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DRY GRASSLANDS IN THE SLOVENSKÝ KRAS MTS (SLOVAKIA) AND THE AGGTELEKI-KARSZT MTS (HUNGARY) – A COMPARISON OF TWO CLASSIFICATION APPROACHES

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Abstract

The paper brings numerical classification of 48 new phytosociological relevés of dry grassland vegetation from the Slovenský kras Mts and the Aggteleki-karszt Mts located on the border between Slovakia and Hungary (Central Europe). We performed a comparison of two classification approaches (an unsupervised method – modified TWINSPAN, and a supervised approach – electronic expert system based on formal definitions of associations), which were applied on the same dataset. Four associations were distinguished: *Campanulo divergentiformis-Festucetum pallentis* Zólyomi (1936) 1966, *Poo badensis-Caricetum humilis* (Dostál 1933) Soó ex Michálková in Janišová et al. 2007, *Alysso heterophylli-Festucetum valesiacae* (Dostál 1933) Kliment in Kliment et al. 2000 and *Festuco rupicolae-Caricetum humilis* Klika 1939. A newly recorded stand of the rare *Stipetum tirsae* Meusel 1938 association is characterised. What is more, we established a neotype of the *Alysso heterophylli-Festucetum valesiacae* association.

Key words: *Bromo pannonici-Festucion pallentis*, xerophilous grassland vegetation, electronic expert system, *Festucion valesiacae*, modified TWINSPAN, phytosociology, supervised and unsupervised classification, syntaxonomy.

Izvleček

V članku je predstavljena numerična klasifikacija 48 novih fitocenoloških popisov vegetacije suhih travnikov iz hribovja Slovenský kras in Aggteleki-karszt na meji med Slovaško in Madžarsko (srednja Evropa). Naredili smo primerjavo dveh klasifikacijskih metod (nenadzorovano metodo – modificirani TWINSPAN, in nadzorovano metodo – elektronski ekspertni sistem, ki temelji na formalnih definicijah asociacij), ki smo ju opravili na istem podatkovnem nizu. Ločili smo štiri asociacije: *Campanulo divergentiformis-Festucetum pallentis* Zólyomi (1936) 1966, *Poo badensis-Caricetum humilis* (Dostál 1933) Soó ex Michálková in Janišová et al. 2007, *Alysso heterophylli-Festucetum valesiacae* (Dostál 1933) Kliment in Kliment et al. 2000 in *Festuco rupicolae-Caricetum humilis* Klika 1939. Označili smo tudi novo nahajališče redke asociacije *Stipetum tirsae* Meusel 1938. Prav tako smo definirali neotip asociacije *Alysso heterophylli-Festucetum valesiacae*.

Ključne besede: *Bromo pannonici-Festucion pallentis*, kserofilna travniška vegetacija, elektronski ekspertni sistem, *Festucion valesiacae*, modificirana metoda TWINSPAN, fitosociologija, nadzorovana in nenadzorovana klasifikacija, sintaksonomija.

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INTRODUCTION

Vegetation of the unique dry grassland biotopes in the Slovenský kras Mts National Park and Biosphere Reserve (Slovakia) was studied by numerous top Slovak and Czech botanists in the past. The adjacent southern part of this karst area, the Aggteleki-karszt Mts National Park and Biosphere Reserve (Hungary), has been studied mainly for its flora composition. A detailed overview of botanical research in the study area was published in Michálková & Janišová (2008). Since the area forms a homogeneous geomorphological unit, it is necessary to study its vegetation complexly. In Slovakia and Hungary, the dry grassland vegetation has been studied separately in the past, resulting in diverse syntaxonomical evaluations (Borhidi 2003, Janišová et al. 2007). To link the two national approaches, a numerical analysis of all accessible relevés from the Slovenský kras Mts and Aggteleki-karszt Mts should be performed in the future (Dúbravková et al. in prep.).

The current paper brings actual vegetation data from the study area, which has been missing until now. During three vegetation seasons we organised fieldwork excursions to collect phytosociological relevés representing the actual species composition of the dry grassland sites including the vascular plants, bryophytes and lichens. The paper reveals new vegetation data of dry grasslands of the *Bromo pannonici-Festucion pallentis* and the *Festucion valesiacae* alliances. We compared classification of the dataset based on modified TWINSPAN algorithm (Roleček et al. 2008) with classification performed using the electronic expert system for identification of associations (Janišová et al. 2007). What is more, a typification of the *Alysso heterophylli-Festucetum valesiacae* association is performed and a new locality of *Stipetum tirsae*, a newly recorded association in the study area, is mentioned.

