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Comparative malacological investigations on the Kaszonyi Hill (NE Hungary)

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Abstract. During the accurate malacological survey carried out in 2000, we investigated of 160 soil samples (quadrates) from 16 different sampling sites of the Kaszonyi hill (Bereg Plain, NE Hungary). Our researches are connected to the rocky grassland reconstruction project organised by the Hortobágy National Park. Our aims were (1) to base the monitoring process of the forthcoming years, (2) to reinvestigate the previously sampled habitats and to compare the new results with the earlier results, and (3) to sample new habitats to get a more precise picture of the hill.

Key-words: Malacology, Faunistic, Hungary

Introduction

The malacofaunistical evaluation of the island hills of the Bereg has begun in 1993 (Deli, T. et al., 1993). These previous investigations superficially dealt with the Mollusc fauna of the Kaszonyi Hill among the forests of the Bereg Plain. The results showed that the area needs more thorough investigations because of the presence of some Carpathian and Central European montane forest species which occurrence in the lowlands is exceptional and confirms the strong Carpathian influence on the region. Besides the faunistical results we concluded the isolated hills of the Bereg (abraded extinct volcanos) to be islands in a biogeographical way as well, located in the border zone of the Carpathicum and Pannonicum faunal regions.

In October, 2000, a habitat reconstruction project was initiated by the Hortobágy National Park to save the valuable rocky grasslands on the Kaszonyi Hill maintaining several interesting plant and animal species (Varga, Z. 1992). The goal of this reconstruction project was to cut down the shrubs emerged on the NE slope of the hill in order to extend the original grassland with its insect fauna. The malacofaunistical researches joined to the habitat reconstrucion. Our aims were (1) to base the monitoring process of the forthcoming years, (2) to reinvestigate the previously sampled habitats and to compare the new results with the earlier results, and (3) to sample new habitats to get a more precise picture of the hill.

Material and methods

Sampling strategy

The Kaszonyi Hill is mostly covered by different types oak forest with white lime. The proportions of the constituent trees and the underwood species differ due to exposure, soils and other abiotic environmental factors. The E and NE slopes have more humid and cooler microclimate and the proportion of the Fagetalia underwood species is higher here. While on the S slope steppe underwood species dominate in the oak forests (Bartha – Gencsi, 1991, Varga-Sipos, J. 1990a, 1990b). For the accurate malacological sampling we surveyed almost each characteristic forest types of the hill (Table 1).

We took 10 soil quadrates (25 cm x 25 cm x 5 cm per quadrates) from each sampling sites. The quadrates were taken from transect where it was possible, or else those were arranged randomly. Besides the quantitative malacological sampling we also picked up single individual(sporadic sampling) s that is necessary in faunistical works.

Data analyses

Similarity of the species composition was calculated by the Bray-Curtis quantitative dissimilarity index, and the similarity structure was analysed by hierarchical cluster analysis with using of the Ward-Orlóci fusion method (MISSQ). The NuCoSA package (Tóthmérész, B. 1993) was used for these computations. To find character species of the cluster hierarchy the IndVal method (Dufrêne, M. – Legendre, P. 1997) was used. This method combines the mean number of species individuals with its relative frequency of occurrence in the various groups of sites in the cluster hierarchy. The index is maximum when all individuals of a species are found in a single group of sites and when the species occurs in all sites of that group, it is a symmetrical indicator (its presence contributes to the habitat specificity and its presence can be predicted in all sites of the group, indicator value >55%). Other species must be considered as accidental ones, these are asymmetrical indicators (their presence cannot be predicted in all samples of one habitat, but contributes to the habitat specificity, indicator value <55%). The index for a given species is independent of the other species relative abundances (Dufrêne, M.– Legendre, P. 1997). The statistical significance of the species indicator values is evaluated using a randomization procedure by 1,000 random permutations. The IndVal 2 package (Dufrêne, M. – Legendre, P. 1997) was used for the computations.

The species were identified according to Kerney, M. P. et al. (1983). We used the ecological classification of Mollusc species due to their habitat preference and humidity requirements following Krolopp, E. – Sümegi, P. (1992, 1995).

Results

During the accurate malacological survey carried out in 2000, we investigated of 160 soil samples (quadrates) from 16 different sampling sites (Fig. 1). We identified 1456 individuals of 25 Gastropod species from soil samples and 136 individuals of 6 species from sporadic sampling.

The multivariate analysis of our data is presented in Fig. 2, where the two main cluster group is sharply distinct and represent the groups of the woody habitats and the tall grasslands. In the woody group can be divided into three subgroups. Accordingly we can differentiate four separate cluster groups (named as I., II., III., IV in Fig. 2).

