Biogeographical characterisation of Szatmár-Bereg plain based on the mollusc fauna

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Introduction

Connected to the biological inventory on the territory of the Hortobágy National Park Directorate in 1993 and 1994 we could investigate the land snail fauna in 20 of the Szatmár-Bereg Plain forests.

Besides the supply of data, we were looking for answers to some zoogeographical questions. From where and how can we trace the descent of snail fauna of the forests of Bereg Plain? Is the migration of the species still in process? What kind of connection is there between the faunas of the relatively close NE-Carpathians and the forests of the Bereg Plain.

Keywords: mollusc fauna, biogeography, Hungary

The inventory of the forests of the Szatmár-Bereg Plain

In the course of the field researches we collected soil samples for the malacological investigations according to the quadrat method (25x25x5 cm/quadrat). We usually took 10 samples in each forest. Besides the quadrat method we applied the bulk collection method.

We worked on 390 quadrats, from wich 3264 entities were examined. These entities belong to 43 species. 1000 entities are from the snail bulk collection method.

It is typical of the species-abundance of the Bereg Plain that 64% of the 74 species possibly found on the Great Plain can be traced here (Bába, 1983). The land-snail fauna of the plain is outstanding not only nationally but also on the Great Plain. Because of the relatively high percentage (11%) of the Carpathians species and the dominance of closed forest species the fauna of the plain hardly fits into the fauna of the dominant, forest-steppe vegetation of the Great Plain. It is reasoned by two facts, first the territory was covered with closed forests, second the origin of the Molluscs of the plain should be searched in the subcarpathian mountain ranges of the Easter-Carpathians.

The territory can be properly typized with a snail-community which consists of the following species: *Aegopinella minor, Cochlodina laminata, Clausilia pumila, Balea stabilis, Perforatella dibothrion, Perforatella vicina.* The coexistance of the first

three and the last species on the Great Plain indicates that the region is touched by mountainous influences (eg. Bátorliget). The species which live only on one- or two spots are: *Discus perspectivus, Vitrea diaphana, Bielzia coerulans, Ruthenica filograna, Balea biplicata.* A similar place can be found along River Tisza, the Bagiszeg Forest. Its connection with the subcarpathion region is still ensured by Tisza. On the Szatmár Plain there is only one similar but poorer site, the Cserköz Forest near Magosliget. The undergrowth is rich in Carpathian *Crocus Heuffelianus* and the snail-community consisting of *Aegopinella minor, Cochlodina laminata, Clausilia pumila, Perforatella vicina* can be also found here. Since fauna of the similar kind cannot be seen anywhere else on the Szatmár Plain, we rank Cserköz Forest to the Bereg Plain from a zoogeographycal point of view.

The closeness of the Carpathians, the transportation-role of Tisza river, the relatively high vapour content and the cold mezoclimate determine the zoogeographical features of the plain (Bába, 1983).

Most of these forests are cut down and are replaced with pastures. Consequently the grassy biotops are secondary features of the plain. The spread of the snails in lack of rivers is very slow. Because of all these factors the land-snail fauna of these fields and pastures are very poor or in most of the cases "snail-free". The change is still in process and we can observe the sudden advance of termophilous and draught-resistante elements. A very good example of this advance is the appearance of the steppe "dweller" *Chondrula tridens* along the sides of the paved road leading through Lónyai-forest. A considerably greater expansion was achieved by the *Cepaea vindobonensis* partly along the pathes in the forests and partly in the bushes along the roads. The advance of this species started earlier and is still in process. This change -