MATERIAL AND METHODS

1. Study area

Slovenský kras Mts and Aggteleki-karszt Mts belong to a homogeneous geomorphologic unit with identical geological structure and flora (Figure 1). It is

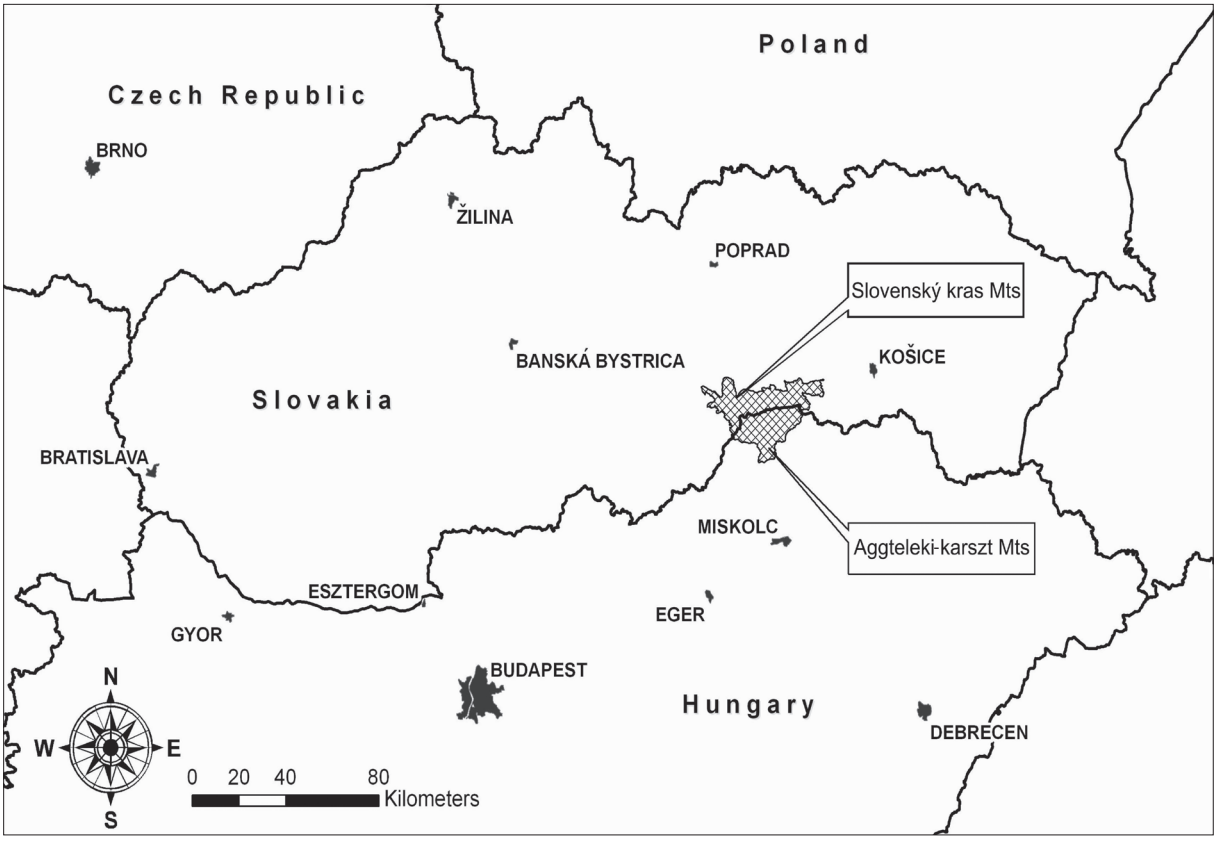

Figure 1: A map indicating location of the study area on the border between Slovakia and Hungary. Author of the map: R. Šuvada.
Slika 1: Karta nahajališč na raziskovanem območju na meji med Slovaško in Madžarsko. Avtor: R. Šuvada.

divided into two parts by a boundary line between Slovakia and Hungary, which is over 50 km long (Rozložník & Karasová 1994). The territory of the Slovenský kras Mts and Aggteleki-karszt Mts is one of the greatest and very well developed karst areas in Central Europe. The today's geomorphology of the area reaches back to the history of the Neogene and Pleistocene ages. The ground water system divided the plateau area formed of limestone into a complex of plateaux with numerous surface as well as underground karst phenomena (karst rocky fields, karst hollows, caves, abysses, gorges). The major soil type is rendzina. Although forests cover the majority of the study area, the karst phenomena indicate rich presence of the xerophilous steppe vegetation in sunny slopes, rocky fields and edges of plateaux. Based on Futák (1984), the area belongs to the Pannonian phytogeographical district (Pannonicum), zone of xerophilous flora of the prae-Matra area (Matricum). However, it is in close vicinity to the Western Carpathian Mts and some montane species enrich the flora of this area.