The potential vegetation of the Kaszonyi Hills is the Oak forest with white lime of different composition. The closed woody habitats were grouped according to the three different stages of a humidity gradient in these forest habitats. The most humid habitats belong to group III. in Fig. 2. Area 7-9 are close to each other in the cluster because of their similar fauna with several montane elements. The surprising species diversity and high number of individuals in the orchard (area 12) is probably caused by the abandoned cultivation that let the shrub growing and the leaf litter also became thick. These conditions, the good water supply of the soil and the carbonate containing loessy sediments maintain a diverse Mollusc assemblage here. The immigration of the species from the surrounding forests could be unbroken. The rich malacofauna found near artificial structures (like fountain) can be explained with the same effects mentioned above. All the areas belonging to group III. are close to each other and exposed to the E, except the oak forest (area 13) in SE exposure.

According to the vegetation and malacofauna, group I. and II. can be deduced from group III. (see above). With the exceptions of the orchard (area 4) and the rocky grassland (area 5) the areas of group II., are opening ecotons or secondary shrubs growing on once thrived forests. These are the areas directly influenced by the habitat reconstruction project. Their relative distinctness can be explained by the composition of their malacofauna and the high abundance of the forest-steppe species. The rocky grassland (area 5) is linked to group II. because the species found are moved here from the surrounding forest and shrub patches. The steppe elements are absent from the rocky grassland. The older and younger shrubs (area 2 and 3) are similat to each other both in appearance and their species composition. Similarly to group III. the areas of group II. are close to each other except the shrubs in SE exposure (area 14).

The dry woody habitats belonging to group I. were cultivated for a long time, thus those can be characterised by poor forest fauna. The segregation of the S shrub (area 15) is causeb by the high abundance of *Euomphalia strigella* that is a steppe element contrary to the other species characteristic to group I.