Carychium minimum O. F. Müller, 1774	*Limax maximus* Linnaeus, 1758
Carychium tridentatum (Risso, 1826)	*Limax cinereoniger* Wolf, 1803
Succinea oblonga Draparnaud, 1801	*Lehmannia marginata* (O. F. Müller, 1774)
Succinea putris (Linnaeus, 1758)	*Bielzia coerulans* (M. Bielz, 1851)
Cochlicopa lubrica (O. F. Müller, 1774)	*Euconulus fulvus* (O. F. Müller, 1774)
Cochlicopa lubricella (Porro, 1838)	*Cochlodina laminata* (Montagu, 1803)
Columella edentula (Draparnaud, 1805)	*Ruthenica filograna* (Rossmässler, 1836)
Truncatellina cylindrica (Férrussac, 1807)	*Clausilia pumila* C. Pfeiffer, 1828
Vertigo angustior (Jeffreys, 1830)	*Laciniarai plicata* (Draparnaud, 1801)
Pupilla muscorum (Linnaeus, 1758)	*Balea biplicata* (Montagu, 1803)
Vallonia pulchella (O. F. Müller, 1774)	*Balea stabilis* (L. Pfeiffer, 1847)
Acanthinula aculeata (O. F. Müller, 1774)	*Bradybaena fruticum* (O. F. Müller, 1774)
Chondrula tridens (O. F. Müller, 1774)	*Perforatella bidentata* (Gmelin, 1788)
Punctum pygmaeum (Draparnaud, 1805)	*Perforatella dibothrion* (M. v. Kimakowicz, 1884)
Arion subfuscus (Draparnaud, 1805)	*Perforatella vicina* (Rossmässler, 1842)
Vitrina pellucida (O. F. Müller, 1774)	*Perforatella rubiginosa* (A. Schmidt, 1853)
Vitrea diaphana (Studer, 1820)	*Euomphalia strigella* (Draparnaud, 1801)
Vitrea crystallina (O. F. Müller, 1774)	*Chilostoma banaticum* (Rossmässler, 1838)
Vitrea contracta (Westerlund, 1871)	*Cepaea vindobonensis* (Férrussac, 1821)
Aegopinella minor (Stabile, 1864)	*Helix pomatia* Linnaeus, 1758
Nesovitrea hammonis (Ström, 1765)	*Helix lutescens* Rossmässler, 1837
Zonitoides nitidus (O. F. Müller, 1774)	

Table 1. List of species collected by us on the Szatmár-Bereg Plain

in the lack of sufficient data about holocen fossil Molluscs - cannot be traced. The forests of the Tiszahát region represent the territory of great changes because of the antropogen-effects and the fact that the climate of the region becomes more and more arid. The forests of Szatmár died, so their undergrowth cannot be typized with the spring-time geophitons any more but with different grass species like *Alopecurus sp.* These events had a great effect on the land-snail fauna. The forest-species disappeared or the shells found reminded us to subfossil forms. While other species like *Pupilla muscorum, Vallonia pulchella* and *Truncatellina cylindrica* appeared.These species which are so typical of the areas, stand out from and do not fit into the species of a closed-forest on the Szatmár Plain. The Bereg Plain from this point of view is in a more favourable position, though changes can be also observed here and will strenghten. With the improvements of infrastructure probably irreversible changes will happen. With permanent monitoring we can easily follow these changes.

Carpathian effects on the fauna of the Bereg inselberg: Kaszony Hill

In the course of malakofaunistical examination of the Kaszony Hill we distinquished 7 typical biotops (in accordance with the things mentioned above). All of these forests are planted or naturally revived. We cannot find Molluscs on vineyards and on greens. In accordance with the biotopes we worked on 70 quadrats and determined 913 entities. Besides, 200 entities were collected with the bulk method. The list of species includes 23 taxons and hopefully it will be enriched with the number of the naked-snail species.

The examination proved that in comparison with the surrounding territories the land-snail fauna of the Kaszony Hill is very rich. The fauna of the Shoutheastern exposed bushes correspond to the snail communities of the zonal wooded-steppe vegetation of the Great Plain, with an element from the NE-n part of the Plain (*Helix lutescens*). The relationship can be traced between the enpoverished faunas of the southern hillsides and oak forest spreaded on the hill-country.

