DOI:10.24394/NatSom.2010.17.7 | Natura Somogyiensis | 17 | 7-14 | Kaposvár, 2010

The rock-heath association *Helleboro odori-Spiraeetum mediae* in the Villány Mts (South Hungary)

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Erdős, L. & Morschhauser, T.: *The rock-heath association Helleboro odori-Spiraeetum mediae in the Villány Mts (South Hungary)*.

Abstract: The rock-heath association *Helleboro odori-Spiraeetum mediae* has not been studied in the Villány Mts so far. In this article, we characterize the stands of the Szársomlyó Mt and compare them to the stands of the Mecsek Mts. In general, the stands are very similar in vegetation structure, ecological indicator spectra and social behaviour type spectra, although there are some differences in species composition.

Keywords: Szársomlyó Mt, long-lived spirea, *Spiraea media* Fr. Schm.

Introduction

The rock-heath association *Waldsteinio-Spiraeetum mediae* has been reported from several points of the North Hungarian Mountain Range (e. g. Zólyomi 1936, Soó 1940, Kovács and Máthé 1964, Vojtkó 1993, 1996, Csiky 1997, Nagy and Zentai 2001) and from the Transdanubian Mountain Range (e. g. Horánszky 1964). Dense stands of the long-lived spirea (*Spiraea media*) were found and studied in the Mecsek Mountains as well (Horvát 1956, Morschhauser 1995). The community of the Mecsek Mts was described as a separate association under the name *Helleboro odori-Spiraeetum mediae* (Borhidi et al. 2003).

The occurence of *Spiraea media* was reported from the Szársomlyó Mt (Villány Mts) by Kitaibel (in Horvát 1942). The species can not be found elsewhere in the Villány Mts (cf. Dénes 2000). Horvát (1956) stated that rock-heath stands of the *Spiraea media* occur on the Szársomlyó Mt. However, these stands have never been studied so far. Borhidi (2003) does not even mention this association from the Villány Mts. Dénes (2000) lists the plant associations of the Villány Mts, but the community *Helleboro odori-Spiraeetum mediae* is lacking from the list.

Our aim was to characterize the *Helleboro odori-Spiraeetum mediae* of the Szársomlyó Mt. We also wanted to give the main differences between the stands of the Szársomlyó Mt and the Mecsek Mts.

ISSN 1587-1908 (Print); ISSN 2062-9990 (Online)

Material and methods

The study area is the Szársomlyó Mt, situated in South Hungary, in the Eastern part of the Villány Mts. The bedrock consists of limestone (LOVÁSZ 1977). Mean annual temperature is 10-10,5 °C. The coldest month is January, the hottest July (FODOR 1977). Mean annual precipitation is 670-690 mm (AMBRÓZY and KOZMA 1990). Because of the east-west direction of the ridge, microclimates of the southern and of the northern slopes are quite different, the northern slopes being considerably cooler and wetter (HORVÁT and PAPP 1964). The Szársomlyó Mt belongs to the phytogeographic province Pannonicum, region Praeillyricum, district Sopianicum (BORHIDI and SÁNTA 1999, BORHIDI 2003).

Coenological relevés were made in 8 m × 8 m and in 6 m × 10 m plots (6 m × 10 m plot size was necessary because of the elongated form of the Spiraea patches). Percentage cover of all vascular species was estimated in July 2009 and in April 2010.

The relevés of the Szársomlyó Mt were compared to the relevés of the Mecsek Mts. In the case of the Mecsek Mts, we used the data published by BORHIDI et al. (2003). For the classification, the program package SYN-TAX 2000 was applied (PODANI 2001). In this analysis, we used presence-absence data. As dissimilarity function, Baroni-Urbani-Buser index was applied.

We were also interested in species which are typical only of the Mecsek or of the Szársomlyó. For this purpose, we used fidelity values calculated by the program JUICE 7.0 (TICHÝ 2002). The phi-coefficient was computed, since it is an appropriate measure of fidelity (TICHÝ and CHYTRÝ 2006). Species with high phi-values occur significantly ($p<0,01$) more frequently in the stand of the Mecsek or of the Szársomlyó. Fisher's exact test was made to exclude non-significant differences.

