

A NEW ROCK-HEATH ASSOCIATION IN THE MECSEK MTS (SOUTH HUNGARY)

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A new rock-heath association (*Helleboro odori-Spiraeetum mediae* Borhidi, Morschhauser et Salamon-Albert ass. nova) was recently discovered in Central Mecsek Mts which is described and discussed by the authors in the article. It represents a special skirt vegetation developing in contact with the chestnut oakwood on the edge of rocky ridges. It differs from the subcontinental rock-heath (*Waldsteinio-Spiraeetum mediae* Zólyomi 1936) living in the North Hungarian Middle Range by having a set of Balcanian, Pontic and sub-Mediterranean species occurring in both the shrub and herb layers. Higher indicator values of certain ecological factors, like temperature (T) and soil reaction (R) are indicating the special basiphilous and warm character of the habitat of the new community. SBT-spectrum shows the well-balanced state, the average values of VAL indicate the natural state of the community.

Key words: ecological indicators, *Helleboro odori-Spiraeetum mediae*, phytosociological characters, rock-heath association, social behaviour types (SBT)

INTRODUCTION

A characteristic rock-heath community was described from the Bükk Mts under the name *Waldsteinio-Spiraeetum mediae* (Zólyomi 1936) and later detected and analysed by several authors in other hilly and mountainous areas of the North Hungarian Middle Range (Soó 1937, Jakucs 1961, Horánszky 1964, Kovács and Máthé 1964, Szujkó-Lacza 1964, Simon 1977, Vojtkó 1996, Csiky 2002). This community lives on both calcareous (limestone) and neutral to slightly acidic volcanic bedrocks (andesite, gabbro) in the skirts of rock-forest (*Tilio platyphyllae-Fraxinetum excelsioris*) and the scree-forest (*Mercuriali-Tilietum*) or forming a mosaic pattern with them. It occurs in higher altitudes on the southern slopes (450–650 m) and much lower on northern ones (200–350 m) always on exposed rocky ridges and peaks. It is a 100–150 cm tall dense scrub dominated by the Long-lived Spirea (*Spiraea media*) associated with thermo- and xerophilous shrubs and herbs of thermophilous continental grasslands, woodlands and rock forests. Characteristic species are Cornelian Cherry

(*Cornus mas*), Mealy Goulder Rose (*Viburnum lantana*), wild Rose species (*Rosa* spp.) in the shrub layer, and *Waldsteinia geoides*, *Aconitum anthora*, *Geranium sanguineum*, *Iris variegata*, *Vincetoxicum hirundinaria*, *Teucrium chamaedrys* in the herb layer. Because of the erosion or natural opening of canopy this vegetation lives in a persistent dynamical fluctuation with the mosaic of rock-forest communities. Its most important stands are in the North Hungarian Middle Range (Börzsöny, Karancs, Mátra, Bükk, Zemplén Mts) and in the Middle-Danube region (Naszály, Pilis, Visegrád Mts). The stands developed in the different mountains are not completely consistent from ecological point of view.

While the classical stands in the Bükk and Mátra Mts grow in xerotherm habitats, the stands in the Zemplén Mts show a more mesotherm character with dominance of brown mosses in moss layer.

Occurrence of *Spiraea media* and *Waldsteinia geoides* was detected on rocky ridges of Mecsek Mts but it was not identified as a distinct plant community (Horvát 1972). In the last years several stands of a different vegetation unit growing in the Central Mecsek Mts has been studied (Morschhauser 1995, Morschhauser and Salamon-Albert 1995, Salamon-Albert 1996) and recognised as a new association as *Helleboro odori-Spiraetum mediae* ass. nova. The characteristics of the new community were published first in the Red data book of the Hungarian plant communities (Borhidi and Sánta 1999) but without type relevé or phytosociological table. The first legal and authentic description and documentation of the association (according the rules of the syntaxonomic nomenclature) is published in this article below.

MATERIAL AND METHODS

Our aim is to describe and characterise the new association from phytosociological and ecological point of view comparing it with the subcontinental rock-thicket (*Waldsteinio-Spiraetum mediae* Zólyomi 1936).

The study area is situated in the middle of Mecsek Mts, southern part of Hungary above the city of Pécs forming a part of the green belt. The Misina–Tubes range has a wide ridge in NW–SE position on which the Triassic limestone bedrock presents a habitat favourable for the development of a rock-thicket vegetation with sub-Mediterranean character.

Between 1993–1999 coenological behaviour was examined on classical scale. Field data were collected by modified Zürich-Montpellier phytosociological method with 8 m × 8 m quadrat size made by A. Borhidi (B51–55), T. Morschhauser and É. Salamon-Albert (M182–184, 228–229). Frequency and cover data of canopy, shrub, herb and moss layer species were registered. The samples are displaying in coenological tables. Species are listed according the

main phytosociological groups and constancy values. The samples were also analysed for the ecological content of the community using the Ellenberg's ecological indicator values extended for the Hungarian flora (T, W, R, N, C, L) and social behaviour types (SBT) (Borhidi 1995) considering frequency and quantitative data.

RESULTS

Species composition and phytosociological characterisation

The *Helleboro odori-Spiraeetum mediae* is an edaphic plant community. Its stands are found in extrazonal situation, on the path of rocky ridges or on cliffs in northern or northeastern exposition connected into the zonal woodland of the chestnut oak (*Tamo-Quercus virgiliana*e Borhidi et Morschhauser) between 450 and 600 m. The bedrock is Triassic limestone covered by a shallow, humic rendzina soil. It is a dense and low shrub community with height of 1–1.5 m in the open plots of the shrub-forest (*Inulo spiraeifoliae-Quercetum pubescentis*), and top forest (*Aconito anthorae-Fraxinetum orni*) or at the forest-grassland ecotone as a skirt vegetation. There are brown mosses with cover of 5–15% on the shaded rocky surfaces under the shrubs (Table 1).

In contrast, the occurrence of *Waldsteinio-Spiraeetum mediae* is rarely on limestone, frequently on andezite. Its stands are on exposed rocky ridges in the belts of Sessile oak-Turkey oakwood, oak-hornbeam wood and beechwood at an altitude between 450 and 750 m.

As for the composition of *Helleboro odori-Spiraeetum* besides the dominant Long-lived Spirea (*Spiraea media*) the relative number of other shrub species is few. These species are the shrubby forms of the neighbouring rock- and shrubwoods like Flowering Ash (*Fraxinus ornus*), White-haired Oak (*Quercus pubescens*), Hungarian Silver Lime (*Tilia tomentosa*) and Mealy Goulder Rose (*Viburnum lantana*).

Contrarily the shrub layer of *Waldsteinio-Spiraeetum mediae* includes many continental and Pannonian elements which are constant and dominant (e.g. *Cornus mas*, *Crataegus monogyna*, *C. laevigata*, *Ligustrum vulgare*, *Cotoneaster matrensis*, *C. niger*).