In the snail-faunas of the Eastern hill-sides in considerable proportion, we can find such fauna elements that recquire forest-environment. These are the Carpathian (*Balea stabilis, Perforatella vicina*), the middle-European species (*Vitrea diaphana,Vitrea contracta, Clausilia pumila, Balea biplicata*) and species that are wide-spread in mountain-ranges. This fauna combination is not typical of the Great Hungarian Plain. Even on the northern part of the Plain, which has great precipitation and mostly covered with forests, it can be considered irregular (esp. because of the presence of *Balea stabilis* and *Vitrea diaphana*). In our oppinion relationships can be traced between this fauna-combination and the one on the mountain-range of medium hight of the Carpathians. The land-snail fauna of the Kaszony Hill, although most of the species can be in the undisturbed forests of the surrounding plain-regions, still shows (in an ecological sense) features of an island fauna. It rises above its surrounding plain

as an island in which faunas corresponding with 3 fauna-zones distinct from one another, have survived still in these days.

The recent microclimatic and malacological investigations (Sólymos, 1997, Sólymos-Nagy, 1997) suggest that the microclimate of the hill slopes has direct and indirect effects on molluscs. Direct effects are linked with the temperature and the relative humidity of the biotope. The interrelation between the air and the plants has an indirect effect: closed and transitional vegetation can keep an increase in humidity, which is favourable for molluscs. This interrelation is very important because plants as generative surface generate the microclimate and this microclimate provides many other living organisms, such as molluscs with proper conditions. It seems to us that some different microclimatic mosaics and lithobiomes (Huggett, 1995) developed on the slopes of Kaszony Hill, thus the different ecological habitat loving Mollusc species (e.g. open or shade loving communities) can live close to each other.

According to the qurtermalacological data (Sümegi-Szabó, 1992) similar mosaic-like habitat developed on these hill slopes during the Pleistocene when the "cold stage" taxa and "warm stage" taxa (Willis et al. 1995) could survive some different climatic changes in small approving environmental pockets (or *oasies*: Willis et al. 1998) therefore there were highly mixed communities in both flora and fauna. Thus these hillslopes were favourable places for temperate refugial populations, firstly Carpathian and Middle European forest elements.

Malakofaunistical evaluation of two floodplain forests

The *Chilostoma banaticum* species, according to our researches live on two floodplain regions of the Szatmár-Bereg Plain. It was first discovered by Bába (1969) in the Bagiszeg Forest belonging to a town of Vásárosnamény. Later it was also found in Szabó-füzes Forest near Tiszabecs (Fintha et. al, 1993).

In the course of the biological inventory we collected samples from 8-8 quadrats, and a great amount of material was collected with the bulk method. On the two territories we found 26 species altogether which is more than 50% of the species found on the Szatmár-Bereg Plain. The common species almost without exception, are of SE-European, European and Carpathian expansion.

Most of the snails, living only near Bagiszeg, are species existing in European closed forests. All of the species living only in Tiszabecs are wide-spread holarctic and palearctic ones which favoure humid, watery biotops independetly from light intensity. The spectacular difference comes from the water-supply of the biotops. The odd thing is that we found twice as many entities in Bagiszeg as in Tiszabecs from the same amount of quadrats (8-8). This diversity cames from the great density of entities of the small-sized species, which is due to the luxuriant undergrouth and the thicker forest floor meaning a more favourable biotop for them.

According to our research besides *Chilostoma banaticum* as the dominant species - we can also find *Bradybaena fruticum, Helix pomatia, Cepaea vindobonensis* on the

flood plain. In Bagiszeg *Perforatella bidentata, Perforatella vicina* enrich this community.

The nearest locality of the population of this species was found along River Tisza at the town Huszt (recently Ukraine).

On the basis of earlier assumptions the Bagiszeg substance was due to the result of a transport by River Szamos (Bába, 1969; Domokos, 1987). Their appearance on the banks of river Tisza and in Hungary near Tiszabecs questions this assumption. To sum it up, the population at Tiszabecs if not constantly but periodically, at the time of great floods is in connection with the population near Huszt. The population living in Bagiszeg forest probably has already detached from the mountain biotopes. The most evident explanation though is ecological, namely that the microclimate of the two examined territories are different.