In order to characterize the ecological features of the community, we used the relative ecological indicator values of Ellenberg extended for the Carpathian basin by BORHIDI (1993, 1995). Characterization of the vegetation was carried out by using the social behaviour types (SBT) of BORHIDI (1993, 1995). In both cases calculation was done by frequency and cover data as well.

Plant species names are used according to SIMON (2000), and plant community names according to BORHIDI (2003).

Results

The stands of the *Helleboro odoro-Spiraeetum mediae* can be found on the northern side of the Szársomlyó Mt, west from the top. Declination is between 30 and 40º. The bedrock is limestone, that is covered by a rendzina soil. The community forms a mosaic with the karst shrubforest *Inulo spiraeifoliae-Quercetum pubescentis* and the closed rock sward *Inulo spiraeifoliae-Brometum pannonici*. Sometimes the stands of the *Helleboro odori-Spiraeetum mediae* form an edge of the karst shrubforest.

In the five relevés (Table 1), we found a total of 99 species, 13 of which are protected. Compared to the Mecsek Mts, these stands are much more species rich; average species number of the plots is 63 in the case of the Szársomlyó, and only 44.5 in the case of the Mecsek. In the shrub layer, *Spiraea media* forms a dense stand. Other shrubs are relatively sparse; the most abundant among them is *Cornus mas*. There are also some low trees spreading over the shrub layer from the neighbouring shrubforests. We found only

one liana, *Tamus communis* in our relevés. In the herb layer, species of mesophilous forests (e. g. *Anemone ranunculoides, Corydalis cava, Corydalis solida, Lilium matagon, Ranunculus ficaria*) occur under the thick shrubs, whereas xerophilous species live in the contact zone to the closed rock sward (e. g. *Asplenium javorkeanum, Bromus pannonicus, Festuca rupicola, Teucrium chamaedrys*). There are typical edge-species, such as *Geranium sanguineum*, but one of the most characteristic edge-species of the shrub-forests, *Artemisia alba* is lacking from here. The *Spiraea*-stands are resting-places of wild animals, that contributes to the high diversity of the association, due to the local disturbances. This fact is pointed out by the great amount of the weeds and disturbance-tolerants.

Table 1: Coenological relevés of the association *Helleboro odori-Spiraeetum mediae* of the Szársomlyó Mt.

		1	2	3	4	5	A-D	K%
Exposition		N	N	N	N	NW		
Declination (°)		35	33	33	38	32		
Height a. s. l. (m)		401	397	404	411	405		
Canopy cover (%)		25	10	20	15	15		
Canopy height (m)		3	4	4	4	5		
Shrub layer cover (%)		90	92	90	90	92		
Shrub layer height (m)		2	1.5	1.5	1.7	2		
Herb layer cover (%)		30	45	30	35	35		
Herb layer height (m)		1	1.2	0.8	1.2	0.8		
Character and differential species								
Spiraea media	B	75	85	85	75	80	75-85	100
Spiraea media	C	10	10	10	8	10	8-10	100
Helleborus odorus	C	2	2.5	1	2	4	1-4	100
Aconitum anthora	C	0.1	0.1	0.1	0.1	0	0.1	80
Galium lucidum	C	0	0.1	0.1	0	0.1	0.1	60
Tamus communis	B	0	0	0	0	0.2	0.2	20
Tamus communis	C	0	0	0	0	0.1	0.1	20
Festuco-Brometea species								
Asplenium trichomanes	C	0.2	0.2	0.1	0.1	0.1	0,1-0,2	100
Bromus pannonicus	C	3	0.5	0.5	0.5	0.5	0,5-3	100
Festuca rupicola	C	0.5	0.1	4	0.5	3	0,1-4	100
Filipendula vulgaris	C	2	0.5	2	0.1	2	0,1-2	100
Geranium sanguineum	C	3	2.5	3	1.5	0.1	0,1-3	100
Asplenium javorkeanum	C	0.1	0.2	0.1	0	0.1	0,1-0,2	80
Teucrium chamaedrys	C	0.1	0.1	0.5	0	0.2	0,1-0,5	80
Thymus odoratissimus	C	1	0.1	0	0.1	0.1	0,1-1	80
Verbascum phoeniceum	C	0.1	0.1	0.2	0	0.1	0,1-0,2	80
Koeleria majoriflora	C	0	0.2	0.1	0.2	0	0,1-0,2	60
Pseudolysimachion spicatum	C	0.1	0.1	0	0	0.1	0.1	60
Anthericum ramosum	C	0.1	0	0.1	0	0	0.1	40
Elymus hispidus	C	0	0	0.1	0	0.1	0.1	40
Orlaya grandiflora	C	0.1	0	0	0	0.1	0.1	40
Chamaecytisus ratisbonensis	C	0	0	0	0	0.1	0.1	20
Dianthus giganteiformis ssp. pontederae	C	0.1	0	0	0	0	0.1	20
Helianthemum ovatum	C	0	0.1	0	0	0	0.1	20
Hesperis tristis	C	0	0	0.1	0	0	0.1	20
Koeleria cristata	C	0.1	0	0	0	0	0.1	20
Lathyrus sphaericus	C	0	0	0	0	0.1	0.1	20
Potentilla recta	C	0	0.1	0	0	0	0.1	20
Ranunculus illyricus	C	0	0.1	0	0	0	0.1	20
Stachys recta	C	0	0.1	0	0	0	0.1	20