The thick herb layer shows a complex coenological character with the species of wood skirts (Trifolio-Geranietea) containing *Geranium sanguineum*, *Securigera varia*, *Dictamnus albus*, *Filipendula vulgaris*, species of dry rocky grasses (Festuco-Brometea) like *Festuca rupicola*, *Helianthemum ovatum*, *Bromus pannonicus*, *Anthericum ramosum*, *Allium flavum*, *Jovibarba hirta*. Among them mesophilous plant species (Fagetalia, Querco-Fagetea) are infiltrated from the

Table 1
Helieboro odori-Spiraeetum mediae Borhidi, Morschhauser et Salamon-Albert, ass. nova

Serial numbers of relevés	1		2		3		4		5		6		7		8		9		10		K%	
	B55	M	B51	M	B52	M	B53	M	B54	M	B55	M	B56	M	B57	M	B58	M	B59	M	B60	M
Exposition		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	N
Declination	35	30	25	25	5	5	20	10	10	10	20	25	30	30	20	20	45.0	6.0	30	30	6.0	2
Canopy, cover %		A																				
Canopy, height (m)		0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	4.0	4.0	4.0	4.0	4.0	6.0	6.0	90.0	75.0	8.0	8.0	0.0	0.0
Shrub layer, cover %		B																				
Shrub layer, height (m)		1.5	4.0	1.5	2.0	2.0	1.5	2.5	2.5	4.0	4.0	4.0	4.0	4.0	1.5	1.5	3.0	3.0	3.0	2.5	2.5	2.5
Herb layer, cover %		C																				
Herb layer, height (cm)		60.0	95.0	80.0	30.0	30.0	60.0	60.0	100	60.0	60.0	40.0	40.0	40.0	40.0	40.0	100	100	45.0	45.0	100	100
Moss layer, cover		D																				
		0.5	0.1	10.0	16.0	16.0	10.0	15.0	15.0	5.0	5.0	5.0	5.0	5.0	1.0	1.0	0.1	0.1	0.1	0.1	0.1	0.1
Character and differential species																						
<i>Spiraea media</i>		B																				
		90.0	60.0	50.0	80.0	80.0	55.0	40.0	40.0	68.0	89.0	70.0	70.0	40.0	40.0	100	100	100	100	100	100	100
<i>Spiraea media</i>		C																				
		0.1	5.0	0.1	0.5	5.0	5.0	1.0	1.0	5.0	5.0	5.0	5.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
<i>Waldsteinia geoides</i>		C																				
		1.0	1.0	1.0	1.0	1.0	2.0	5.0	5.0	5.0	5.0	5.0	5.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
<i>Galium lucidum</i>		C																				
		1.0	1.0	10.0	2.0	2.0	5.0	2.0	2.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
<i>Aconitum anthora</i>		C																				
		1.0	0.1	0.1	0.1	0.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
<i>Centaurea axillaris</i> subsp. <i>stricta</i>		C																				
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<i>Tamus communis</i>		C																				
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<i>Mercurialis ovata</i>		C																				
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<i>Inula spiraeifolia</i>		C																				
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<i>Doronicum hungaricum</i>		C																				
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<i>Doronicum orientale</i>		C																				
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Quercetea pubescentis-petraeae species																						
<i>Fraxinus ornus</i>		A																				
		10.0	20.0	5.0	0.1	0.1	10.0	0.1	0.1	30.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
<i>Quercus pubescens</i> agg.		B																				
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		C																				
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		A																				
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		B																				
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		C																				
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Table 1 (continued)

<i>Cornus mas</i>	B	0.1	3.0	5.0	0.1	0.1	0.5	-	-	1.5	6.0	80
<i>Euonymus verrucosus</i>	B	0.1	-	-	-	0.1	0.1	-	-	3.0	-	40
<i>Prunus spinosa</i>	B	0.1	-	-	0.1	-	-	-	-	15.0	1.0	40
<i>Rosa canina</i>	B	5.0	-	-	-	0.1	-	2.0	-	-	-	30
<i>Viburnum lantana</i>	B	-	-	-	1-	0.1	0.1	-	-	-	-	30
<i>Rosa gallica</i>	B	5.0	10.0	-	-	-	-	-	-	-	-	20
<i>Quercus cerris</i>	B	-	-	-	0.1	-	-	-	-	-	-	10
<i>Geranium sanguineum</i>	C	30.0	20.0	40.0	15.0	40.0	60.0	20.0	3.0	5.0	1.0	100
<i>Arabis turrita</i>	C	0.1	8.0	0.1	0.1	-	1.0	2.0	1.0	2.0	0.1	90
<i>Erysimum odoratum</i>	C	0.1	0.1	-	0.1	0.1	0.1	0.1	0.1	-	0.1	80
<i>Dictamnus albus</i>	C	0.1	1.0	0.1	0.1	-	-	-	1.0	2.0	1.0	70
<i>Vincetoxicum hirundinaria</i>	C	0.1	1.0	1.0	1.0	5.0	-	-	0.1	-	0.1	70
<i>Trifolium alpestre</i>	C	0.1	0.1	-	0.1	1.0	0.1	-	-	-	0.1	60
<i>Euphorbia epithymoides</i>	C	0.1	-	0.1	0.1	0.1	-	-	-	-	-	40
<i>Valeriana collina</i>	C	-	-	1.0	-	0.1	5.0	0.1	-	-	-	40
<i>Campanula persicifolia</i>	C	-	-	-	-	0.1	1.0	0.1	-	-	-	30
<i>Lactuca quercina</i> subsp. <i>sagittata</i>	C	-	-	-	-	0.1	1.0	0.1	0.1	-	0.1	30
<i>Polygonatum odoratum</i>	C	0.1	0.1	-	-	-	-	-	-	0.1	-	30
<i>Potentilla adscendens</i>	C	-	-	-	0.1	1.0	0.1	-	-	-	-	30
<i>Potentilla heptaphylla</i>	C	-	-	-	-	-	-	1.0	0.1	0.1	-	30
<i>Euphorbia dulcis</i>	C	-	0.1	-	-	-	-	0.1	-	-	-	20
<i>Iris variegata</i>	C	1.0	0.1	-	-	-	-	-	-	-	-	20
<i>Laser trilobum</i>	C	0.1	2.0	-	-	-	-	-	-	-	-	20
<i>Potentilla recta</i>	C	0.1	-	-	-	-	0.1	-	-	-	-	20
<i>Brachypodium pinnatum</i>	C	-	-	-	5.0	-	-	-	-	-	-	10
<i>Calamintha clinopodium</i>	C	-	-	-	-	-	-	-	-	-	0.1	10
<i>Chrysanthemum corymbosum</i>	C	-	-	-	-	0.1	-	-	-	-	-	10
<i>Lycinis coronaria</i>	C	0.1	-	-	-	-	-	-	-	-	-	10
<i>Silene italica</i> subsp. <i>memoralis</i>	C	-	-	-	-	-	0.1	-	-	-	-	10
Festuco-Brometea species												
<i>Securigera varia</i>	C	1.0	0.1	10.0	1.0	2.0	10.0	0.1	1.0	0.1	5.0	100
<i>Anthericum ramosum</i>	C	0.1	-	0.1	0.1	1.0	5.0	0.1	0.1	0.1	-	80
<i>Bromus pannonicus</i>	C	5.0	0.1	10.0	10.0	10.0	10.0	2.0	-	0.1	-	80
<i>Filipendula vulgaris</i>	C	-	0.1	-	1.0	0.1	5.0	2.0	0.5	0.5	0.1	80