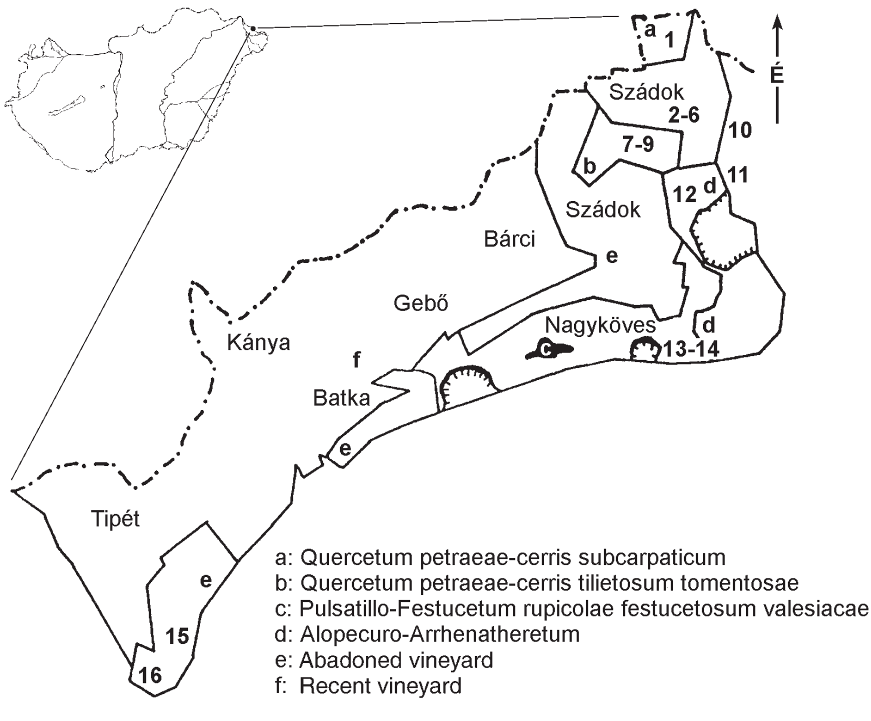

Fig. 1. Map of the Kaszonyi Hill with the location of the sampling sites

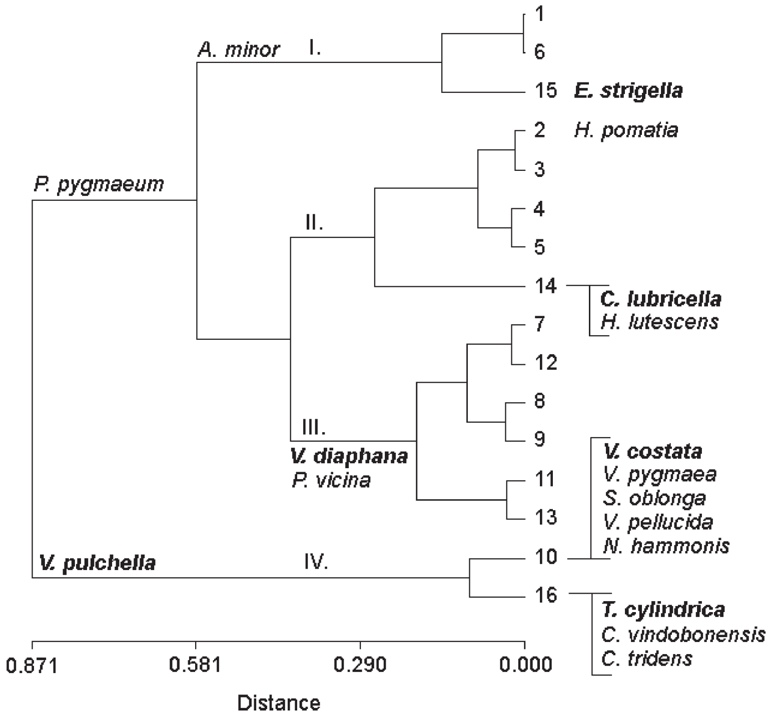

Fig. 2. Cluster analysis of the sampling sites (1-16) and the character species of the main cluster hierarchy. The Bray-Curtis dissimilarity index and Ward-Orlóci fusion method (MISSQ) was applied. Bold letters represent symmetrical character species (IndVal>55%)

The snail assemblages in the ecotons and in the tall grasses are different from that of in the woody habitats. Thus these areas are placed in the very separate group IV. The tall grass (area 10) is located on the hillfoot, where the soil is relatively deep and the rain flowing down from the hilltop. Consequently the area is characterised by humid microclimate. On the contrary, the agrostis grass on the S slope (area 16) is located on the slope so is drier than area 10. The dominant species are the same for each habitats of group IV. In area 10, hygrophilous species (*Succinea oblonga, Nesovitrea hammonis*) and some forest elements were found. Thus this area can serve shelter for forest species in the arid periods. Besides the single occurrence of *Chondrula tridens*, we found several forest-steppe elements (*Euomphalia strigella*, *Cepaea vindobonensis*, *Helix lutescens*) as well in area 16 on the S slope. We can never find such contrasty faunal composition in the woody habitats that are able to maintain stable and humid climate that is essential for land snails. The environmental factors in the tall grass are much more variable.

Connected to the cluster analysis we used the IndVal method to identify species being characteristic to the different levels of the cluster hierarchy. The main character species of the first dichotomy in the cluster have wide geographical range. Woody habitats (I.-II.-III.) have only asymmetrical indicator species, like the hygrophilous sylvicol *Punctum pyg-*

maeum (IndVal=25.64%). The real indicator species of the tall grass habitats of group IV. is *Vallonia pulchella* (IndVal=93.56%) preferring the open and humid area 10 while the meso-xerophilous *Truncatellina cylindrica* (IndVal=64.39%) is the real indicator of the drier area 16.

Concerning woody habitats we found some indicator species reflecting the exposition differences of the habitats. Since the habitats of the southern slope are not placed in the same cluster group, specific indicator species were not found. Although the single habitats have their own symmetrical character species which are all forest-steppe elements: *Euomphalia strigella* (IndVal=77.78%) for the southern shrubs (area 15), *Cochlicopa lubricella* (IndVal=55,91%) for the SE shrubs (area 14). For area 14 is the *Helix lutescens* (IndVal=22.22%) is an asymmetrical indicator species. On the contrary, *Vitrea diaphana* (IndVal=57.69%)is the only symmetrical indicator species for the habitats on the NE slope (group III.). In group III. *Perforatella vicina* (IndVal=35.65%) is an asymmetrical indicator. Both latter species reflect the strong montane influence on the area.

Discussion

The previous multivariate analysis of the Kaszonyi hill (Deli, T. 1996) resulted in a cluster with two main division according to the exposure of the habitats. the present investigations involves more than twice as much habitats and we used quantitative index for the cluster analysis instead of a binary one. Thus recent classification differs from that of the previous. Consequently we can conclude that the composition of the Mollusc assemblages is determined firstly by the vegetation structure (compare Fig. 1 and Table 1) and only secondly by exposure.