Table 1. continued:

		1	2	3	4	5	A-D	K%
Querco-Fagetea species								
Cornus mas	A	1	3	0,5	2	0	0,5-3	80
Cornus mas	B	8	1	2	3	0,1	0,1-8	100
Cornus mas	C	0,1	0	0	0,1	0	0,1	40
Corydalis solida	C	0,1	0,1	0,1	0,1	0,1	0,1	100
Fraxinus ornus	A	25	7	20	10	12	7-20	100
Fraxinus ornus	B	4	4	5	0,5	1	0,5-5	100
Fraxinus ornus	C	0,1	0,1	0	0	0,1	0,1	60
Iris variegata	C	1	2	2,5	0,5	2,5	0,5-2,5	100
Scilla vindobonensis	C	0,1	1	0,5	0,2	0,1	0,1-1	100
Sedum telephium ssp. maximum	C	0,1	0,1	0,1	0,1	0,1	0,1	100
Silene viridiflora	C	0,1	0,2	0,1	0,1	0,1	0,1-0,2	100
Symphytum tuberosum ssp. nodosum	C	0,1	0,1	0,1	0,1	0,1	0,1	100
Arum maculatum	C	0,1	0	0,1	0,1	0,1	0,1	80
Campanula persicifolia	C	0	0,1	0,1	0,1	0,1	0,1	80
Euonymus verrucosus	B	1,5	1	0	0,5	7	0,5-7	80
Euonymus verrucosus	C	0,1	0,1	0	0	0,2	0,1-0,2	60
Euphorbia epithymoides	C	0	0,1	0,1	0,2	0,1	0,1-0,2	80
Moehringia trinervia	C	0	0,1	0,1	0,1	0,1	0,1	80
Viola odorata	C	0,1	0,5	0	0,1	1	0,1-1	80
Arabis glabra	C	0,1	0,1	0	0	0,1	0,1	60
Corydalis cava	C	0	6	0,1	0,1	0	0,1-6	60
Digitalis grandiflora	C	0	0,2	0,2	0,2	0	0,2	60
Gagea pratensis	C	0	0,1	0,1	0	0,1	0,1	60
Lilium martagon	C	0,1	0	0	0,2	0,1	0,1-0,2	60
Polygonatum odoratum	C	0,1	0,1	0	0	0,1	0,1	60
Quercus pubescens agg.	A	0	0,5	1,5	0	3	0,5-1,5	60
Quercus pubescens agg.	B	1	0	0,5	0,1	0	0,1-1	60
Quercus pubescens agg.	C	0	0	0,1	0	0	0,1	20
Ranunculus ficaria	C	0	0,1	0	0,2	0,1	0,1-0,2	60
Anemone ranunculoides	C	0,1	0,2	0	0	0	0,1-0,2	40
Melica uniflora	C	0	0,5	0	0,1	0	0,1-0,5	40
Muscari botryoides	C	0	0	0	0,1	0,1	0,1	40
Tanacetum corymbosum	C	0	0	0,1	0	0,1	0,1	40
Tilia tomentosa	C	0	0,1	0	0,1	0	0,1	40
Acer platanoides	C	0	0,1	0	0	0	0,1	20
Arum orientale	C	0	0	0	0	0,2	0,2	20
Galanthus nivalis	C	0	0,1	0	0	0	0,1	20
Glechoma hirsuta	C	0,1	0	0	0	0	0,1	20
Inula spiraeifolia	C	0	0	0,5	0	0	0,5	20
Ligustrum vulgare	C	0	0	0	0	0,1	0,1	20
Rosa arvensis	C	0	0	0	0	0,1	0,1	20
Trifolium alpestre	C	0	0	0,1	0	0	0,1	20
Chenopodietea + Secalietea + Artemisietea species								
Anthriscus cerefolium	C	0,1	2	0,1	0,2	0,1	0,1-2	100
Geranium robertianum	C	0,1	2,5	0,1	0,5	0,1	0,1-2,5	100
Lamium purpureum	C	0,1	0,1	0,1	0,1	0,1	0,1	100
Veronica hederifolia	C	2	4	0,5	4	2	0,5-4	100
Viola arvensis	C	0	0,1	0,1	0,1	0,1	0,1	80
Fallopia dumetorum	C	0	0	0,2	0,2	0,1	0,1-0,2	60
Geranium columbinum	C	0	0,1	0,1	0	0,1	0,1	60
Chenopodium album	C	0	0,1	0	0,1	0	0,1	40
Chelidonium majus	C	0	0	0	0,1	0	0,1	20