Table 1 (continued)

<i>Festuca rupicola</i>	C	1.0	1.0	-	1.0	0.1	-	25.0	-	2.0	0.1	70
<i>Fragaria moschata</i>	C	-	-	-	1.0	2.0	10.0	1.0	2.0	1.0	1.0	70
<i>Allium flavum</i>	C	0.1	0.1	-	0.1	-	0.1	0.1	-	0.1	-	60
<i>Cardaminopsis arenosa</i>	C	-	-	-	0.1	0.1	0.1	0.1	0.1	0.1	-	60
<i>Teucrium chamaedrys</i>	C	-	-	1.0	-	-	0.1	0.1	0.1	-	-	40
<i>Muscari racemosum</i>	C	0.1	0.1	-	-	-	-	-	0.1	-	-	30
<i>Phleum phleoides</i>	C	-	0.1	-	-	0.1	-	-	-	-	0.1	30
<i>Stachys recta</i>	C	1.0	0.1	-	-	-	0.1	-	-	-	-	30
<i>Adonis vernalis</i>	C	-	-	-	0.1	-	-	0.1	-	-	-	20
<i>Helianthemum ovatum</i>	C	-	-	-	-	-	5.0	0.5	-	-	-	20
<i>Melica ciliata</i>	C	-	-	0.1	0.2	-	-	-	-	-	-	20
<i>Allium montanum</i>	C	-	0.1	-	-	-	-	-	-	-	-	10
<i>Potentilla arenaria</i>	C	-	0.1	-	-	-	-	-	-	-	-	10
<i>Ranunculus illyricus</i>	C	-	-	-	-	-	-	-	-	-	-	10
<i>Thymus glabrescens</i>	C	-	-	-	-	-	-	0.1	-	-	-	10
Fagetalia + Quercus-Fagetia species												
<i>Ligustrum vulgare</i>	B	0.1	3.0	-	0.1	0.1	10.0	-	-	4.0	-	60
<i>Melica uniflora</i>	C	2.0	2.0	15.0	0.5	5.0	10.0	8.0	10.0	5.0	5.0	100
<i>Sedum maximum</i>	C	0.1	0.1	0.1	1.0	1.0	1.0	0.5	0.1	0.1	0.1	100
<i>Stellaria holostea</i>	C	5.0	1.0	2.0	0.1	1.0	1.0	1.0	0.1	1.0	5.0	100
<i>Geum urbanum</i>	C	5.0	1.0	0.1	0.1	0.1	-	1.0	0.1	0.1	1.0	90
<i>Lamium maculatum</i>	C	1.0	-	1.0	0.1	1.0	0.1	0.1	0.1	0.1	0.1	90
<i>Fallopia concolvtulus</i>	C	0.1	-	0.1	0.1	0.1	-	0.1	0.1	0.1	0.5	80
<i>Glechoma hirsuta</i>	C	10.0	-	2.0	1.0	1.0	5.0	-	0.1	2.0	-	80
<i>Dactylis polygama</i>	C	0.1	0.1	-	-	-	-	-	0.1	2.0	-	50
<i>Geranium robertianum</i>	C	0.1	15.0	0.1	-	-	-	1.0	-	0.1	-	50
<i>Fragaria vesca</i>	C	-	-	-	-	0.1	-	0.5	0.1	0.1	-	40
<i>Hedera helix</i>	C	0.1	0.1	1.0	-	-	-	-	0.1	-	-	40
<i>Veronica chamaedrys</i>	C	-	-	-	0.1	-	-	0.1	-	0.1	-	40
<i>Bronnus ramosus subsp. benekeni</i>	C	-	-	0.1	-	1.0	-	-	-	-	0.1	20
<i>Geranium lucidum</i>	C	-	-	-	-	-	-	0.1	-	-	-	20
<i>Arum maculatum</i>	C	-	-	-	-	-	-	-	-	0.1	-	10
<i>Corydalis solida</i>	C	-	-	-	-	-	-	-	-	-	0.1	10
<i>Mycelis muralis</i>	C	0.1	-	-	-	-	-	-	-	-	-	10

Table 1 (continued)

<i>Tilia tomentosa</i>	C	-	-	-	-	0.1	-	-	-	-	-	-	-	10
<i>Viola hirta</i>	C	-	-	-	-	-	-	0.1	-	-	-	-	-	10
<i>Viola odorata</i>	C	0.1	-	-	-	-	-	-	-	-	-	-	-	10
Others														
<i>Crataegus monogyna</i>	B	1.0	1.0	-	-	-	-	-	-	3.0	5.0	-	-	40
<i>Euphorbia cyparissias</i>	C	0.5	10.0	1.0	0.2	10.0	0.1	-	-	-	-	3.0	80	
<i>Viola arvensis</i>	C	0.1	0.1	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	80	
<i>Dactylis glomerata</i>	C	0.1	-	1.0	2.0	5.0	0.1	-	-	-	3.0	-	70	
<i>Galium aparine</i>	C	1.0	10.0	0.1	-	-	1.0	1.0	1.0	1.0	1.0	60.0	70	
<i>Veronica hederifolia</i>	C	-	-	-	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	50	
<i>Alliaria petiolata</i>	C	0.5	0.1	-	-	-	-	-	-	-	0.1	1.0	40	
<i>Chaerophyllum temulum</i>	C	0.1	-	1.0	-	3.0	-	-	-	-	-	0.5	40	
<i>Polypodium vulgare</i>	C	0.1	0.1	-	0.1	-	2.0	-	-	-	-	-	40	
<i>Cerastium brachypetalum</i>	C	0.5	0.1	-	-	-	1.5	-	-	-	-	-	30	
<i>Geranium columbinum</i>	C	-	-	-	-	-	0.1	1.5	0.1	-	-	-	30	
<i>Hypericum perforatum</i>	C	0.1	-	-	0.1	0.1	-	-	-	-	-	-	30	
<i>Koeleria cristata</i>	C	1.0	0.1	0.2	-	-	-	-	-	-	-	-	30	
<i>Poa angustifolia</i>	C	-	-	-	1.0	-	0.1	-	-	-	-	0.1	30	
<i>Asplenium trichomanes</i>	C	-	-	-	-	-	-	-	-	-	-	-	20	
<i>Stellaria media</i>	C	1.0	20.0	-	-	-	-	-	-	-	-	-	20	
<i>Valerianaella locusta</i>	C	-	0.1	-	-	-	-	-	-	-	-	0.1	20	
<i>Vicia tetrasperma</i>	C	-	-	-	-	-	0.5	-	-	-	-	0.1	20	
<i>Agropyron intermedium</i>	C	-	-	-	-	-	-	-	-	-	-	0.1	10	
<i>Arrhenatherum elatius</i>	C	1.0	-	-	-	-	-	-	-	-	-	-	10	
<i>Carex paireae</i>	C	-	-	-	-	-	-	-	-	-	-	0.5	10	
<i>Galium mollugo subsp. erectum</i>	C	-	-	-	-	-	-	-	0.5	-	-	-	10	
<i>Lactuca serriola</i>	C	-	0.1	-	-	-	-	-	-	-	-	-	10	
<i>Poa bulbosa f. vivipara</i>	C	-	0.1	-	-	-	-	-	-	-	-	-	10	
<i>Veronica praecox</i>	C	-	-	-	-	-	-	-	-	-	0.1	-	10	
Mosses														
<i>Hypnum cupressiforme</i>	D	10.0	1.0	8.0	10.0	10.0	1.0	2.0	5.0	0.1	0.1	0.1	100	
<i>Mnium seligeri</i>	D	-	-	2.0	0.1	2.0	1.0	-	0.1	-	-	-	70	
<i>Eurhynchium zetterstedtii</i>	D	0.1	-	0.1	2.0	-	0.1	2.0	-	-	-	-	50	
<i>Thuidium abietinum</i>	D	-	-	-	0.5	-	3.0	-	1.0	-	-	-	30	