2. Vegetation survey and data analysis

The phytosociological relevés used in the analyses were sampled by applying the principles of the Zürich-Montpellier school (Braun-Blanquet 1964, Westhoff & van der Maarel 1973). They were collected during the vegetation seasons in 2005, 2006 and 2007. Longitude, latitude and altitude of the sampled sites were measured by eTrex Vista GPS set. We stored all the relevés in a TURBOWEG database (Hennekens & Schaminée 2001). The cover values of species in all relevés were transformed into the nine-degree ordinal scale (van der Maarel 1979). Vegetation data were processed in the JUICE 6.5 software (Tichý 2002), which helped in all procedures – performing modified TWINSPAN analysis, applying the expert system and creating Table 2.

For the purpose of numerical analyses, we have merged some problematically determinable species or subspecies, which were not determined in all relevés. These taxa are: *Campanula sibirica* (incl. *C. sibirica* subsp. *divergentiformis*), *Centaurea stoebe* (incl. *C. stoebe* subsp. *micranthos*), *Festuca valesiaca* s. lat. (incl. *F. valesiaca* and *F. pseudodalmatica*) and *Potentilla arenaria* s. lat. (incl. *P. arenaria* and *P. tommasiniana*). In Table 2, in the case of *Festuca valesiaca* s. lat., we indicate cover values of both a merged taxon (*F. valesiaca* s. lat., standard font size) and a relevant ploidity stage of *F. valesiaca* s. lat. (*F. valesiaca* s. str. – diploid 2n=2x or *F. pseudodalmatica* – tetraploid 2n=4x, smaller font size). The ploidity level of individual herbarium specimens was determined by Petr Šmarda (Masaryk University Brno, the Czech Republic) using laboratory methods. The ploidity stage of *Festuca valesiaca* s. lat. is very difficult to determine directly in the field. According to our actual knowledge, the ploidity itself has no major influence on the syntaxonomical classification of the stands (Michálková 2007: 47).

The numerical classification was performed using the modified TWINSPAN algorithm, a divisive classification method sensitively respecting the internal structure of the data. As a heterogeneity measure we used the total inertia index. Three pseudospecies cut levels (0 %, 5 %, 25 %) were applied. The results of numerical classification are summarised in Table 2. Percentage constancy (C) is given for each species in individual clusters. In small clusters (5 or less relevés) we indicate only the presence (P) of species in the cluster expressed as number of relevés with the species present. The diagnostic species for the clusters were selected subjectively. This selection rule was applied: constancy of diagnostic species was higher than 30 % and at the same time fidelity was higher than 0.3. As a fidelity measure, we applied the *phi* coefficient with the Fischer's exact test at the level of significance $P<0.05$ (Tichý & Holt 2006). The size of all clusters was standardised to equal size. The dry grassland vegetation in the study area is very variable, frequently forming transitions between different communities. For this reason, and because of small number of relevés in each cluster, the diagnostic species mentioned in this paper are set as preliminary.

Besides the unsupervised classification methods such as TWINSPAN, the vegetation data can be classified using methods of supervised classification. We compared the classification of relevés in Table 2 based on modified TWINSPAN analysis with the results of classification of the same dataset, using the electronic expert system for identification of associations (Janišová et al. 2007, http://ibot.sav.sk/ES_trav_veg_Sk.doc). The expert system was designed using the Cocktail method (Bruelheide 2000, Bruelheide & Chytrý 2000), a type of supervised classification approach. It is based on formal definitions of associations using exclusively floristic criteria (the presence of sociological species

groups in combination with species dominance). The expert system was created for the territory of the Slovak Republic using a large stratified dataset comprising all vegetation types. In spite of this, we dare apply it also for the Aggteleki-karszt Mts in Hungary since the Slovenský kras Mts and Aggteleki-karszt Mts are a geologically and floristically integrated area. Classification procedure based on the electronic expert system was accomplished in two steps: formal definition criteria fulfillment, and similarity index calculation.