Table 1. continued:

		1	2	3	4	5	A-D	K%
Indifferent species								
Alliaria petiolata	C	0,1	0,1	0,1	1	0,1	0,1-1	100
Cystopteris fragilis	C	0,5	0,2	0,2	0,5	0,2	0,2-0,5	100
Dactylis glomerata agg.	C	0,1	1	0,1	2	0,1	0,1-2	100
Fallopia convolvulus	C	0,1	0,5	0,1	0,1	0,1	0,1-0,5	100
Galium aparine	C	0,1	0,5	0,1	0,1	0,2	0,1-0,5	100
Stellaria media	C	0,1	0,1	0,1	0,1	0,1	0,1	100
Thlaspi perfoliatum	C	0,1	0,1	0,1	0,1	0,1	0,1	100
Valerianella locusta	C	0,1	0,1	0,1	0,1	0,1	0,1	100
Ajuga genevensis	C	0,1	0,1	0	0,1	0,1	0,1	80
Hypericum perforatum	C	0,1	0,1	0,1	0	0,1	0,1	80
Brachypodium sylvaticum	C	0	2	0,1	0	0,5	0,1-2	60
Veronica chamaedrys	C	0,1	0,1	0,1	0	0	0,1	60
Bromus sterilis	C	0	0,1	0	0	0,1	0,1	40
Euphorbia cyparissias	C	0,1	0	0,1	0	0	0,1	40
Poa angustifolia	C	0,1	0	0,1	0	0	0,1	40
Vicia hirsuta	C	0	0,1	0	0,1	0	0,1	40
Eryngium campestre	C	0	0	0,1	0	0	0,1	20
Taraxacum officinale	C	0	0,1	0	0	0	0,1	20
Vicia angustifolia	C	0	0,1	0	0	0	0,1	20
Other species								
Cerastium brachypetalum	C	0,1	0,1	0,1	0,1	0,1	0,1	100
Geum urbanum	C	0,5	6	0,5	8	3	0,5-8	100
Polypodium vulgare	C	0,2	0,1	0,2	0,2	0,1	0,1-0,3	100
Myosotis stricta	C	0,1	0,1	0,1	0	0,1	0,1	80
Rosa canina	A	2	0	0	4	0,5	0,5-4	60
Rosa canina	B	1	0,5	0	10	5	0,5-10	80
Arrhenatherum elatius	C	0	2	0,1	0	0,1	0,1-2	60
Myosotis ramosissima	C	0	0,1	0,1	0,1	0	0,1	60
Saxifraga bulbifera	C	0	0	0,1	0	0	0,1	20