neighbouring vegetation like *Melica uniflora*, *Stellaria holostea*, *Lamium maculatum*. Constant and characteristic species are for both associations *Waldsteinia geoides* and *Aconitum anthora*.

The characteristic combination of *Helleboro odori-Spiraeetum mediae* consists of a set of species southern distribution and partially of evergreen character, like *Helleborus odoratus*, *Hedera helix*, *Galium lucidum*, *Tamus communis*, *Inula spiraeifolia*, *Doronicum orientale*.

In comparison the herb layer of the North Hungarian rock-heath (*Waldsteinio-Spiraeetum mediae*) contains Pannonian endemics, Central European and continental elements which are entirely absent in the South Hungarian association, like *Cotoneaster matrensis*, *C. niger*, *Carduus collinus*, *Carex brevicollis*, *Stipa dasyphylla*, *Melica altissima*, *M. picta*, *Poa pannonica*, *Dianthus carthusianorum*.

The new association is a rare and vulnerable community, because its stands are small and exposed to several disturbing effects like mining, reforestation, constructions and trampling by tourists. Therefore – according to the Red data book of the Hungarian plant communities (Borhidi and Sánta 1999) – South Hungarian rock-heath is proposed for strictly protection (FVJ).

Summarising the characterisation of the new association

Helleboro odori-Spiraeetum mediae Borhidi, Morschhauser et Salamon-Albert, ass. nova hoc loco

Type: Table 1, holotype relevé: No. 1 (B 55), Hungary, Mecsek, Dömörkapu, 15.07.1997, A. Borhidi

Dominant species: *Spiraea media* V

Characteristic and differential species: *Waldsteinia geoides* V, *Helleborus odoratus* V, *Galium lucidum* V, *Aconitum anthora* IV, *Centaurea axillaris* subsp. *stricta* II, *Tamus communis* II, *Mercurialis ovata* II, *Inula spiraeifolia* II, *Doronicum hungaricum* I, *D. orientale* I, *Tilia tomentosa* I

Constant and subconstant species: *Geranium sanguineum* V, *Arabis turrita* V, *Securigera varia* V, *Melica uniflora* V, *Telephium maximum* V, *Stellaria holostea* V, *Geum urbanum* V, *Lamium maculatum* V, *Hypnum cupressiforme* V, *Fraxinus ornus* IV, *Cornus mas* IV, *Dictamnus albus* IV, *Erysimum odoratum* IV, *Vincetoxicum hirundinaria* IV, *Anthericum ramosum* IV, *Bromus pannonicus* IV, *Filipendula vulgaris* IV, *Fallopia convolvulus* IV, *Glechoma hirsuta* IV, *Euphorbia cyparissias* IV, *Viola arvensis* IV, *Dactylis glomerata* IV, *Galium aparine* IV, *Mnium seligeri* IV

Ecological characterisation by indicator values

Ecological indicator spectra were calculated by frequency and cover data (Table 2) and are displaying in Figures 1–2. The values of temperature scale

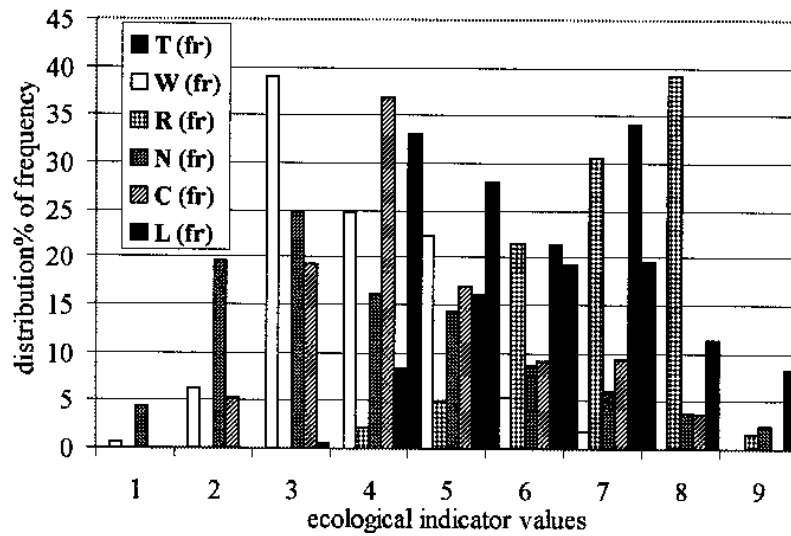


Fig. 1. Ecological indicator values by frequency of species

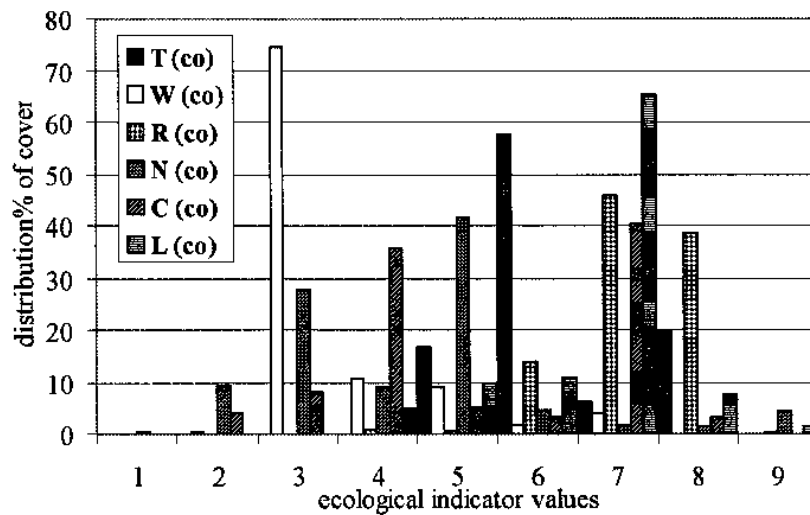


Fig. 2. Ecological indicator values by cover of species

Table 2

Distribution of ecological indicator values in the samplings based on frequency (fr) and cover (co) of the species. Abbreviations: T = temperature, W = humidity, R = soil reaction, N = nutrient, C = continentality, L = light

