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Transitional plant communities of the Villány Mts

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Erdős L., Bátori Z., Morschhauser T., Dénes A. & Körmöczi L.: *Transitional plant communities of the Villány Mts.*

Abstract: Transitional communities of the Villány Mts were investigated. The associations *Inulo spiraeifoliae-Brometum pannonici, Festuco rupicolae-Arrhenatheretum, Helleboro odori-Spiraeetum mediae* and *Inulo spiraeifoliae-Quercetum pubescentis* were analysed in the context of north-south facing vegetation gradients. Their species composition and ecological conditions as well as their position along the gradient were evaluated in relation to the nearby communities. We found that the four communities studied not only occupy a transitional position in the topographical space, but also their species composition and ecological conditions seem to be transitional.

Keywords: Szársomlyó, *Inulo spiraeifoliae-Brometum pannonici, Festuco rupicolae-Arrhenatheretum, Helleboro odori-Spiraeetum mediae, Inulo spiraeifoliae-Quercetum pubescentis*

Introduction

The analysis of ecological gradients has been a central issue in vegetation science during the last few decades (e.g. van der Maarel and Leertouwer 1967, Whittaker 1967, Werger et al. 1983, Hoagland and Collins 1997, Austin 2005). Because of the marked differences between the microclimates of the northern and southern slopes, the Villány Mts provide excellent opportunities to study north-south facing vegetation gradients (Erdős et al. 2008, 2009). Former classical coenological studies revealed that in northern exposures, near the ridges, transitional plant communities can be found, where species of mesophilous forests and of xerophilous grasslands co-occur. Stands of karst shrubforests, occuring in northern exposures are deviating from stands in southern exposures (Dénes 1995). The rock-heath association *Helleboro odori-Spiraeetum mediae*, as well as rock swards develop in similar positions, on the northern sides of the ridges (Dénes 1998, Erdős and Morschhauser 2010, Erdős et al. 2010).

Since the plant communities mentioned above are located at special sections of north-south facing gradients, the present study tries to place them into the context of vegetation gradients. The aim of this work was to summarize the published results as well as to

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perform some complementary analyses on the vegetation gradients and possible ecological background factors. We sought to gain a better understanding on these special segments of gradients.

Material and methods

Study area is the Villány Mts, situated in the South of Hungary. Mean annual temperature is 10-10.5°C (SZILÁRD 1981). Mean annual precipitation is 670-690 mm (AMBRÓZY and KOZMA 1990). The Villány Mts belong to the phytogeographic province Pannonicum, region Praeillyricum, district Sopianicum (BORHIDI and SÁNTA 1999). The northern sides are covered mainly by mesophilous forests, whereas the southern sides are occupied by xerophilous forests and grasslands (DÉNES 2000).

Based on the relevés of DÉNES (1995), ERDŐS and MORSCHHAUSER (2010), ERDŐS et al. (2010), and Dénes (ined.), we gave a brief characterization of the species composition of the associations. Moreover, we calculated the spectra of the ecological indicator values of BORHIDI (1993, 1995), based on frequency data.

As a complementary analysis, we studied the whole gradient with special regard to the position of the communities under scrutiny. For this study, Mt Szársomlyó was chosen, where vegetation can be considered natural. A 200 m long north-south facing transect consisting of 1 m² permanent plots was established, crossing the ridge. Presence of all vascular species of the field layer was registrated in April and in July. A Canonical Correspondence Analysis was performed, using the ecological indicator values T, W and N as environmental variables. For the computation, SYN-TAX 2000 was applied (PODANI 2001).

Communities were identified along the transect visually. A morphological profile of the transect was prepared using a topographical map and ArcView GIS 3.2 (ESRI).

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

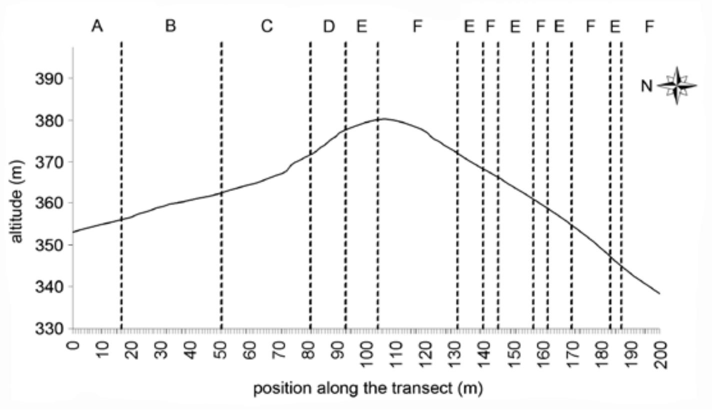

Fig. 1: Community sequence and morphological profile of the transect on Mt. Szársomlyó. Vertical dashed lines indicate visually identified boundaries between communities. A: *Asperulo taurinae-Carpinetum*, B: *Tilio tomentosae-Fraxinetum orni,* C: *Aconito anthorae-Fraxinetum orn*i, D: *Festuco rupicolae-Arrhenatheretum*, E: *Inulo spiraeifoliae-Quercetum pubescentis*, F: *Sedo sopianae-Festucetum dalmaticae*