According to the field study and literature (Bartha, D. – Gencsi, Z. 1991, Varga-Sipos, J. 1990a, 1990b) the original vegetation of the Kaszonyi hill is oak forest with white lime. So the Mollusc fauna is uniform in its basic feature. The original vegetation is fragmented into a variety of small mosaic parts because of different edaphic causes and different anthro-

Area	Vegetation	Cover	Exposure
1.	Oak forest at the border	Closed	NE
2.	Old shrubs	Transitional	NE
3.	Young shrubs	Transitional	NE
4.	Orchard patches in shrubs	Closed	NE
5.	Rocky grassland	Open	NE
6.	False acacia forest	Closed	NE
7.	White lime forest	Closed	NE
8.	Oak forest above the ravine	Closed	NE
9.	Ravine	Closed	NE
10.	Humid tall grassland	Open	NE
11.	Surrounding of artificial structures	Closed and transitional	NE
12.	Orchard	Closed	NE
13.	Oak forest with maple	Closed	SE
14.	Shrubs (ecoton of area 13)	Transitional	SE
15.	Shrubs	Transitional	S
16.	Dry tall grassland	Open	S

Table 1. Main characteristics of the sampling sites. Fig. 1 shows the location of these areas

Table 2. Two-way indicator table with the distribution of individuals among the sampling sites. Second numbers show the fidelity of the species in a given site (presence per 10 soil samples). The ranks of the column headings correspond to those of Fig. 2. The IndVal column indicates the maximum species indicator value observed in the clustering hierarchy represented by boldfaced numbers in the site columns. The indicator value is boldfaced if IndVal>55%, all the IndVal values are significant at the p<0.05 level

Species	IndVal	Sampling sites															
	(%)	1	6	15	2	3	4	5	14	7	12	8	9	11	13	10	16
Aegopinella minor (Stabile, 1864)	61.73	**24/7**	**33/8**	**10/4**	3/3	20/7	8/5	2/1	2/2	11/6	–	5/3	2/2	1/1	3/1	–	–
Euomphalia strigella (Draparnaud, 1801)	77.78	–	–	**13/7**	–	–	–	–	–	–	–	–	–	–	–	–	–
Punctum pygmaeum (Draparnaud, 1801)	25.64	**4/2**	**13/4**	–	**6/3**	**9/4**	**4/1**	**1/1**	–	**2/1**	**5/3**	**9/5**	–	**26/4**	**4/2**	–	–
Helix pomatia Linnaeus, 1758	40.91	–	–	–	**6/3**	1/1	1/1	–	–	–	–	–	–	–	–	–	–
Balea stabilis (L. Pfeiffer, 1847)	6.78	–	–	–	**1/1**	–	–	1/1	–	–	1/1	–	–	–	–	–	–
Cochlicopa lubricella (Porro, 1838)	55.91	–	–	–	7/3	2/2	4/3	–	**33/7**	–	34/9	1/1	–	–	8/2	2/1	1/1
Helix lutescens Rossmässler, 1837	22.22	–	–	–	–	–	–	–	**2/2**	–	–	–	–	–	–	–	–
Cochlodina laminata (Montagu, 1803)	23.14	–	–	–	**1/1**	–	**5/4**	**1/1**	**3/3**	**15/7**	**13/5**	–	–	**28/4**	–	2/2	–
Acanthinula aculeata (O. F. Müller, 1774)	22.55	–	1/1	1/1	**6/3**	**3/3**	**11/5**	–	**4/3**	–	**14/6**	–	–	**9/4**	–	–	–
Vitrea diaphana (Studer, 1820)	57.69	–	–	–	–	–	–	–	–	**20/7**	**99/10**	**10/3**	**13/5**	**37/5**	–	–	–
Perforatella vicina (Rossmässler, 1842)	35.65	1/1	3/2	–	–	3/3	8/4	–	4/3	**7/6**	**34/9**	**3/2**	**2/2**	**25/4**	**9/5**	4/2	–
Cochlicopa lubrica (O. F. Müller, 1774)	48.81	–	–	–	–	–	–	–	–	–	–	–	2/2	**117/5**	–	–	–
Clausilia pumila C. Pfeiffer, 1828	47.50	–	1/1	–	6/3	7/5	14/8	15/6	–	–	11/7	–	1/1	**44/10**	–	10/3	–
Limacidae	20.00	–	–	–	–	–	–	–	–	–	–	–	–	**3/2**	–	–	–
Vallonia costata (O. F. Müller, 1774)	58.93	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**11/5**	3/2
Vertigo pygmaea (Draparnaud, 1801)	50.33	–	–	–	–	–	–	–	–	6/3	–	–	–	–	–	**18/5**	7/3
Succinea oblonga Draparnaud, 1801	42.86	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**7/3**	–
Vitrina pellucida (O. F. Müller, 1774)	21.36	–	1/1	6/5	–	–	1/1	–	–	4/3	–	1/1	–	11/5	–	**7/4**	–
Nesovitea hammonis (Ström, 1765)	14.29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1/1**	–
Vallonia pulchella (O. F. Müller, 1774)	93.56	–	–	1/1	–	–	–	–	–	–	–	–	–	–	–	**37/6**	**32/9**
Truncatellina cylindrica (Férussac, 1807)	64.39	–	2/2	2/2	1/1	1/1	4/2	–	–	1/1	2/2	–	–	1/1	1/1	–	**35/7**
Cepaea vindobonensis (Férussac, 1821)	34.88	–	–	–	1/1	5/5	–	–	–	–	–	–	–	1/1	–	1/1	**6/5**
Chondrula tridens (O. F. Müller, 1774)	11.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1/1**

