO-550012 Sibiu, Romania, meosirbu@yahoo.com;
**Hungarian Natural History Museum, Department of Zoology, Baross u. 13, H-1088, Budapest, Hungary, feher@nhmus.hu;
*** Biodiversity Research Laboratory, Schulstraße 3, D-25491 Hetlingen, Germany, gloeer@malaco.de;
**** Andrei Şaguna Pedagogical National College, 2 Turnu Roşu St., Hipodrom, Sibiu, Romania.

KEYWORDS: Gastropods, Bivalves, endemic species, chorology, ecology, aquatic, human impact.

ABSTRACT

In the Romanian tributaries' of the Upper Tisa River basin, 16 species of aquatic molluscs (among them 13 species of Gastropods and three of Bivalves), have been found up to the present. The present paper presents their annotated systematical and chorological check-list, some ecological characteristics and the main environmental issues related to the human impact, of this area. The reduced specific diversity is due to geomorphological and hydrological features, such as: steep slopes, high water velocity, mountain landscapes with few specific habitats, high range of water debits, unstable substratum etc. which are limiting habitats' conditions for most freshwater molluscs, while another issue is the large part of the region, as well as many waters, which were not researched up to the present. However, the area shelters some local endemic species, explained by the presence of some glacial refuges. Both scarce specific habitats, as well as human pressure, shape the structure and distribution of the freshwater mollusc species in the area.

RÉSUMÉ: Données sur les mollusques d'eau douce des affluents roumains du bassin supérieur du Tisa.

Dans les affluents roumains du bassin supérieur du Tisa, 16 espèces de mollusques aquatiques (parmi eux 13 espèces de gastéropodes et trois bivalves) ont été trouvés jusqu'au présent. Cette oeuvre présente leur catalogue systématique et chorologique, certaines caractéristiques écologiques et les principaux problèmes environnementaux liés à l'ïmpact humain, dans cette région. La réduction de la diversité spécifique est due aux caractéristiques géomorphologiques et hydrologiques, tels que: des pentes raides, la vitesse élevée de l'eau, paysages de montagne avec peu des habitats spécifiques, la gamme haute des débits d'eau, le substrat instable etc. Cettes sont des conditions limitatives pour la plupart des mollusques d'eau douce. Toutefois, la zone abrit certaines espèces endémiques locales, fait expliqué par la présence de certains refuges glaciaires. La rarité des habitats spécifiques, ainsi que la pression humaine, façonnent la structure et la distribution des espèces de mollusques d'eau douce dans la région.

REZUMAT: Date privind moluştele acvatice din afluenţii din România ai bazinului Tisei superioare.

În afluenţii din România ai bazinului superior al râului Tisa au fost identificate până în prezent 16 specii de moluşte acvatice (dintre care 13 specii de gastropode şi trei de bivalve). Lucrarea de faţă prezintă lista sistematică şi chorologică actualizată, preferinţe ecologice şi probleme legate de efectele impactului antropic în această zonă. Diversitatea specifică redusă se datorează pe de o parte caracteristicilor reliefului, cum ar fi prezenţa extinsă a ariilor montane, pante mari şi cursuri rapide ale râurilor, variaţii cu amplitudini ridicate ale debitelor, substrat instabil etc., constituind factori limitativi pentru cele mai multe specii de moluşte, precum şi datorită faptului că arii extinse şi numeroase ape nu au fost încă cercetate sub aspect malacologic. Aria studiată adăposteşte câteva specii endemice locale, a căror prezenţă este explicată de existenţa unor refugii glaciare. Atât raritatea habitatelor specifice, cât şi impactul antropic, se reflectă în structura şi distribuţia speciilor de moluşte acvatice în aria de interes.