Nomenclature of vascular plants and lichens is in accordance with Marhold & Hindák (1998), nomenclature of bryophytes with Kubinská & Janovicová (1996). The syntaxa names and assignment of species to diagnostic species for high-level syntaxa in Table 2 follow Janišová et al. (2007). The following abbreviations were used in the paper: agg. – aggregate, cl. – cluster, C-B – *Cirsio-Brachypodion pinnati*, E_2 – layer of shrubs, E_1 – layer of herbs, E_0 – layer of mosses and lichens, FPFI – frequency-positive fidelity index, incl. – inclusive (including), rel. – relevé, subsp. – subspecies, s. lat. – sensu lato (in a wide sense) and s. str. – sensu stricto (in a constricted sense). The cover values of species in Table 2 were abbreviated as follows: 2a–a, 2b–b and 2m–m.

RESULTS

1. Syntaxonomy

We identified five associations of dry grassland vegetation in the study area. Based on Janišová et al. (2007: 29) and Chytrý et al. (2007), the syntaxonomical position of these associations is as follows:

Classis: *Festuco-Brometea* Br.-Bl. et Tüxen ex Soó 1947
- Alliancia: *Bromo pannonici-Festucion pallentis* Zólyomi 1966
  - Associatio: *Campanulo divergentiformis-Festucetum pallentis* Zólyomi (1936) 1966
  - Associatio: *Poo badensis-Caricetum humilis* (Dostál 1933) Soó ex Michálková in Janišová et al. 2007
- Alliancia: *Festucion valesiacae* Klika 1931
  - Associatio: *Alysso heterophylli-Festucetum valesiacae* (Dostál 1933) Kliment in Kliment et al. 2000
  - Associatio: *Festuco rupicolae-Caricetum humilis* Klika 1939
  - Associatio: *Stipetum tirsae* Meusel 1938

2. Classification based on modified TWINSPAN analysis

Vegetation of the alliances *Bromo pannonici-Festucion pallentis* (dry grasslands of limestone and dolomite outcrops) and *Festucion valesiacae* (narrow-leaved continental steppes) was clearly separated at the highest classification level. Along the moisture and soil-depth gradient, we separated 5 clusters at the lower hierarchical level. Clusters 1–4 represent ecologically and floristically well-defined associations. The two relevés in cluster 5 show transition in their species composition towards the *Cirsio-Brachypodion pinnati* alliance.

The open vegetation of ***Campanulo divergentiformis-Festucetum pallentis*** (Table 2, cl. 1, rel. 1–5) occurs in extremely dry rocky stands with thin soil layer. The dominant species is *Festuca pallens*. In some stands *Carex humilis* and *Potentilla arenaria* agg. dominate as well, which indicates a shift in succession towards the *Poo badensis-Caricetum humilis* association. In individual cases, some powerful competitors can take over (e. g. *Anthyllis vulneraria*, *Bromus erectus*, *Stipa pulcherrima*). Rare endemic taxa *Astragalus vesicarius* subsp. *albidus* and *Onosma tornensis* grow in this vegetation type.

The ***Poo badensis-Caricetum humilis*** association (Table 2, cl. 2, rel. 6–29; Figure 2) occurs in karst rocky fields with humus rich soil accumulated in cracks between the boulders. The community settles the deforested south-facing slopes of the karst plateaus (e. g. Plešivská planina Plateau and Dolný vrch/Alsó-hegy Plateau). Dominant species are *Carex humilis*, *Stipa pulcherrima* and *Potentilla arenaria* agg. In places with deeper soil, the dominants are replaced by tussock grasses (e. g. *Festuca valesiaca*, *F. rupicola*) and the vegetation composition changes into the following association.

Semi-open vegetation of the ***Alysso heterophylli-Festucetum valesiacae*** association (Table 2, cl. 3, rel. 30–40; Figure 3) develops on deeper soil layers accumulated over karst limestone. The less extreme stands are located at bases of slopes where the substrate accumulation is possible. They commonly occur close to human settlements because the stands used to serve as pastures for sheep and cattle in the past.

Syntaxonomical remark:
Until now no nomenclatural type has been established for the *Alysso heterophylli-Festucetum valesiacae* association. Reasons for this fact are explained in Kliment et al. (2000: 169) and Michálková (2007: 40). The major problem was

Figure 2: *Poo badensis-Caricetum humilis* in the Slovenský kras Mts, Turniansky hradný vrch National Nature Reserve, township of Turňa nad Bodvou, 340 m above sea level. The open vegetation in a stand located on a rocky karst field. Flowering taxa are *Anthyllis vulneraria* and *Astragalus vesicarius* subsp. *albidus*. Photo: D. Dúbravková, May 2005.