Results

The identified communities along the transect are shown in relation to the topographical circumstances in Figure 1. The northern end of the transect reached the Illyrian oak-hornbeam forest *Asperulo taurinae-Carpinetum*. (In fact, this community covers extensive areas far behind the northern endpoint of the transect.) Approaching the ridge, the soil gradually becomes shallower and the oak-hornbeam forest turns into a non-typical stand of the scree-forest *Tilio tomentosa-Fraxinetum orni*. Nearer to the ridge, the top-forest *Aconito anthorae-Fraxinetum orni* can be found. In the immediate proximity of the ridge, on the northern side, the closed rock sward *Festuco rupicolae-Arrhenatheretum* and the karst shrubforest *Inulo spiraeifoliae-Quercetum pubescentis* developed. The southern side is covered by a mosaic of the open rock sward *Sedo sopianae-Festucetum dalmaticae* and the karst shrubforest. This sequence is quite common in the Villány Mts. On the northern sides, near the ridges or plateaus, karst shrubforests and closed rock swards are situated on Mt Szársomlyó, Mt Tenkes, Mt Fekete and Mt Csukma. However, on the highest parts of the northern side of Mt Szársomlyó, the rock sward *Festuco rupicolae-Arrhenatheretum* is replaced by the association *Inulo spiraeifoliae-Brometum pannonici*. Also the rock-heath association *Helleboro odori-Spiraeetum mediae* lives in this location.

Species composition of the communities under study clearly shows a dual character. In the case of the grasslands (*Festuco rupicolae-Arrhenatheretum* and *Inulo spiraeifoliae-Brometum pannonici*), species of beech and oak-hornbeam forests (e. g. *Anemone ranunculoides, Corydalis solida, Galanthus nivalis, Ranunculus ficaria, Scilla vindobonensis, Stellaria holostea*) are scattered in a matrix of xerofrequent species (mainly *Festuca rupicola, Festuca valesiaca and Bromus pannonicus*). Other important xerofre-

Table 1: Spectra of the ecological indicator value T in the four associations studied, based on frequency data

	T5	T6	T7	T8	T9
Festuco rupicolae-Arrhenatheretum	28.01	30.14	29.31	11.58	0.95
Inulo spiraeifoliae-Brometum pannonici	21.66	30.88	27.19	14.75	5.53
Helleboro odori-Spiraeetum mediae	34.39	31.85	20.38	12.74	1.27
Inulo spiraeifoliae-Quercetum pubescentis	27.88	33.87	23.73	12.67	1.84

Table 2: Spectra of the ecological indicator value W in the four associations studied, based on frequency data

	W1	W2	W3	W4	W5	W6	W7
Festuco rupicolae-Arrhenatheretum	5.79	18.32	38.06	15.72	17.73	2.25	2.13
Inulo spiraeifoliae-Brometum pannonici	10.60	26.73	41.01	11.52	8.29	1.38	0.46
Helleboro odori-Spiraeetum mediae	1.27	8.54	28.48	19.62	28.16	7.91	6.01
Inulo spiraeifoliae-Quercetum pubescentis	2.07	10.14	26.73	20.05	28.34	8.99	3.69

Table 3: Spectra of the ecological indicator value N in the four associations studied, based on frequency data

	N1	N2	N3	N4	N5	N6	N7	N8	N9
Festuco rupicolae-Arrhenatheretum	12.17	27.30	19.98	13.24	7.45	7.09	8.75	2.25	1.77
Inulo spiraeifoliae-Brometum pannonici	20.28	31.80	22.12	13.36	6.91	0.00	2.76	2.76	0.00
Helleboro odori-Spiraeetum mediae	2.53	20.25	17.09	15.82	13.29	7.59	13.29	6.65	3.48
Inulo spiraeifoliae-Quercetum pubescentis	3.46	21.66	14.98	17.51	11.75	7.60	13.36	5.99	3.69

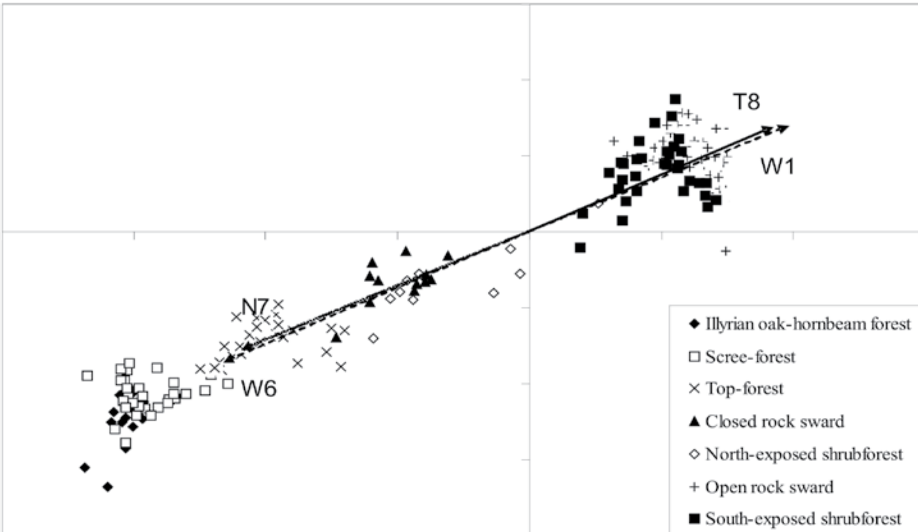

Fig. 2: Ordination scattergram of the Canonical Correspondence Analysis. For simplicity, only four ecological indicator values are shown

quent species are *Allium flavum, Dianthus giganteiformis, Helianthemum ovatum, Koeleria cristata, Melica ciliata* and *Orlaya grandiflora.*