B55	sp	1	2	3	4	5	6	7	8	9	Avg
Tfr	60	0.00	0.00	0.00	0.00	38.33	21.67	21.67	18.33	0.00	6.20
Wfr	60	0.00	8.33	36.67	25.00	23.33	5.00	1.67	0.00	0.00	3.85
Rfr	60	0.00	0.00	0.00	3.33	5.00	21.67	28.33	38.33	3.33	7.03
Nfr	60	5.00	16.67	26.67	16.67	11.67	8.33	6.67	6.67	1.67	4.08
Cfr	60	0.00	6.67	23.33	30.00	20.00	10.00	6.67	3.33	0.00	4.37
Lfr	60	0.00	0.00	0.00	10.00	18.33	16.67	30.00	15.00	10.00	6.52
M228	sp	1	2	3	4	5	6	7	8	9	Avg
Tfr	54	0.00	0.00	0.00	0.00	29.63	25.93	27.78	16.67	0.00	6.32
Wfr	54	1.85	12.96	35.19	24.07	20.37	3.70	1.85	0.00	0.00	3.67
Rfr	54	0.00	0.00	0.00	1.85	3.70	20.37	27.78	42.59	3.70	7.17
Nfr	54	7.41	18.52	25.93	20.37	12.96	3.70	3.70	3.70	3.70	3.57
Cfr	54	0.00	5.56	20.37	31.48	16.67	9.26	12.96	3.70	0.00	4.57
Lfr	54	0.00	0.00	0.00	7.41	14.81	20.37	27.78	16.67	12.96	6.70
B51	sp	1	2	3	4	5	6	7	8	9	Avg
Tfr	34	0.00	0.00	0.00	0.00	38.24	26.47	11.76	23.53	0.00	6.21
Wfr	34	0.00	2.94	38.24	26.47	20.59	8.82	2.94	0.00	0.00	3.82
Rfr	34	0.00	0.00	0.00	2.94	5.88	17.65	32.35	41.18	0.00	7.03
Nfr	34	0.00	14.71	26.47	14.71	20.59	8.82	8.82	2.94	2.94	4.35
Cfr	34	0.00	8.82	17.65	41.18	8.82	11.76	8.82	2.94	0.00	4.35
Lfr	34	0.00	0.00	0.00	14.71	17.65	17.65	35.29	11.76	2.94	6.21
B52	sp	1	2	3	4	5	6	7	8	9	Avg
Tfr	48	0.00	0.00	0.00	0.00	27.08	22.92	22.92	27.08	0.00	6.50
Wfr	48	2.08	6.25	43.75	25.00	18.75	4.17	0.00	0.00	0.00	3.65
Rfr	48	0.00	0.00	0.00	2.08	4.17	18.75	31.25	43.75	0.00	7.10
Nfr	48	8.33	20.83	29.17	14.58	12.50	10.42	2.08	2.08	0.00	3.52
Cfr	48	0.00	6.25	10.42	37.50	20.83	8.33	14.58	2.08	0.00	4.67
Lfr	48	0.00	0.00	0.00	8.33	10.42	22.92	33.33	12.50	12.50	6.69
B 53	sp	1	2	3	4	5	6	7	8	9	Avg
Tfr	49	0.00	0.00	0.00	0.00	34.69	26.53	18.37	20.41	0.00	6.25
Wfr	49	0.00	4.08	40.82	28.57	22.45	4.08	0.00	0.00	0.00	3.82
Rfr	49	0.00	0.00	0.00	4.08	4.08	18.37	28.57	44.90	0.00	7.06
Nfr	49	4.08	16.33	30.61	18.37	14.29	10.20	4.08	2.04	0.00	3.80
Cfr	49	0.00	4.08	12.24	42.86	18.37	8.16	10.20	4.08	0.00	4.61
Lfr	49	0.00	0.00	2.04	6.12	18.37	16.33	38.78	12.24	6.12	6.45
B54	sp	1	2	3	4	5	6	7	8	9	Avg
Tfr	48	0.00	0.00	0.00	0.00	22.92	33.33	22.92	20.83	0.00	6.42
Wfr	48	2.08	10.42	39.58	29.17	14.58	4.17	0.00	0.00	0.00	3.56
Rfr	48	0.00	0.00	0.00	2.08	6.25	14.58	27.08	47.92	2.08	7.19
Nfr	48	10.42	20.83	25.00	18.75	10.42	8.33	4.17	2.08	0.00	3.50
Cfr	48	0.00	4.17	14.58	43.75	18.75	8.33	4.17	6.25	0.00	4.50
Lfr	48	0.00	0.00	0.00	4.17	16.67	25.00	33.33	10.42	10.42	6.60

Table 2 (continued)