INTRODUCTION

The freshwater Mollusca fauna from the Romanian tributaries of the Upper Tisa River were scarcely studied up to the first decade of 2000. Some few information date back to the XIXth Century, by the work of E. A. Bielz (1867), M. V. Kimakowicz (1883), their collections being kept mainly in the Natural History Museum from Sibiu. Some data about terrestrial species were published by J. Frivaldszky (1871, ap. Fehér et al., 2008), especially regarding Clausilidae and Helicidae. In the middle XXth Century more data were provided by the work of János Wagner (=H[ans] Wagner) (1941 and others) which also described *Bythinella molcsanyi* as a new species, from the Igniş Mountains. Others dealt mainly with terrestrial species, but some aquatic taxa were also quoted (L. Soós, 1940, 1943. etc.). There was little else done afterwards, until the late 90's. During the month of August 1995 an international transboundary research team investigated the ecological state and the diversity of several aquatic groups in the Upper Tisa Basin, from its two sources (the rivers Bila Tisa and Chorna Tisa) in the Ukrainean Carpathians, down to the confluence with the River Someş/Szamos (the first name being in Romanian, while the second is in Hungarian) in Hungary, covering also the streatch of the Tisa River which is the natural boundary between Ukraine and Romania, in which the main rivers from Maramureş watershed flow: the Iza and the Vişeu rivers. The screening-type research included also a study concerning the freshwater molluscs from the tributaries Teresva, Tereblia and Batar from Ukraine (Sárkány-Kiss, 1999). However in the present paper only the streach down to the Terbelia flow is considered. In this sector the former mentioned author highlighted a very reduced diversity of freshwater mollusc species. Some more data regarding the molluscs from Maramureş were published by K. Bába (1997), Popa et al. (2006) and Gheoca (2010) concerning terrestrial gastropods. Fehér Z. et al. (2008) published a Malaco-faunistical study of Maramureş (as a region, containing both rivers' basins: the Upper Tisa and the Someş River tributaries of different orders), with some taxonomical and conservation notes, established in the framework of the research program "Invertebrate faunistical investigation of the Maramureş", molluscs from many areas being sampled between 2004 and 2008 (Murányi, 2008). During this project a revision of the collection of János Wagner was done, the material being collected and preserved between 1940 and 1944 by the late staff of the Hungarian Natural History Museum in Budapest. The paper presented an annotated check-list of the mollusc fauna of Maramureş county, including literature data, some unpublished material from the Wagner collection, as well as the results of recent samplings. An important outcome of this study was the discovery of *Bythinella molcsanyi* type material, which was believed to be fully destroyed. The study revealed that the mollusc fauna of Maramureş county

is relatively poor, considering either the total species richness or the number of endemic and rare taxa, compared to other parts of the Carpathians. Concerning the mollusc fauna from the Romanian Tisa river tributaries, a number of 6 freshwater molluscs species were found or quoted, among them the identity of *Bythinella austriaca* was questioned recently (Falniowski et al., 2009 a, b); they belong to five species of gastropods and one bivalve. The other aquatic species were quoted from the Someş River Basin area included in the Maramureş region. I. and M. Sîrbu have done several malacological sampling trips along the Mara, Iza, Săpânţa and Vişeu Rivers, as well as in the Gutâi, Rodna and Maramureş Mts. during the summer of 1999 and 2007; some data were published (Sîrbu et al., 2008 regarding the Maramureş Mountains Nature Park auquatic and hygrophilous molluscs; Sîrbu and Benedek, 2004 concerning some clams species; Glöer and Sîrbu, 2006 about some new taxa found in the Romanian fauna; Sîrbu 2010 revised the freshwater molluscs from the Natural History Museum in Sibiu). Some more contributions were provided by Falniowski, Szarowska and Sîrbu (2009 a and b) concerning the systematical revision of the genus *Bythinella* in Romania, which confirmed the status of some endemic species, rejected the presence of some others, and described new species for the science, including two from the area of interest. The area and watersheds which are about to be referred here, are the Romanian northern rivers-group basins (Ujvári, 1972), namely the tributaries of the Upper Tisa River: Vişeu River basin (surface of 1606 km^2, length = 80 km), Iza River basin (surface = 1303 km^2, length = 83 km), Săpânţa River (surface = 135 km^2, length = 20 km) as well as the Tisa River sector wich is the natural 62 km border between Romania and Ukraine. These waters drain the central and northern part of the Maramureş Mountains, the northern Rodna and Lăpuş Mts., as well as most northern watersheds of Oaş-Gutâi-Ţibleş Mts.