Slika 2: Asociacija *Poo badensis-Caricetum humilis* na hribovju Slovenský kras, nacionalni naravni park Turniansky hradný vrch, občina Turňa nad Bodvou, 340 m nad morjem. Rastišče odprte vegetacije na kamnitem kraškem polju. Cvetoči vrsti sta *Anthyllis vulneraria* in *Astragalus vesicarius* subsp. *albidus*. Foto: D. Dúbravková, maj 2005.

absence of a relevé containing both taxa *Festuca valesiaca* and *Alyssum tortuosum* subsp. *heterophyllum*, and according to the International Code of Phytosociological Nomenclature (Weber et al. 2000, Art. 16) it would be suitable to be set as a neotype. Just for this purpose we decided to trace an appropriate locality and sample a relevé. We establish relevé No. 35 in Table 2 as **neotypus hoc loco** of the *Alysso heterophylli-Festucetum valesiacae* (Dostál 1933) Kliment in Kliment et al. 2000 association. Basionym (Dostál 1933): *Festucetum vallesiacae pannonicum* Dostál 1933.

Compared to previous associations, ***Festuco rupicolae-Caricetum humilis*** (Table 2, cl. 4, rel. 41–44) is less extreme in water deficiency. The closed stands are located in places with colder or more humid microclimate usually near forests or shrubberies. Besides the generalists of steppe habitats, some mesophilous meadow species are also present (e. g. *Arrhenatherum elatius, Filipendula vulgaris* and *Salvia pratensis*).

The last cluster (Table 2, cl. 5, rel. 45, 46) indicates a transition between the *Festucion valesiacae* and the *Cirsio-Brachypodion pinnati* alliances. *Brachypodium pinnatum* was not present in the sampled stands but it dominated in their vicinity. However, relevé 45 shows close relationships to the *Polygalo majoris-Brachypodietum pinnati* Wagner 1941 association.

Figure 3: *Alysso heterophylli-Festucetum valesiacae* in the Slovenský kras Mts, Turniansky hradný vrch National Nature Reserve, township of Turňa nad Bodvou, 345 m above sea level. Some of the noticeable species are *Festuca valesiaca*, *Koeleria macrantha, Sedum acre* and *Thymus pannonicus.* Photo: R. Šuvada, June 2005.

Slika 3: Asociacija *Alysso heterophylli-Festucetum valesiacae* na hribovju Slovenský kras, nacionalni naravni park Turniansky hradný vrch, občina Turňa nad Bodvou, 345 m nad morjem. Najbolj opazne so vrste: *Festuca valesiaca*, *Koeleria macrantha, Sedum acre* in *Thymus pannonicus.* Foto: R. Šuvada, junij 2005.

3. Classification based on the electronic expert system

A noticeable consensus between the results of modified TWINSPAN analysis and classification of the same dataset (Table 2) using the electronic expert system for identification of syntaxa was achieved in two associations (*Poo badensis-Caricetum humilis* and *Festuco rupicolae-Caricetum humilis*, Table 1). We explain the procedure of the expert system utilization and results interpretation using the example of the *Poo badensis-Caricetum humilis* association. An identical technique was used for other clusters. Electronic expert system classification was accomplished in two steps: formal definition criteria fulfillment and similarity index calculation. Five of all 24 relevés from cl. 2 fulfilled the criteria of the formal definition of *Poo badensis-Caricetum humilis*. For the individual relevés in cl. 2, which did not meet conditions of the definition, we calculated the Frequency-Positive Fidelity Index (FPFI, Tichý 2005), which expresses the similarity of species composition of a relevé and an association to be assigned to. The highest index values do not always mean that the relevé should undoubtedly be assigned to the association at the first position. The final classification result should be carefully indicated by the author concerning several most similar associations and looking at the information regarding their environmental and chorological conditions (Janišová 2007: 27). For this reason we looked at the three highest values of similarity index FPFI. If one of the associations with first three highest numbers of FPFI was the one which was set by the modified TWINSPAN analysis (e. g. for relevés in cl. 2 it is *Poo badensis-Caricetum humilis*), we considered the

relevé as correctly assigned to a proper association. The consensus of modified TWINSPAN and expert system classifications for the formal definition step, similarity measure step (FPFI) and their total is given in Table 1. Summing up, the compatibility of the two types of classification of relevés in cluster 2 was high: based on the formal definition criteria fulfillment 20.8 %, and based on similarity index calculation 58 % of relevés were assigned to the identical association.

Based on the fulfillment of a formal definition of the *Festuco rupicolae-Caricetum humilis* association, 3 from the 4 relevés in cl. 3 where classified within this association.

Table 1: A comparison of classification of relevés in Table 2 based on modified TWINSPAN analysis with the results of classification using the electronic expert system for identification of associations (Janišová et al. 2007).