M182	sp	1	2	3	4	5	6	7	8	9	Avg
Tfr	51	0.00	0.00	0.00	0.00	35.29	27.45	21.57	15.69	0.00	6.18
Wfr	51	0.00	5.88	45.10	15.69	21.57	9.80	1.96	0.00	0.00	3.91
Rfr	51	0.00	0.00	0.00	3.92	3.92	23.53	33.33	31.37	3.92	6.96
Nfr	51	3.92	23.53	19.61	17.65	11.76	9.80	7.84	1.96	3.92	4.04
Cfr	51	0.00	3.92	21.57	43.14	13.73	7.84	7.84	1.96	0.00	4.31
Lfr	51	0.00	0.00	0.00	7.84	21.57	15.69	29.41	13.73	11.76	6.55
M183	sp	1	2	3	4	5	6	7	8	9	Avg
Tfr	38	0.00	0.00	0.00	0.00	31.58	34.21	13.16	21.05	0.00	6.24
Wfr	38	0.00	5.26	42.11	23.68	23.68	2.63	2.63	0.00	0.00	3.84
Rfr	38	0.00	0.00	0.00	0.00	5.26	28.95	28.95	34.21	2.63	7.00
Nfr	38	0.00	28.95	15.79	13.16	18.42	10.53	5.26	2.63	5.26	4.18
Cfr	38	0.00	5.26	21.05	36.84	15.79	10.53	7.89	2.63	0.00	4.39
Lfr	38	0.00	0.00	0.00	10.53	13.16	21.05	42.11	7.89	5.26	6.39
M184	sp	1	2	3	4	5	6	7	8	9	Avg
Tfr	47	0.00	0.00	0.00	0.00	31.91	31.91	19.15	17.02	0.00	6.21
Wfr	47	0.00	4.26	34.04	27.66	23.40	8.51	2.13	0.00	0.00	4.05
Rfr	47	0.00	0.00	0.00	2.13	4.26	27.66	29.79	36.17	0.00	6.91
Nfr	47	4.26	19.15	19.15	14.89	14.89	10.64	8.51	4.26	4.26	4.49
Cfr	47	0.00	2.13	21.28	34.04	17.02	10.64	8.51	6.38	0.00	4.64
Lfr	47	0.00	0.00	0.00	8.51	14.89	25.53	36.17	8.51	6.38	6.40
M229	sp	1	2	3	4	5	6	7	8	9	Avg
Tfr	44	0.00	0.00	0.00	0.00	40.91	29.55	13.64	15.91	0.00	6.05
Wfr	44	0.00	2.27	34.09	22.73	34.09	2.27	4.55	0.00	0.00	4.14
Rfr	44	0.00	0.00	0.00	0.00	6.82	22.73	38.64	31.82	0.00	6.96
Nfr	44	0.00	15.91	29.55	11.36	15.91	6.82	9.09	9.09	2.27	4.43
Cfr	44	0.00	4.55	29.55	27.27	18.18	6.82	11.36	2.27	0.00	4.30
Lfr	44	0.00	0.00	2.27	6.82	15.91	31.82	34.09	4.55	4.55	6.21
B55	cover	1	2	3	4	5	6	7	8	9	Avg
Tc	184.9	0.00	0.00	0.00	0.00	10.22	75.66	4.54	9.57	0.00	6.14
Wc	184.9	0.00	0.76	81.18	8.60	8.27	0.65	0.54	0.00	0.00	3.29
Rc	184.9	0.00	0.00	0.00	0.11	0.16	8.00	55.27	36.34	0.11	7.28
Nc	184.9	0.16	4.87	26.23	5.68	57.49	0.27	3.35	1.41	0.54	4.40
Cc	184.9	0.00	1.24	7.25	30.18	4.27	7.63	49.32	0.11	0.00	5.58
Lc	184.9	0.00	0.00	0.00	4.49	9.30	7.36	67.71	10.11	1.03	6.73
M228	cover	1	2	3	4	5	6	7	8	9	Avg
Tc	194.6	0.00	0.00	0.00	0.00	25.90	44.14	15.83	14.13	0.00	6.18
Wc	194.6	0.05	0.36	65.93	6.12	14.65	7.76	5.14	0.00	0.00	3.79
Rc	194.6	0.00	0.00	0.00	0.05	0.10	16.70	47.43	34.64	1.08	7.21
Nc	194.6	0.21	2.88	25.90	12.59	31.60	2.62	8.22	10.33	5.65	4.99
Cc	194.6	0.00	1.13	15.26	36.59	11.61	0.72	32.07	2.62	0.00	5.02
Lc	194.6	0.00	0.00	0.00	9.30	11.10	21.27	48.77	8.74	0.82	6.39
B51	cover	1	2	3	4	5	6	7	8	9	Avg
Tc	169.5	0.00	0.00	0.00	0.00	23.89	56.34	3.66	16.11	0.00	6.12
Wc	169.5	0.06	0.00	75.28	11.98	11.39	1.24	0.06	0.00	0.00	3.39
Rc	169.5	0.00	0.00	0.00	0.59	0.65	11.33	37.52	49.91	0.00	7.38
Nc	169.5	0.00	6.73	45.01	13.04	32.63	1.24	0.71	0.59	0.06	3.81
Cc	169.5	0.00	10.03	2.01	49.79	6.55	1.95	29.62	0.06	0.00	4.78
Lc	169.5	0.00	0.00	0.00	10.15	5.96	4.90	61.12	17.82	0.06	6.71

Table 2 (continued)

	cover	1	2	3	4	5	6	7	8	9	Avg
B52	cover	1	2	3	4	5	6	7	8	9	Avg
Tc	143.8	0.00	0.00	0.00	0.00	7.10	72.60	8.34	11.96	0.00	6.25
Wc	143.8	0.14	0.21	84.08	13.28	1.53	0.76	0.00	0.00	0.00	3.21
Rc	143.8	0.00	0.00	0.00	0.70	0.14	1.53	65.37	32.27	0.00	7.26
Nc	143.8	0.28	4.66	28.86	4.17	60.01	1.88	0.07	0.07	0.00	4.21
Cc	143.8	0.00	7.37	0.97	23.71	5.98	1.53	60.08	0.35	0.00	5.75
Lc	143.8	0.00	0.00	0.00	0.56	0.97	13.21	74.27	9.87	1.11	6.95
B53	cover	1	2	3	4	5	6	7	8	9	Avg
Tc	166.7	0.00	0.00	0.00	0.00	11.40	64.43	1.62	22.56	0.00	6.35
Wc	166.7	0.00	0.12	84.04	7.68	6.36	1.80	0.00	0.00	0.00	3.26
Rc	166.7	0.00	0.00	0.00	1.26	0.66	6.30	42.95	48.83	0.00	7.37
Nc	166.7	0.66	4.80	44.15	5.16	38.45	5.52	0.66	0.60	0.00	3.98
Cc	166.7	0.00	3.06	1.44	48.11	5.16	3.00	36.17	3.06	0.00	5.24
Lc	166.7	0.00	0.00	0.60	3.66	10.38	8.58	66.77	9.84	0.18	6.68
B54	cover	1	2	3	4	5	6	7	8	9	Avg
Tc	220.1	0.00	0.00	0.00	0.00	19.76	68.06	3.32	8.86	0.00	5.96
Wc	220.1	0.05	0.23	66.24	15.22	15.95	2.32	0.00	0.00	0.00	3.54
Rc	220.1	0.00	0.00	0.00	2.27	1.45	16.45	33.58	43.98	2.27	7.22
Nc	220.1	0.23	5.77	42.48	16.67	25.90	7.31	1.59	0.05	0.00	3.91
Cc	220.1	0.00	4.59	7.13	52.84	7.13	5.04	22.72	0.55	0.00	4.71
Lc	220.1	0.00	0.00	0.00	4.59	5.13	13.36	66.61	10.09	0.23	6.73
M182	cover	1	2	3	4	5	6	7	8	9	Avg
Tc	207.4	0.00	0.00	0.00	0.00	8.63	47.73	9.31	34.33	0.00	6.69
Wc	207.4	0.00	0.14	85.73	6.03	6.94	0.68	0.48	0.00	0.00	3.25
Rc	207.4	0.00	0.00	0.00	1.01	0.10	9.79	38.14	50.48	0.48	7.36
Nc	207.4	0.10	12.97	38.52	7.71	35.82	3.23	1.06	0.05	0.53	3.84
Cc	207.4	0.00	3.91	3.86	42.72	2.07	2.56	42.48	2.41	0.00	5.29
Lc	207.4	0.00	0.00	0.00	4.87	30.67	4.29	47.78	4.05	8.34	6.41
M183	cover	1	2	3	4	5	6	7	8	9	Avg
Tc	207.6	0.00	0.00	0.00	0.00	6.21	64.16	1.35	28.28	0.00	6.52
Wc	207.6	0.00	0.10	90.80	2.46	6.12	0.05	0.48	0.00	0.00	3.17
Rc	207.6	0.00	0.00	0.00	0.00	0.10	7.51	62.67	29.67	0.05	7.23
Nc	207.6	0.00	21.44	9.30	7.51	59.97	1.11	0.10	0.05	0.53	4.13
Cc	207.6	0.00	4.87	1.25	31.84	0.48	1.30	60.21	0.05	0.00	5.73
Lc	207.6	0.00	0.00	0.00	4.96	7.85	1.73	84.10	1.25	0.10	6.69
M184	cover	1	2	3	4	5	6	7	8	9	Avg
Tc	189.0	0.00	0.00	0.00	0.00	14.29	55.56	7.83	22.33	0.00	6.46
Wc	189.0	0.00	0.11	71.75	16.08	9.79	1.75	0.53	0.00	0.00	3.41
Rc	189.0	0.00	0.00	0.00	1.59	1.11	20.37	49.21	27.72	0.00	7.00
Nc	189.0	0.11	15.24	13.97	11.48	48.20	7.51	0.21	0.11	3.17	4.35
Cc	189.0	0.00	2.65	3.54	23.33	8.52	7.46	47.09	7.41	0.00	5.82
Lc	189.0	0.00	0.00	0.00	2.80	12.86	16.24	65.19	1.75	1.16	6.54
M229	cover	1	2	3	4	5	6	7	8	9	Avg
Tc	176.4	0.00	0.00	0.00	0.00	41.10	27.66	3.68	27.55	0.00	6.18
Wc	176.4	0.00	0.06	38.66	18.54	8.62	0.06	34.07	0.00	0.00	4.72
Rc	176.4	0.00	0.00	0.00	0.00	0.62	41.84	26.25	31.29	0.00	6.88
Nc	176.4	0.00	13.21	3.34	7.14	25.79	14.80	0.96	0.74	34.01	6.01
Cc	176.4	0.00	2.89	38.66	18.71	1.47	0.68	23.41	14.17	0.00	4.85
Lc	176.4	0.00	0.00	0.06	3.46	4.65	18.99	70.46	2.27	0.11	6.64