The available information from collections, papers and references, as well as data and molluscs collected from field research trips, accomplished by the authors, are considered in order to establish a present-day picture about the frehshwater mollusc fauna from the specified area, namely the Romanian watershed of the Upper Tisa River Basin. Lots of areas and freshwater habitats are still not researched, and the available data are scarce and scattered, thus another issue is to identify the future needs and topics in order to improve the knowledge.

METHODS AND RESEARCH AREA

Being a synthesis on all present-day available information concerning this topic, all sources of literature, revised collections and sampled materials were considered. The systematical and chorological check-list of the freshwater molluscs from the Romanian sector of the Upper Tisa River basin is given, together with some critical remarks, discussions on systematical and ecological features, and human impact sources and effects are characterized hereby. Original unpublished data, gathered between 1999 and 2007 are also considered. The systematics is given in accordance to R. Bank (2011) and R. Araujo (2011), respectively considering Fauna Europaea v. 2.4 (2011), than according to P. Glöer and I. Sîrbu (2006), while the newly described species are characterized and presented according to Falniowski et al. (2009 a, b). Most molluscs, sampled between 1999 and 2007, were done in the frame of several screening-type researches; the sampling sites were selected from the mountain areas down to hills, valleys and depressions, according to geomorphologic and hydrologic features, and to the presence of human impact sources. Thus a wide variety of habitats were investigated, like riverbeds, rivulets, brooks, permanent or temporary ponds and pools, springs, high altitude glacial lakes, etc. The main areas investigated were the Mara, Iza, Vişeu and Săpânţa rivers' valleys and some parts of their basins.

RESULTS

The systematical and chorological annotated check-list of the freshwater molluscs species found up to the present in the Romanian Upper Tisa River Basin, is given below.

Classis Gastropoda Cuvier, 1795

Ordo Neotaenioglossa Haller, 1892

Fam. Hydrobiidae Troschel, 1857; Subfam. Amnicolinae Tryon, 1862

(according to Fauna Europaea v. 2.4)

(Grossu, 1986) ascribed the genus to **Fam. Bythinellidae Radoman, 1976**

1. *Bythinella molcsanyi* H. Wagner, 1941

Taxonomic identifier (fauna europaea, v. 2.4): urn:lsid:faunaeur.org:taxname:427982

Observation: Fauna Europea incorrectly lists this species as *B. molcsany*, however, the correct name is *B. molcsanyi.*

Endemic species, described in literature from "Rozsály-tömb [Muntii Igniş], Izvora-fennsík [Statiunea Izvoare], springs near Molcsány-tanya (forester's hut) (ca. 1000 m) [= type locality]" (Wagner, 1941; ap. Fehér et al., 2008). Four lots (39 specimens altogether) were found in the Wagner collection, which are indicated as "*B. Molcsányi*" or "*Bythinella n.sp*." by Wagner's handwriting (Fehér et al., 2008). Since no holotype was designated originally, all of them are syntypes. Three of the lots are housed now in the Mollusca Collection of the Hungarian National History Museum, Budapest, and one in the Mollusca Collection of the Mátra Museum, Gyöngyös; this taxon is still known only from the type locality (idem). J. Wagner (1941) mentioned the occurrence of "*Bythinella austriaca* (Frauenfeld, 1857)" at several localities around the locus typicus of *B. molcsanyi*, which later proved to be another species. In the same type locality it was found again by Sîrbu I. and Sîrbu M. (leg. 1999), Fehér et al. (2008, leg. 2004-2008), Falniowski et al. (2009; found in rivulets springing from on oligotrophic marsh, helocrenic brooks). Within the type locality it lives sympatrically with *Bythinella grossui* Falniowski, Szarowska & Sîrbu, 2009. At present, all the known localities of *B. molcsanyi* are situated in the Igniş Mountains (springs and flowing waters belonging both to the Mara-Iza as well to the Lăpuş-Someş rivers basins). Benke et al. (2009) also mention this species in their paper. However, the material, that they assigned to this species, was originated from the Cimpoieş valley near Staţiunea Borşa. This is one of the populations, which was referred as "*Bythinella cf. austriaca*" in Fehér et al. (2008) and its systematic position is still unclear; possibly belongs to *B. viseuiana* or an undescribed species.