pogenic influences. The soils of these mosaics differ in their water holding capacity and carbonate content. This cause differences in the abundances of the Mollusc species. Forest-steppe elements are abundant in S exposure besides forest species, but the forest species are more abundant in NE exposure (Szádok, see Fig. 1).

In Fig 2. we can see the three woody cluster group (I-III.) represented by a forest fauna, but in S and SE exposures forest-steppe elements appear as real indicator species emphasising the differences in exposure.

Areas involved in the rocky grassland reconstruction form a relative distinct group (see area 2-5 in Fig. 2). In average most of the areas can be characterised by forest species. Thus the growing shrub maintain forest fauna in the more or less open habitats too. The cutting off the shrubs will decelerate the further immigration process of the forest species. Since real steppe elements are absent from these areas, the unambiguously positive effect of the cut off on the mollusc fauna is not sure. In our opinion the orchard patches and the encircling econton should be left undestroyed. The close location of these areas enables the immigration of the different mollusc species especially in the rainy periods. Accordingly the original malacofauna will remain and open grass dwelling animal species can inhabit the areas as well.

Összefoglalás

A Beregi-síkságból 100-200 m-re kimagasodó egykori vulkánok csúcsán kialakult növény- és állatvilág a környező síkságétól nagymértékben különbözik. A Beregi-sík hazai oldalán a Kaszonyi-hegy az egyetlen olyan „szigethegy”, ahol eltérő származású és élőhelyigényű fajok unikális jellegű élőlényegyüttesei maradtak fenn az erős emberi bolygatás ellenére.

A Kaszonyi-hegyen kijelölt 16 mintavételi területről 25 faj (ebből 5 újonnan megtalált) 1592 egyede került elő.

A mintavételi területeken feltárt csigaegyütteseket többváltozós statisztikai módszerekkel értékeltük. A klaszteranalízis során a nyílt és a zárt állományok alapvetően elkülönültek. A fő klasztercsoportok szerkezete alapján arra a következtetésre jutottunk, hogy a Kaszonyi-hegy erdei élőhelyein a Mollusca fauna összetételét döntően a növényzeti borítás mértékéből eredő nedvességi viszonyok befolyásolják. A déli és délkeleti kitettségű fás állományok mindegyikében olyan erdőssztyepp fajok élnek, amelyek ugyanakkor az északkeleti oldalról hiányoznak. A klasztercsoportokra elvégzett indikátorfaj-elemzés valódi indikátorokként jelölte meg ezeket az erdőssztyepp fajokat (*Euomphalia strigella, Helix lutescens*), mutatva a déli, délkeleti oldalak ilyen szinten való különállóságát. Az indikátorfaj-elemzés eredményei azt mutatják, hogy az égtáji kitettségből adódó különbségek sem elhanyagolható tényezők a csigaegyüttesek kialakulásában.

A hegy északkeleti oldalán az egykoron kiterjedtebb sziklagyep helyén ma többé-kevésbé összefüggő cserjés található. A HNP-igazgatóság vezetésével 2000. év októberében a cserjés egy részét – a sziklagyep-rekonstrukciós program keretében – leirtották annak érdekében, hogy a sziklagyep-sztyepprét-magaskórós mozaikok – értékes élőlényegyütteseikkel együtt – nagyobb élettérhez juthassanak. A Kaszonyi-hegyen folyó malakológiai kutatás másik igen fontos célja az, hogy a cserjeirtásnak, a malakofaunára és a csigaegyüttesek szerkezetére gyakorolt hatását több éven keresztül figyelemmel kísérjük. Ennek megfelelően a múlt év (2000) őszén a cserjeirtást megelőző állapotfelmérést végeztük el.

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