vary from T5 (montane mesophilous broad-leaved forest belt) to T8 (sub-Mediterranean woodland and grassland belt) showing a maximum at T5. By cover data T6 (submontane broadleaved forest belt) and T8 are the most frequent values. Species belonging to these groups are e.g. *Aconitum anthora*, *Allium montanum*, *Fragaria moschata*, *Glechoma hirsuta*, *Spiraea media*, *Stellaria holostea*, *Viola odorata* and *Bromus pannonicus*, *Dictamnus albus*, *Fraxinus ornus*, *Galium lucidum*, *Helleborus odoratus*, *Inula spiraeifolia*, *Quercus pubescens* agg., *Tamus communis*, *Waldsteinia geoides*.

Spectra of humidity value continuously vary from W1 to W7, the three categories with greatest distribution are W3 (xerotolerant plants eventually occurring on fresh soils), W4 (plants of semidry habitats) and W5 (plants of semihumid habitats under intermediate conditions). Paid attention to the spectrum constructed by cover data greater than 70% of their distribution belong to W3, represented by e.g. *Adonis vernalis*, *Bromus pannonicus*, *Dictamnus albus*, *Euphorbia cyparissias*, *Festuca rupicola*, *Fraxinus ornus*, *Galium lucidum*, *Geranium sanguineum*, *Inula spiraeifolia*, *Prunus spinosa*, *Quercus pubescens* agg., *Spiraea media*, *Teucrium chamaedrys*.

The scale of soil reaction expands from R4 (moderately acidophilous plants) to R9 (explicitly calciphilous plants and ultrabasic specialists). These values are pointing to mosaic-like soil reaction in space. Considering the spectrum by cover data basifrequent (R7) and basiphilous (R8) plants are dominating in vegetation like *Bromus ramosus*, *Crataegus monogyna*, *Euphorbia cyparissias*, *Geranium lucidum*, *Iris variegata*, *Lamium maculatum*, *Spiraea media* and *Bromus pannonicus*, *Cornus mas*, *Euonymus verrucosus*, *Festuca rupicola*, *Inula spiraeifolia*, *Polygonatum odoratum*, *Rosa gallica*, *Tamus communis*. Ultrabasic specialist are *Laser trilobum*, *Helianthemum ovatum* and *Muscari racemosum*.

The nutrient status of the habitat is expressed by the nitrogen scale from N1 (soils extremely poor in mineral nitrogen) to N9 (plants only on hyperfertilised soil extremely rich in mineral nitrogen) covering the total spectrum. Main categories are dispersed by N3 (plants of moderately oligotrophic habitats) and N5 (plants of mesotrophic habitats) in case of cover data. These species e.g. *Bromus pannonicus*, *Securigera varia*, *Fraxinus ornus*, *Inula spiraeifolia*, *Polygonatum odoratum*, *Viburnum lantana* and *Euphorbia epithymoides*, *Spiraea media*, *Stellaria holostea*. Plants indicating soils extremely rich in mineral nitrogen (N9) and N indicators (N8) are *Galium aparine* and *Alliaria petiolata*, *Arum maculatum*, *Lamium maculatum*, *Stellaria media*.

The continentality index varies from C2 (oceanic species with spreading in West Europe and western Central Europe) to C8 (continental species reaching only in eastern part of Central Europe). Most of the species are attached to C4 (suboceanic species mainly in Central Europe) but in the histogram of cover data shows an other main group at C7 (continental-subcontinental spe-

Table 3

Average of the indicator values of the community based on frequency (fr) and cover (co) of the species

Tfr	6.26	Tco	6.29
Wfr	3.83	Wco	3.50
Rfr	7.04	Rco	7.22
Nfr	4.00	Nco	4.36
Cfr	4.46	Cco	5.28

cies mainly in East Europe). C4 plants are e.g. *Bromus pannonicus*, *Cornus mas*, *Dactylis glomerata*, *Euphorbia cyparissias*, *Galium lucidum*, C7 plants are e.g. *Adonis vernalis*, *Dictamnus albus*, *Festuca rupicola*, *Spiraea media*, *Tilia tomentosa*.