2. *Bythinella grossui* Falniowski, Szarowska & Sîrbu, 2009

Taxonomic identifier (fauna europaea, v. 2.4): urn:lsid:faunaeur.org:taxname: 427961

Endemic species; locus typicus: in the Izvoare Resort (Igniş Mountains), rivulets springing from an oligotrophic marsh (helocrenic brooks), Mara River Basin; 47°44'50.8"N, 23°43'02.7"E, 909 m a.s.l. (Falniowski et al., 2009 a,b). The holotype, as well as paratypes are deposited at the Museum of Natural History, Wrocław University. Its present known distribution, apart from the type locality, comprises three other localities in the Igniş Mountains. The species occurs sympatrically with *Bythinella molcsanyi*.

3. *Bythinella viseuiana* Falniowski, Szarowska & Sîrbu, 2009

Taxonomic identifier (fauna europaea, v. 2.4): urn:lsid:faunaeur.org:taxname: 428041

Endemic, recently described species. Its locus typicus is the Vişeu River Valley, downstream from the village of Bistra, a helocrenic brooklet close to the main road, a tributary of the Vişeu (first sampled by Monica Sîrbu in 2007); 47°52'14" N, 24°11'23" E, 362 m a.s.l (Falniowski et al., 2009 a,b). The holotype, as well as paratypes are deposited at the Museum of Natural History, Wrocław University. In present it is still known only from the type locality (but see notes at *B. molcsanyi*).

Six more endemic *Bythinella* species, collected by Z. Fehér, D. Murányi and A. Varga, occur in this region which can be distinguished by morphological as well as by anatomical features. We cannot mention the names or sampling sites here, because the new descriptions have not been published yet. However, it shows that mountainous regions like the Carpathians provide good habitats for spring-snails, possibly like the mountains of Bulgaria (Glöer & Georgiev 2011).

Ordo Basommatophora Keferstein, 1864

Fam. Lymnaeidae Lamarck, 1812

4. *Galba truncatula* (O.F. Müller, 1774)

Literature data: Sighetu Marmaţiei (M. Kimakowicz, 1883), Gutâi Mountains (J. Wagner, ap. Fehér et al., 2008), Rodnei Mountains, Borşa - Staţiunea Borşa resort, Cimpoies valley, beech forest, wet grassland and brooks in the vicinity of the mineral water spring (Fehér et al., 2008).

Original data: brooks and marshes covered with vegetation at the northern edge of the Bistra Village in the Vişeu River Valley (Sîrbu et al., 2008); puddles and brooks close to the dam, upstream CFF Crivina (Mara River Valley; leg.1999); in the Lăpuş Mountains near Slătioara (leg. 2009) and on the Igniş plateau, 3 km N of Pleaşca (leg. 2009).

5. *Stagnicola palustris* (O.F. Müller, 1774)

Literature data: E.A. Bielz (1867)- (*Stagnicola palustris* agg.) Rodna; "Mauritius and Richard Winnicki von Kimakowicz" collection in the Natural History Museum from Sibiu - labeled as "*Lymnaea palustris"* and "*Lymnophysa palustris*" from Sighetu Marmaţiei.

Original data: brooks and marshes covered with vegetation at the northern edge of the Bistra Village in the Vişeu River Valley (Sîrbu et al., 2008).