Tabela 1: Primerjava klasifikacij popisov iz Tabele 2 med modificirano analizo TWINSPAN in rezultatom klasifikacije z elektronskim ekspertnim sistemom za prepoznavanje asociacij (Janišová et al. 2007).

	Cluster 1	**Cluster 2**	**Cluster 3**	**Cluster 4**
Association	*Campanulo divergentiformis-Festucetum pallentis*	*Poo badensis-Caricetum humilis*	*Alysso heterophylli-Festucetum valesiacae*	*Festuco rupicolae-Caricetum humilis*
Number of relevés in cluster	**5**	**24**	**11**	**4**
Rel. accomplishing a formal definition	0	5	1	3
Classification consensus (formal definition)	0 %	20.8 %	9.1 %	75 %
Rel. reaching first 3 highest values of FPFI	0	14	2	0
Classification consensus (FPFI)	0 %	58.0 %	18.2 %	0 %
Classification consensus total	**0 %**	**78.8 %**	**27.3 %**	**75 %**

In cases of the *Campanulo divergentiformis-Festucetum pallentis* and the *Alysso heterophylli-Festucetum valesiacae* associations, the results were not so plausible.

None of the relevés, that we identified as *Campanulo divergentiformis-Festucetum pallentis* according to the modified TWINSPAN analysis was classified within this association using the expert system. Beside the small number of relevés in cl. 1, we believe the reason is in the untypical character of the sampled sites. Degradation and successional shifts in the species composition is remarkable in the high cover values of *Anthyllis vulneraria* (Table 2, rel. 1–4) and *Bromus erectus* (rel. 5).

The formal definition of the *Alysso heterophylli-Festucetum valesiacae* association was fulfilled only by one relevé from cl. 3. The other two relevés showed the first to the third highest level of similarity coefficient FPFI for this association (one of them was rel. 35 – the newly established neotype of the association). The total agreement in the two classification approaches is 27 %. Reasons for such a little correspondence might be found in a few factors. It is possible that the formal definition of the association is set quite narrowly, incorporating only a small number of relevés with very typical species composition. What is more, the variability of stands dominated by *Festuca valesiaca* s. lat. in Central Europe is hard to trace. The vegetation comprises numerous steppe generalists and a small number of specialists, which are diagnostic for the individual communities. Therefore, besides the typical stands, a lot of relevés miss the specialists for many reasons or just by chance. The specific character of the individual communities dominated by *Festuca valesiaca* s. lat. might be diminished by abandonment of the sites. The cessation of grazing leads to homogenisation of species composition of these fragile steppe communities.

4. *Stipetum tirsae* Meusel 1938 – a new association in the study area

We recorded an interesting stand dominated by *Stipa tirsa* in the Aggteleki-karszt Mts, locality Galyatetö (rel. 1). A similar site occurs also in Szőlő-hegy Mt. (Figure 4). *Stipa tirsa* is a species of continental distribution, which occurs in Central Europe in relic localities indicating the former Pleistocene steppes (Chytrý et al. 2007: 422).

This vegetation syntaxonomically belongs to the ***Stipetum tirsae*** association. Compared to the diagnostic species listed in Chytrý et al. (2007: 421), four species are in common: *Festuca rupicola, Fragaria viridis, Stipa tirsa* and *Thymus pannonicus.*

Figure 4: *Stipetum tirsae* in the Aggteleki-karszt Mts, Szőlő-hegy Mt., township of Jósvafő, 324 m above sea level. Photo: V. Virók.
Slika 4: Asociacija *Stipetum tirsae* na hribovju Aggteleki-karszt, hribovje Szőlő-hegy, občina Jósvafő, 324 m nad morjem. Foto: V. Virók.

In place of the diagnostic moss *Weissia brachycarpa*, *W. controversa* occurs in our stand. The numerical analysis showed a close relationship of this relevé to *Festuco rupicolae-Caricetum humilis*. Both associations are the least xerophilous associations within the *Festucion valesiace* alliance. The slightly mesic character of the stand is fully reflected in the species composition (rel. 1). This also may be caused by shrubs, which partly shade the locality.

The stands of *Stipetum tirsae* are usually species-poor (Meusel 1938, Chytrý et al. 2007). Relevé 1 includes as many as 42 species, however cover value of 14 species does not exceed 1 % (r). These species were leaf rosettes and isolated individuals, which penetrated into the stand from species-rich surrounding vegetation types (fringe vegetation and rocky dry grasslands).