	Bagiszeg Forest		Tiszabecs Szabó-füzes	
common species	**quadrat**	**sporadic**	**quadrat**	**sporadic**
Carychium minimum	200		4	
Succinea oblonga	1		1	
Succinea putris	1		1	
Cochlicopa lubrica	5		20	
Punctum pygmaeum	19		1	
Arion subfuscus	0	•	0	•
Zonitoides nitidus	1		5	
Limax maximus	0	•	0	•
Bradybaena fruticum	9		15	
Perforatella vicina	6		0	
Perforatella rubiginosa	2		6	
Chilostoma banaticum	5		8	
Cepaea vindobonensis	0	•	0	•
Helix pomatia	1		2	
Helix lutescens	0	•	0	•
only Bagiszeg				
Carychium tridentatum	30			
Vitrea crystallina	199			
Aegopinella minor	1			
Bielzia coerulans	0	•		
Cochlodina laminata	10			
Laciniaria plicata	1			
Perforatella bidentata	7			
only Tiszabecs				
Vitrea contracta			2	
Nesovitrea hammonis			6	
Euconulus fulvus			0	•
Euomphalia strigella			0	•
together	498			

Table 2. Valuation of the quadrats and sporadic data on two floodplain biotopes (Bagiszeg Forest, Szabó-füzes)

Summary

In the course of a 2 years long biological inventory carried out on the Szatmár-Bereg Plain, more than 4000 entities of land snails were identified and classified into 43 species. Consequently, we could enlarge our information about the range of land snail species with 218 data. On the basis of the outstanding 11% presence of Carphatian species within the 30% of Middle-European mountain elements found in the forests, we suggest that "*Praecarpathicum*", as a new distinctive zoogeographical unit should be introduced. This zoogeographical unit developed between the foothill of Carpathians and lowland region, around the Carpathian forested mountain region, which called *Carpathicum* (Soós, 1943). Some fragments of the Carpathicum can be found on the side of rivers which spring from Carpathian mountain. The hidrochor spreading Mollusc species can colonise in these closed forested fragments (*green corridor effect*: Deli et al. 1994). Probably, the Praecarpathicum is a biogeographical fluctuation zone of Carpathian and Central European shade-loving Molluscan elements where the forest habitat loving molluscs can spread in the favourable, warm and wet climatic cycles of Quaternary and they could survive in some small oasis-like spots, which were the rest of temperate forests (the *biogegoraphical islands of Carpathicum*), during the unfavourable, cold and dry climatic cycles.

The quartermalacological (Sümegi-Szabó, 1992) and recent malacological data suggest that some small diffusion forest spots developed in the Bereg Plain during the last glacial of Pleistocene. The shade-loving Mollusc elements (e.g. *Vestia turgida, Cochlodina laminata, Perforatella vicina*) could survive in these forest spots during the Weichselian glacial cold phases.Then these elements expanded from these small *oasis* spots (Willis et al 1998) at the transition of the lateglacial/postglacial time when an sharp and large increase developed in the temperature and humidity (Bennett et al. 1991, Kutzbach-Guetter, 1986, Willis et al. 1995).

Based on the radiocarbon-dated quartermalacological records (Sümegi-Hertelendi, 1998) the best place for refugial forest population could be found between the foothill and floodplain zone where higher temperature microclimate on the southern slope associated with more humid microenvironment. Similar situation developed in the region of Bereg Plain where a wet floodplain has surrounded some small volcanic hills (e.g. Tipet-hill at Barabás, Nagy-hill at Tarpa). Thus the effect of the slope morphology and base-rock: the altitudinal microclimatic gradients and mosaic microenvironments (lithobiomes) were favourable for developing of relict forest populations during the Pleistocene glacial times.

These results suggest that some important refugial spots of temperate trees with shade-loving mollusc species developed on the studied region. Although this forest refugial area was effectively an isolated community but importance of these refugial areas for both short-and long-term conservation of biodiversity cannot be overestimated (Willis, 1996). Thus present day diversity of the forest habitat loving fauna and flora on the Bereg Plain is probably related not only to its geographical situation (between the Carpathian mountains and the Great Hungarian Plain) and green corridor effects but also is refugial role.

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