6. *Stagnicola turricula* (Held, 1836)

Literature data: M. Kimakowicz (1883) - Sighetu Marmaţiei

7. *Radix labiata* (Rossmässler, 1835) syn. *Radix peregra* (O.F. Müller, 1774)

Literature data: Wagner (1942, ap. Fehér et al., 2008) vicinity of the Băile Borşa resort, up to Pietrosu Rodnei Mt., 1200 - 1900 m and in the Gutâi Mountains. Fehér et al. (2008) make the remark that "these records refer probably to the following species" (i.e. *Radix ovata*).

Original data: brooks and marshes covered with vegetation at the northern edge of the Bistra Village in the Vişeu River Valley; Rica Valley upstream Coşnea, both in ponds and brooks; in the same habitats in Coşnea Valley; Culic Valley; Bistra Valley, here also in temporary pools in the flood area; marshes along Valea Neagră, in the Bistra village; ponds in the flood area of the Vişeu River at Leordina (Sîrbu et al., 2008); brooks in Mara River Valley, upstream the dam, close to the Cheile Tătarului narrows, in the Mara River close to Vadu Izei village, in the Vişeu River Basin, Pietrosu rivulet, upstream of the Baia Borşa resort (leg. 1999).

8. *Radix balthica* (Linnaeus, 1758) syn. *Radix ovata* (Draparnaud, 1805)

Literature data: Fehér et al. (2008) - quoted *Radix ovata* from Maramureş Mountains, Poienile de Sub Munte locality, Rica Valley in artificial ponds, at 763 m (leg. 2007); and Bocicoiu Mare village in Tisa (leg. 2004).

Fam. Planorbidae Rafinesque, 1815

9. *Planorbarius corneus* (Linnaeus, 1758)

Literature data: M. Kimakowicz (1883) - Sighetu Marmaţiei.

10. *Anisus spirorbis* (Linnaeus, 1758)

Original data: brooks and marshes covered with vegetation at the northern edge of the Bistra Village in the Vişeu River Valley (Sîrbu et al., 2008).

11. *Anisus leucostoma* (Millet, 1813)

Original data: This species has been found in 2009 in the Lăpuş Mountains, in the Morii valley, 7 km south of Bârsana, in a sidestream.

12. *Gyraulus rossmaessleri* (Auerswald, 1852)

Original data: helocrenic pond with clear water, invaded by aquatic and paludal vegetation, in the Izvoare resort, Gutâi Mountains, Mara River basin, here living together with *Pisidium casertanum*, upstream and close to the brooks where *Bythinella molcsanyi* was sampled, in sectors with faster flowing water. When it was sampled by the authors, in 1999, it was the first encounter of this species in the Romanian fauna (Glöer and Sîrbu, 2006).

13. *Ancylus fluviatilis* O.F. Müller, 1774

Literature data: It was quoted by M.v. Kimakowicz from the Vişeu area in the XIXth Century (collection kept in the Natural History Museum in Sibiu) without specific location. Bába (1997, ap. Fehér et al., 2008) sampled it from Igniş Mts., without definite locality; Sárkány-Kiss (1999) considers it as the single living freshwater mollusc species along the upper Tisa River, from the sources area, down to the flow of Tereblia tributary (including the sector which borders Romania and Ukraine); Fehér et al. (2008) Igniş Mountains, Deseşti - Izvoare Resort, Roşie Valley, river in a beech forest, forest edge and grasslands; Munţii Pietrii, Săpânţa, Brazi river in a pine forest at the Brazi valley, rocks and grassland patches (841 m); Runc river on the Runcului meadow (937 m); Săpânţa River in a beech forest at the Şipot waterfall and a sidespring in a meadow (663m; leg. 2005); Munţii Pietrii, Săpânţa river in a beech forest (500 m), Gutâi Mts., SW Mara, Rîuşor; Remeţi NW, Tisa. According to Curtean-Bănăduc (2008 and in. verbis) it lives in high numbers in Socolău River 50 m downstream the confluence with Rica; in Ruscova River 50 m upstream the confluence with Bardi; Cvaşniţa River 3.6 km upstream the confluence with Ruscova; in Repede River 50 m upstream the omonimous locality; Ruscova River 50 m upstream the flow in the Vişeu River; Frumuşeaua River 2 km downstream the confluence of the rivulets Tomnatec and Pop Ivan; Vişeu River in its Defile.