Relevé 1
HU, Aggteleki-karszt Mts, Aggtelek, Galya-tetö, upper part of a karst rocky field above the village, a grassland surrounded by shrubs, 48°28'19"N, 20°30'43"E, 20 m^2, 396 m a. s. l., W (260°), 30°, E_t 100 %, E_1 100 %, E_0 2 %, V. Virók, D. Dúbravková & E. Illyés, 39/06, 29. 5. 2006.

E_1: *Stipa tirsa* 4, *Festuca rupicola* 2b, *Achillea pannonica* 2a, *Fragaria viridis* 2a, *Arrhenatherum elatius* 1, *Salvia pratensis* 1, *Agrimonia eupatoria* +, *Allium flavum* +, *Brachypodium sylvaticum* +, *Dorycnium pentaphyllum* agg. +, *Eryngium campestre* +, *Tithymalus cyparissias* +, *Koeleria macrantha* +, *Poa angustifolia* +, *Potentilla arenaria* +, *Sedum sexangulare* +, *Teucrium chamaedrys* +, *T. montanum* +, *Thymus pannonicus* +, *Vicia angustifolia* +, *V. hirsuta* +, *Ligustrum vulgare* juv. +, *Prunus spinosa* juv. +, *Rosa canina* agg. juv. +, *Carduus nutans* r, *Daucus carota* r, *Echinops sphaerocephalus* r, *Filipendula vulgaris* r, *Geranium pusillum* r, *Lepidium campestre* r, *Myosotis arvensis* r, *Picris hieracioides* r, *Pyrus pyraster* juv. r, *Ranunculus bulbosus* r, *Stachys germanica* r, *Vincetoxicum hirundinaria* r, *Viola hirta* r.
E_0: *Brachythecium glareosum* +, *Schistidium apocarpum* +, *Thuidium abietinum* +, *Weissia controversa* +.

DISCUSSION AND CONCLUSIONS

The comparison of classification of the same dataset using an unsupervised method (TWINSPAN) and a supervised approach (expert system) brought some interesting points to discuss.

Both of the classification approaches have advantages and disadvantages. The divisive (TWINSPAN) and agglomerative classification methods (cluster analyses) seek to find major gradients in data variability and the algorithm used creates clusters as homogeneous as possible, according to the internal information in the analysed data set. The variability of species composition in plant communities is usually continuous (Chytrý 2007: 20). Therefore the "sharp edges" between clusters might sometimes be artificially defined. For the purpose of clusters' interpretation, the unifying features of clusters as complex units are emphasised. There is a risk that a cluster might include some rather different relevés just because they are most similar to this cluster concerning the whole analysed dataset. This might distort the results of classification.

On the other hand, the expert system applies an individual approach to relevés, which leads to a less generalised interpretation of classification. The supervised classification uses external predefined criteria of what the individual vegetation units should look like. These criteria are independent from the classified dataset. This means that the actually analysed data do not serve as a dataset for calibration of the classification. The expert system was calibrated by a dataset, which served for its creation – a stratified dataset including all vegetation types of the territory for which it was created (it was Slovakia in our case). Although the accuracy of correct classification of relevés depends on numerous factors, it still remains a great tool for relevés classification.

An important advantage of the expert system usage lies in the identification of transitional stands. For example, rel. 3 and 4 in Table 2 were classified as *Poo badensis-Caricetum humilis*; rel. 8, 19, 39, 40, 46 in Table 2 and rel. 1 mentioned in the text (*Stipetum tirsae*) were identified as *Festuco rupicolae-Caricetum humilis*. Although these results cannot be implicitly accepted by the modified TWINSPAN analysis and our field observations, it is evident that the species composition of these particular relevés is shifted towards the mentioned associations.

Concluding the results, we find combined usage of both unsupervised method (divisive or agglomerative classification) and supervised method (expert system) to be a very informative and favourable tool for the vegetation data classification. However, the expert knowledge and experience of a researcher performing the classification remain one of the key factors in correct interpretation of any classification approach.

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Table 2: Communities of the *Bromo pannonici-Festucion pallentis* and the *Festucion valesiacae* alliances with dendrogram of the modified TWINSPAN analysis.

Tabela 2: Združbe zvez *Bromo pannonici-Festucion pallentis* in *Festucion valesiacae* na dendrogramu modificirane analize TWINSPAN.