In the case of the woody habitats (*Helleboro odori-Spiraeetum mediae* and I*nulo spiraeifoliae-Qercetum pubescentis*), species of beech and oak-hornbeam forests have greater relative abundances, due to the shading. *Corydalis cava, Galanthus nivalis* and *Moehringia trinervia* are especially typical. Xerotolerant species occur mainly at the edges of the stands, where more light reaches the field layer.

The analysis of the ecological indicator values also emphasizes the dual character of the communities (Tables 1-3). Although proportion of T5 (species of the montane mesophilous broad-leaved forest belt), T6 (species of the submontane broad-leaved forest belt) and T7 plants (species of the thermophilous forest or woodland belt) is the greatest, T9 species can also be found in every community (besides *Ruscus aculeatus*, which is quite frequent in the beech and oak-hornbeam forests in the region, the following species: *Asplenium javorkeanum, Artemisia alba, Festuca dalmatica* and *Pisum elatius*). In the case of humidity values, W1 plants (species of extremely dry habitats or bare rocks, e. g. *Artemisia alba, Festuca dalmatica, Sedum* spp., *Thymus* spp.) and W7 plants (species of moist soils not drying out and well aerated, e. g. *Arum maculatum, Cystopteris fragilis*) occur within the very same vegetation units. In the case of the N-values, maxima are at N2 (species of habitats very poor in nitrogen). However, it is interesting that spectra are ranging from N1 (plants occuring on soils extremely poor in mineral nitrogen) to N9 (plants occuring on soils extremely rich in nitrogen).

The Canonical Correspondence Analysis shows that there are at least 3 ecological factors responsible for the vegetational gradient: temperature, moisture and nutrient-content of the soils (Fig. 2). According to this ordination, the northern side has a cooler microclimate, whereas the southern side is hotter, with the highest rate of the termofrequent species (for example T8 species). The oak-hornbeam forest and the scree-forest grow in the moistest habitats. The rate of the species with higher moisture requirement (for example W6 species) is the highest here. The top-forest is drier, the closed rock sward even drier. At the other end of the gradient the shrubforests and the open rock swards can be found, with the highest rate of xerofrequent species (for example W1 species). The proportion of the species with higher nutrient-requirement (for example N7 species) is the highest in the communities of the northern side, while the communities of the southern side grow on nutrient-poorer soils.

On the ordination scattergram, two relatively dense groups can be differentiated, with a trajectory between them. This trajectory, referring to a transitional zone, consists partly of top-forest plots, but mostly of closed rock sward plots and north-exposed shrubforest plots (Fig. 2).

Discussion

The aim of this study was to characterize the transitional communities of the Villány Mts in the context of north-south facing vegetation gradients. The communities under scrutiny have been analysed only separately so far (DÉNES 1995, 1998, ERDŐS and MORSCHHAUSER 2010, ERDŐS et al. 2010).

We found that all of the communities located on the northern side of the ridges or plateaus can be characterized by a combination of xerofrequent plants and plants of beech and oak-hornbeam forests. The analysis of the ecological indicator values also pointed to their dual caharcter (Tables 1-3).

Generally, the top-forest *Aconito anthorae-Fraxinetum orni* is considered a transitional community between the northern and southern slopes of the Mecsek Mts (KEVEY and BORHIDI 1998, 2010). However, situation is somewhat different in the Villány Mts. Here, the top-forest is further from the ridges (Fig. 1). Therefore, the real transitional communities are the north-facing shrubforest, the *Spiraea* rock-heath community and rock-swards. These communities are in the immediate proximity of the ridges and plateaus. The ordination scattergram also supports this view since the trajectory between the plots of the northern slope and plots of the southern slope is formed mainly by rock sward and shrubforest plots (and not by top-forest plots) (Fig. 2). However, it must be noted that in our analysis, only the field layer was sampled. It is known that the field-layer of the top-forest consists mostly of mesophilous plants, whereas the canopy and shrub layers are formed by xerofrequent species (KEVEY and BORHIDI 1998, 2010). Thus it is probable that the top-forest would have shown a more transitional character if not only the herb layer were sampled.

Canonical correspondence analysis showed that microclimate of the communities of northern exposures is humid and cool, and soils of the northern sides have a greater nutrient-content, whereas southern slopes are dryer and warmer, with nutrient-poor soils (Fig. 2). These results are in good agreement with the measurements of HORVÁT and PAPP (1964), carried out on Mt Szársomlyó.

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