Original data: During our researches it was found in 2007 in the Bistra River upstream the omonimous village, in Rica River (upstream the confluence in exceptionally large numbers, i.e. hundreds of individuals on square meter) and Coşnea rivers. It is worth mentioning that in 1999 it was not found in any station along the Vişeu River, from downstream Borşa to Petrova, upstream the defile (Sîrbu et al., 2008). In 1999 the authors sampled it from the Mara River and tributaries upstream the dam from the Tătarului narrows, downstream to CFF Crivina; in the Săpânţa River upstream the village.

Clasis Bivalvia Linnaeus, 1758

Ordo Veneroida H. & A. Adams, 1856

Fam. Sphaeriidae Deshayes, 1855 (1820)

14. *Pisidium casertanum* (Poli, 1791)

Literature data: J. Wagner (1941 ap. Fehér et al., 2008) - from the Igniş Mts., spring at ca. 1000 m; Bába (1997, ap. Fehér et al., 2008) - Igniş Mts. (without definite locality).

Original data: brooks and marshes close to the northern edge of the Bistra village, in the Vişeu River Valley; ponds and rivulets in Rica Valley, in Coşnea, Culic and Bistra rivers valley; marshes in Valea Neagră (Sîrbu et al., 2008); in the Gutâi Mts., brooks close to Izvoare resort; rivulets downstream the spring Izvorul Albastru al Izei, upstream of Săcele village; in the Săpânţa River, downstream the fishery (leg. 1999); on the Igniş plateau, 3 km N of Pleaşca; in the Ţibleş Mts. near Botiza (leg. 2009).

15. *Pisidium personatum* Malm, 1855

Original data: brooks and puddles in the Bistra village, along several km upstream the locality (Sîrbu et al., 2008); in the Săpânţa River, downstream the fishery (leg. 1999).

16. *Pisidium nitidum* Jenyns, 1832

Original data: lakes and pools above the upper mountain level in the Mihăilecu - Farcău mountains area, and in Vinderelu Lake (Sîrbu et al., 2008); in the Pietrosul Rodnei glacial lake (leg. M.&I. Sîrbu, 1999; leg. A.M. Benedek, 2009); from the Tăurile Buhăescu glacial lakes (leg. A.M. Benedek, 2009).