On the dendrogram (Fig. 1), relevés of the Szársomlyó Mt form a discrete cluster, because of the somewhat different species composition. The significant ($p<0,01$) differential species are listed in Table 2. The most important is *Waldsteinia geoides*, a character species of the alliance *Spiraeion mediae*, which is constant in the stands of the Mecsek Mts, but is completely absent from the stands of the Szársomlyó Mt (*Waldsteinia geoides* does not live in the Villány Mts). An other considerable difference is that ferns (*Cystopteris fragilis, Asplenium javorkeanum, Asplenium trichomanes*) are more common in the case of the Szársomlyó.

The spectra of the social behaviour types (Fig. 2.) is nearly the same as on the Mecsek (cf. BORHIDI et al. 2003). Considering presence-absence data, generalist species are the most frequent (41.14%), while disturbance tolerants have the second greatest participation (23.42%). The proportion of weeds is 9.49%, while 6.33% of the species are specialists. Considering abundance data, proportion of competitor species is the greatest (78.66%). Generalists have a proportion of 10.44%, and disturbance tolerants 7.68%.

Compared to the stands of the Mecsek Mts, there are no considerable differences in the spectra of the ecological indicator values. The spectra of the temperature values expand from T5 to T9, having a peak at T5 in the case of presence-absence data, and at T6 in the case of abundance data. The values of the water spectra vary from W1 to W7,

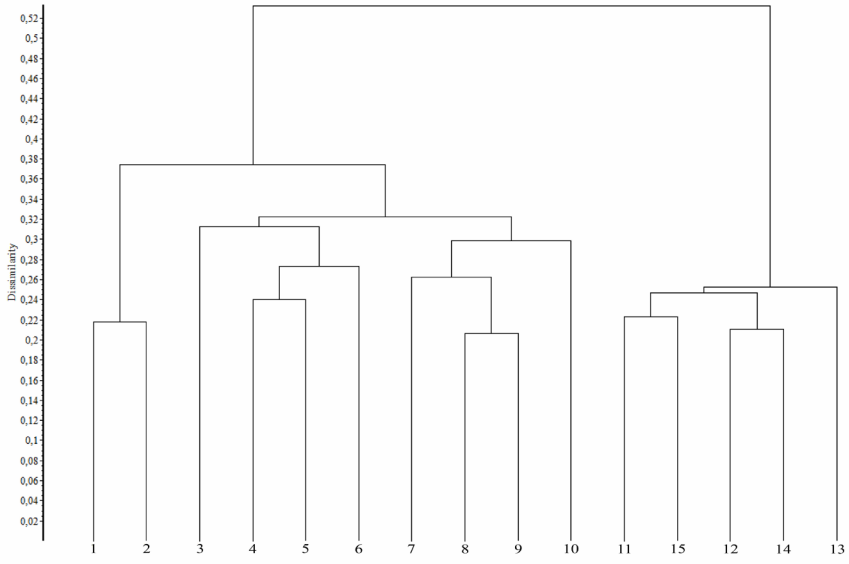

Fig. 1: Dendrogram of the relevés made in the association *Helleboro odori-Spiraeetum mediae*. Relevés 1-10 were made on the Mecsek Mts, whereas relevés 11-15 on the Szársomlyó Mt.