The scale of light values varies from L4 (shadow-halfshadow plants) to L9 (full light plants of open habitats). The main category of light figures is at L7 by

Table 4

Distribution of the social behaviour types (SBT) in the samplings and the community and their naturalness values (Val) based on frequency (fr) and cover (co) of the species

SBT(fr)	S+Sr	C	G	NP	DT	W	RC	Val
B55	13.4	13.3	45.0	1.7	21.7	5.0	0.0	3.84
M228	11.2	14.8	48.1	3.7	14.8	7.4	0.0	3.76
B51	8.8	20.6	41.2	0.0	23.5	5.9	0.0	3.74
B52	10.4	33.3	35.4	2.1	16.7	2.1	0.0	4.17
B53	6.1	26.5	42.9	2.0	18.4	4.1	0.0	3.88
B54	8.4	20.8	52.1	2.1	12.5	4.2	0.0	4.03
M182	9.8	19.6	35.3	3.9	21.6	9.8	0.0	3.63
M183	2.6	23.7	44.7	2.6	13.2	13.2	0.0	3.60
M184	8.5	23.4	36.2	4.3	17.0	10.6	0.0	3.70
M229	9.1	18.2	31.8	0.0	29.5	9.1	2.3	3.39
Ave	8.8	21.4	41.3	2.2	18.9	7.2	0.2	3.78
SBT(co)	S+Sr	C	G	NP	DT	W	RC	Val
B55	1.35	77.44	11.90	0.27	8.39	0.65	0.00	4.94
M228	2.27	54.96	19.44	0.11	18.46	4.81	0.00	4.08
B51	6.02	72.08	8.09	0.00	13.69	0.12	0.00	4.57
B52	1.65	83.95	10.89	0.07	3.07	0.07	0.00	4.80
B53	3.77	80.02	12.02	0.06	4.00	0.12	0.00	4.80
B54	1.41	60.18	25.01	0.05	13.28	0.27	0.00	4.36
M182	2.10	84.02	10.03	0.79	2.37	0.69	0.00	4.82
M183	0.48	93.30	4.19	0.05	1.35	0.67	0.00	4.90
M184	3.40	72.90	18.00	0.11	2.07	3.52	0.00	4.65
M229	1.45	41.75	17.36	0.00	4.28	3.51	0.07	3.30
Ave	2.39	72.08	13.70	0.15	7.09	4.59	0.01	4.49

frequency and cover data as well with distribution greater than 60%. The dominant species like *Quercus pubescens* agg. and *Spiraea media* determine features of this spectrum.

Main features of vegetation structure

Applying social behaviour types (SBT) histograms were constructed to analyse vegetation structure. The average of category types and samples were calculated to express their participation in the vegetation (Table 4). Spectra of social behaviour types are displayed by frequency and cover values (Fig. 3).

In the averages of frequency data generalists (G) have the greatest, competitors (C) have the second greatest participation among the categories. Main competitor species are *Spiraea media*, *Fraxinus ornus*, *Quercus pubescens* agg., *Prunus spinosa* in canopy and shrub layer, *Geranium sanguineum*, *Brachypodium pinnatum*, *Festuca rupicola*, *Bromus pannonicus*, *Melica ciliata*, *M. uniflora* in herb layer. There are many specialists (S) in this association (ca 10%) like *Aconitum anthora*, *Galium lucidum*, *Doronicum hungaricum*, *Dictamnus albus*, *Laser trilobum*, *Adonis vernalis*, *Ranunculus illyricus*. Among SBTs of plants living in disturbed, secondary or artificial habitats disturbance tolerants (DT) has the greatest relative participation with e.g. *Rosa canina* agg., *Geum urbanum*, *Lamium maculatum*, *Geranium robertianum*, *Veronica chamaedrys*, *Euphorbia cyparissias*, *Alliaria petiolata*. These plants are attached to own set of species in natural

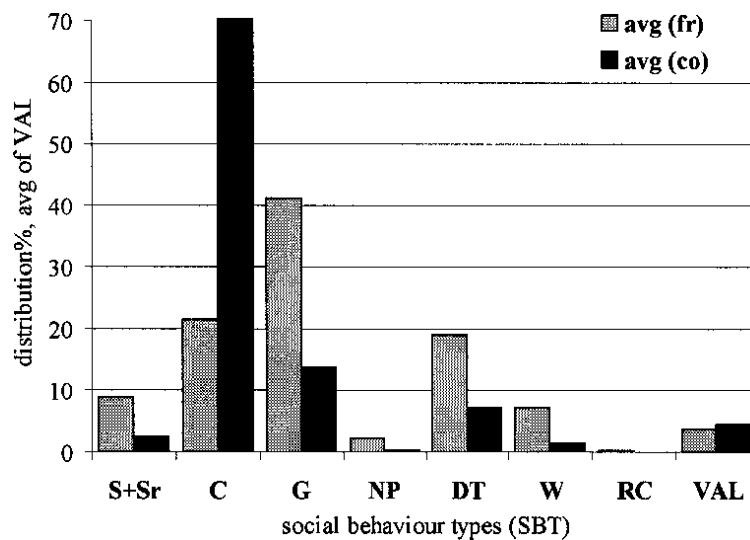


Fig. 3. Social behaviour types (SBT) by frequency (fr) and cover (co) of species

vegetation. Ruderal competitors (RC) are nearly entirely absent (0.2%) only with one species in spite of that stands are near the busy forest path.

By reason of covering data the relative distribution of SBT categories shows a well-balanced state in the vegetation structure: C (competitors) > G (generalists) > S (specialists), > DT (disturbance tolerants) > W (weeds) > RC (ruderal competitors). The average value of VAL is a little bit greater in case of covering data (4.49) referring to the natural state of this community.

DISCUSSION

Presence and range of the new rock-heath association is exclusively in Central Mecsek Mts on flattening rocky ridge of Misina–Tubes. It entirely differs from the northern one in species composition of shrub, herb and moss layers as well. There is a smaller species diversity attaching to the rock and shrub-woodlands beside the dominant species (*Spiraea media*) in bush layer. The thick herb layer shows a complex coenological character with elements of Trifolio-Geranietea, Festuco-Brometea and Fagetalia-Querco-Fagetea. Real differentially diagnostic species are southern flora elements and partially evergreen.

Habitat extremities are expressed by frequency spectra of ecological indicator values, the main features of habitat are manifested on histograms by cover data. Ecological indication of most character and differential species are at categories R8 and T8 expressing a basiphilous soil with warm microclimate. These ecological factors are defining the differential character of this special plant community. The averages of the indicator values of the community show that values based on cover of species are higher than values based on species frequency excepting soil humidity (Table 3). It refers to dry character of the South Hungarian rock-heath.

In the case of SBT categories' histograms plants of natural habitats (specialists, competitors, generalists, natural pioniers) are collected in group of character and differential species, Quercetea pubescentis-petraea and Festuco-Brometea. Category of Fagetalia and Querco-Fagetea is diverse with numerous S, C, G, DT, W species. Plants living in disturbed habitats are accumulated in group of other (indifferent) species.

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