DISCUSSION

Regarding the Hydrobiidae s.lat. (or the Bythinellidae), this family was supposed (J. Wagner, 1941; Grossu, 1986; Sîrbu et al., 2008 etc.) to be represented by two species in the Romanian watershed of the Upper Tisa River Basin, namely by *Bythinella austriaca* (v. Frauenfeld, 1857), and a local endemic species *Bythinella molcsanyi* H. Wagner, 1941. Fehér et al. (2008) quoted or sampled more spring-snails from Igniş Mts., Rodna Mts. (Borşa resort, Cimpoies valley), Lăpuş Mts. etc. Molecular studies on this material (see also: Benke et al. 2009) suggested that "although resembles morphologically to the *B. austriaca* populations of the Northern Carpathians, Maramureş material seems to be very different from them by the sequence of the mitochondrial COI gene (Benke et al., 2009). This might be an indication of a cryptic species, but can also be explained by an extreme intraspecific molecular diversity. Until this is not clarified, we treat this species tentatively as *B. cf. austriaca*". Later, Falniowski et al. (2009 a), verified that there is, in fact, no *B. austriaca* in Romania. In the frame of a several-years research (2005 - 2009), according to Falniowski et al. (2009, a, b) "mitochondrial cytochrome oxidase I (COI) and ribosomal internal transcribed spacer 1 (ITS-1) sequences were analysed in 12 Romanian *Bythinella* populations. Phylogenetic relationships were inferred using maximum parsimony, maximum likelihood and Bayesian techniques. For COI, the Kimura two-parameter (K2P) distances and haplotype networks were computed. Two sympatric and four allopatric groups were distinguished. The K2P distances are similar to those for congeneric rissooids, so each of the six groups represents a species. Two are identified as *Bythinella molcsanyi* H. Wagner, 1941, and *Bythinella dacica* Grossu, 1946." The other four groups were ascribed to four new species. "The occurrence of six species, each with a low haplotype number and high interspecific differences between haplotypes, is explained by: (1) a relatively long history of *Bythinella* in the territory of a Pleistocene glacial refugium; (2) the discontinuous character of the northernmost refugium, promoting speciation, but local extinction and subsequent recolonization; (3) unstable, post-glacial microhabitat conditions; and (4) the fragmented distribution of Romanian *Bythinella*." (according to Falniowski et al., 2009 a, p. 2955). Thus, in Maramureş, inclusively in the Romanian tributaries' basins of the Tisa River, up to the present three endemic species have been recognized, based on biomolecular, morpho-anatomical and biogeographical evidence, namely *Bythinella molcsanyi* H. Wagner, 1941, *Bythinella grossui* Falniowski, Szarowska & Sîrbu, 2009, which occurs sympatrically with the former species, and *Bythinella viseuiana* Falniowski, Szarowska & Sîrbu, 2009. The molecular distinctness of the studied species is not reflected in their morphology, the morphological differences are poorly marked, their variability ranges overlapping. However, in *Bythinella* molecular differences are usually not well reflected in morphology, which confirms the morphostatic model of evolution, with numerous cryptic species within the genus (idem). There are still several samples of *Bythinella* from the whole region, which have to be checked out before they should be ascribed to the mentioned, and

possibly also to some other, new taxa. The authors of the present paper have sampled (1999 - 2007) spring-snails also from the Mara River Valley, in the Cheile Tătarului narrows, in the Runcului Valley, from springs in the Dealul Herii hill, Ronişoara river basin, tributary of the Iza River, than springs and brooks beneath the Prislop Pass, close to the Rodna Mountains, brook in the Culic Valley on the mountain slope, in the Nadoşa valley over Săpânţa, in the Morii valley over Bârsana and in the Ţibleş Mts. near Botiza. Future research will possibly bring new evidence regarding these spring-snails systematics and their evolutionary biology.

It should be noted that from the Ukrainean part of the Upper Tisa watershed (more precisely from Ugolsky forestry of the Karpatsky Reserve in Tyachev district), some related taxa were described, namely *Terrestribythinella baidashnikovi* Sitnokova, Starobogatov & V. Anistratenko 1992, *T. amphibiotica* V. Anistratenko 1995 and *T. carpathica* Sitnikova, Starobogatov & V. Anistratenko 1992. According to Sitnikova et al. (1992), these are terrestrial animals but conchologically resemble to *Bythinella*. In the Fauna Europaea check-list, the latter two are treated as the synonyms of the former taxon. It would be desirable to clarify its systematic relationship to Romanian *Bythinella* species and to delimit its range more precisely (including its possible occurrence in Romania).

Another problems regarding the hydrobiids is *Paladilhiopsis carpathica* Soós, 1940 which was described on the basis of one individual from a cave close to Hoverla (in Ukrainean) or Hovârla (in Romanian) Mountain, in Ukraine close to the border with Romania. It is a troglobiont aquatic species with uncertain systematical status, which has to be taxonomically investigated by means of biomolecular criteria in the future. Its presence in Romania is still possible, thus it is mentioned here, but not included in the check-list.