Table 2: Phidelity values multiplied by 100

	Mecsek	Szársomlyó
Stellaria holostea	100	---
Securigera varia	100	---
Waldsteinia geoides	100	---
Lamium maculatum	94,3	---
Arabis turrita	94,3	---
Erysimum odoratum	88,5	---
Symphytum tuberosum	---	100
Lamium purpureum	---	100
Anthriscus cerefolium	---	100
Cystopteris fragilis	---	100
Thlaspi perfoliatum	---	100
Silene viridiflora	---	100
Scilla vindobonensis	---	100
Asplenium javorkeanum	---	88,5
Moehringia trinervia	---	88,5
Verbascum phoeniceum	---	88,5
Myosotis stricta	---	88,5
Ajuga genevensis	---	88,5
Corydalis solida	---	68,8
Asplenium trichomanes	---	53,5
Valerianella locusta	---	53,5
Iris variegata	---	53,5
Stellaria media	---	53,5

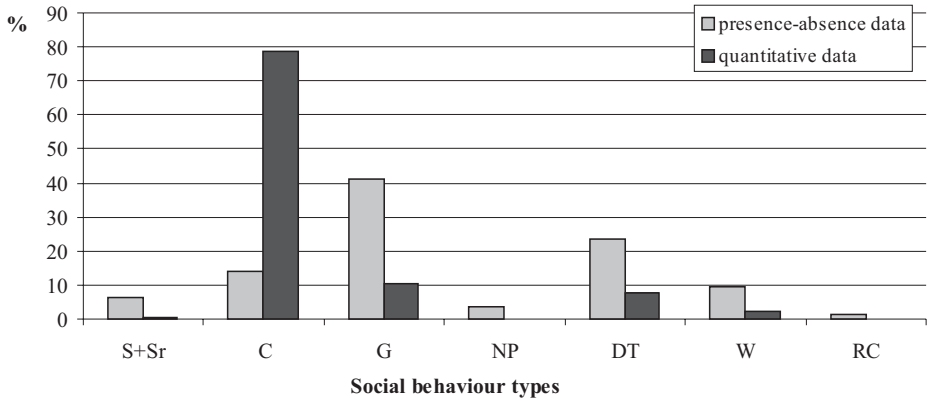

Fig. 2: Spectra of the social behaviour types based on presence-absence data and on quantitative data

with maxima at W3 in the case of frequency and cover data as well. In the case of the soil reaction values, basifrequent (R7) plants are dominating. Considering the relative nutrient values, the most frequent categories are N2, N3 and N4 in the case of presence-absence data. However, in the case of abundance data, the category N5 is by far the most considerable, because of the great cover values of the *Spiraea media*, an N5 plant. The peak of the relative light values is at L7 in both cases. The continentality spectra has its maximum at the categories K3 and K4 in the case of the frequency data. In contrast, proportion of K7 values is the greatest if cover values are taken into account; this is due to the dominance of the K7 species *Spiraea media*.

Discussion

We analysed the rock-heath association *Helleboro odori-Spiraeetum mediae* of the Szársomlyó Mt (Villány Mts). We compared this stand to the stands of the Mecsek Mts. Habitat conditions, structural characteristics as well as the spectra of the social behaviour types and of the ecological indicator values are very similar. Therefore, it is unambiguous, that the stands of the two mountains belong to the same association. However, there are certain differences in species composition and the community is much more species rich on the Szársomlyó. There are some species in the *Spiraea*-stands of the Szársomlyó Mt (e. g. *Ajuga genevensis, Anemone ranunculoides, Cystopteris fragilis*) that are lacking from the Mecsek, but are characteristic of the North Hungarian Mountain Range. Another important difference is, that in the Mecsek Mts *Helleboro odori-Spiraeetum mediae* stands are in contact with the top-forest *Aconito anthorae-Fraxinetum orni*. In contrast, on the Szársomlyó Mt the two communities are further away.

Acknowledgement

We are thankful to the Inspectorate for Environment, Nature and Water for allowing us to carry out these studies in the strictly protected nature reserve of the Szársomlyó Mt. We are also indebted to Zoltán Bátori for his help in preparing the manuscript.

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