During the screening-type research accomplished by the international team in August 1995, A. Sárkány-Kiss (published in 1999) found along the Tisa river, except for the sampling stations placed close to the sources, on both Bila Tisa and Chorna Tisa, downstream to the Tereblia confluence, only the species *Ancylus fluviatilis.* This segment covers the Ukarinean sector, as well as the sector which marks the natural border between Romania and the former country. Some few other species, namely *Radix labiata* and *Radix auricularia*, were quoted by the same source form the Teresva tributary, and *Radix labiata, Stagnicola palustris* and *Galba truncatula* were found in the Tereblia tributary, in both cases near their confluences with the Tisa river, because they shelter habitats of stagnant waters and rich algal periphyton, due to nutrients enrichment from fertilizers used in mountains pastures (idem). A higher diversity of aquatic molluscs species was found only beginning with the vicinity of Vinogradiv. The reduced diversity was explained by Sárkány-Kiss (1999) due "... first of all the steep slopes of the riverbed. The high speed of the stream results in strong erosion. For the same reason large quantities of boulders are carried by the river. From the sources of the river, down to (...) the Hungarian border, the riverbed consists of large sized boulders, which become more and more rounded going downstream". The mentiond author considers a high quality of the water in the upper Tisa River sector (idem). These features are in a broader sense valid for the whole area of interest, and explain the poor specific diversity (only 15 species of freshwater species). The mountainous landscape shape the riverscapes and limit the molluscan specific habitats.

According to the annual report of environmental quality state of the Maramureş county agency (2010), in the upper Tisa river basin 329 km of running waters are monitorized. Most sectors lie within the I - II quality classes according to all parameters, but the Ţâşla (Cisla) tributary of the Vişeu River is qualified as III -IV because of the Cu, Zn and Mn contents, originating from the Borşa mining indutry. Below the flow of this tributary, the Vişeu River falls accordingly in a lower quality class, but downstream, at the level of the Bistra locality, due to natural cleaning processes, it recovers again.

Sîrbu et al. (2008) wrote: "*Ancylus fluviatilis* in some respect is witness of a certain rivers' and brooks' ecological state, and even when such kind of habitats are somehow organic loaded, it clearly proves a sound degree of oxygenation and self-cleaning capacity of the aquatic habitat. It's absence is equally significant, being the other side of the coin.(...) It's absence from a whole riverbed, as it is the case of Ţâşla River, supports a conclusion of severe debasement of river's system quality. Along the Vişeu River it is almost not to be found (as it was revealed by the researches done by I. and M. Sîrbu in 1999 and A. Curtean-Bănăduc in 2007), at least not downstream of Baia Borşa as far as Petrova, despite the fact that this river offers the specific conditions of its habitat. The remnant pollution caused by mining, related to heavy metals discharges, acidification, cianide spills etc., and other sources, are still the main causes of its absence. Although it is generally considered that the remnant pollution belongs to the past, its effects are still present, and will be also in the future a certain timespan". The natural, self-cleaning capacity of the Vişeu River was proved by several papers, like those published by Staicu et al. (1997), Curtean-Bănăduc (2008, which found *A. fluviatilis* in the Vişeu River almost in the lowest sector, namely in its final defile, downstream Petrova), and Sîrbu et al. (2008).

In the Romanian area of the Upper Tisa River Basin, most rivers' ecological systems are of high quality in their upper sectors, but prove certain effects in their middle and lower sectors, due to human impact sources. The main threats and problems are linked to: mining and other industrial wastewater discharges, enforced deforestation, saw mills wastes, household wastes and discharges, improper hydrotechnical works, and others.

CONCLUSIONS

In the Romanian tributaries of the Upper Tisa River, 16 species of freshwater molluscs were identified, among them three are endemic taxa: *Bythinella molcsanyi, Bythinella grossui* and *Bythinella viseuiana.* The possible presence of some other new taxa belonging to this group (new taxa of *Bythinella* or *Paladilhiopsis carpathica*) has still to be investigated. 13 species are gastropods and three bivalves (clams). The reduced number and specific composition is due to the landscapes' characteristics: mostly a mountain region, with steep slopes and fast-flowing waters, hig seasonal ranges of waterlevels, coarse unstable substratum etc., while another reason is that the largest part of the region, and most waters, were not yet researched as far as molluscs are concerned. Human impact is also a limiting factor, especially linked to mining industry as well as other wastewater discharges, however the rivers from this area prove a certain self-cleaning capacity.

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