Alliance	*Bromo pannonici-Festucion pallentis*					*Festucion valesiacae*					
Cluster No.	1		2			3		4		5	
Association	*Campanulo divergentiformis-Festucetum pallentis*		*Poo badensis-Caricetum humilis*			*Alysso heterophylli-Festucetum valesiacae*		*Festuco rupicolae-Caricetum humilis*		*Transition to C-B*	
Relevé No.	1 2 3 4 5	**P**	6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	**C (%)**		30 31 32 33 34 35 36 37 38 39 40	**C (%)**	41 42 43 44	**P**	45 46	**P**
E$_2$											
Rosa canina agg.	. . . . .	.	. . + + . . + + ... 1 . . . . . + ... r	**29**		. + + r . + . . + . .	**45**	. + . .	**1**	. .	.
Juniperus communis	. . . . .	.	. . . .	.		. + . . + + ... r	**36**	. . . .	.	. .	.
Ligustrum vulgare	. . . . .	.	+ + + ... 1 . . . . + ...	**21**		. . . . + + ...	**18**	+ . . .	**1**	. .	.
Pyrus pyraster	. . . . .	.	. . . . + . r . r . . .	**13**		. + r	**18**	. . . .	.	. .	.
Fraxinus ornus	. . . . .	.	r + . . . r . . . . + . .	**17**		. . . .	.	+ . . .	**1**	. .	.
Berberis vulgaris	. . . . .	.	+ + . . . + + ...	**17**		. . . . . + ...	**9**	. . . .	.	. .	.
Crataegus monogyna	. . . . .	.	. . . . + ... + r . . .	**13**		. . . . + ...	**9**	. . . .	.	. .	.
Cerasus mahaleb	. . . . +	**1**	. . . + + 1	**13**		. . . . . . + ...	**9**	. . . .	.	. .	.
Quercus pubescens agg.	. + . . .	**1**	. . . . + . + ...	**8**		r . . . . r	**18**	. . . .	.	. .	.
Prunus spinosa	. . . . .	.	. . . . 1	**4**		. . . r . . . . . + .	**18**	. . . .	.	. .	.
Swida sanguinea	. . . . +	**1**	. . . . + ...	**4**		. . . . + ...	**9**	+ . . .	**1**	. .	.
E$_1$											
Diagnostic species of individual clusters											
Anthyllis vulneraria	a 4 b b 1	**5**	+ . . . . + 1	**13**		. b + + a + . . . + +	**64**	+ . . .	**1**	+ .	**1**
Minuartia setacea	+ 1 + + +	**5**	. . . .	.		. . . .	.	. . . .	.	. .	.
Tortella tortuosa E$_0$	1 1 1 1 +	**5**	1 1 . 1 . . 1 . 1 . . 1 1 . . . m	**33**		. . . 1 . 1	**18**	. . . .	.	. .	.
Rhodax canus	1 1 1 a .	**4**	. . . .	.		. . . .	.	. . . .	.	. .	.
Anthericum ramosum	+ + + a .	**4**	+ . . + ... r + r r . . + ...	**29**		. . . .	.	. . . .	.	. .	.
Cerastium glutinosum	+ . + + +	**4**	. . . . + . + ... + + +	**21**		. . . . . . 1	**9**	. . + .	**1**	. .	.
Orobanche alba	. + + + +	**4**	. . + ... + . + ... + + ...	**21**		. . . . . . + ...	**9**	. . + .	**1**	. .	.
Festuca pallens	b 3 a . .	**3**	. . . .	.		. . . .	.	. . . .	.	. .	.
*Astragalus *albidus*	. 1 a a .	**3**	. . . . + ... r	**8**		. . . .	.	. . . .	.	. .	.
Linum tenuifolium	. b a + .	**3**	. . . . + ...	**4**		. . . . . + ...	**9**	. . . .	.	. .	.
Onosma tornensis	. . + 1 +	**3**	. . . .	.		. . . .	.	. . . .	.	. .	.

Relevé No.	1	2	3	4	5	P	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	C (%)	30	31	32	33	34	35	36	37	38	39	40	C (%)	41	42	43	44	P	45	46	P
Carex humilis	3	3	a	b	.	**4**	3	3	3	a	b	a	3	3	b	3	+	3	a	1	+	.	.	.	.	.	.	.	.	.	**63**	.	.	+	a	.	+	.	.	.	.	.	**27**	.	.	.	.	**.**	.	.	**.**
Stachys recta	.	.	.	1	+	**2**	.	+	+	+	r	+	+	+	r	+	.	r	+	+	r	+	+	+	+	+	+	+	.	+	**88**	+	.	.	r	.	.	.	+	.	.	**27**	.	1	1	1	**3**	1	+	**2**
Lactuca perennis	.	.	.	.	.	**.**	+	+	.	1	+	+	1	+	r	+	r	+	.	+	+	.	.	+	+	+	.	r	r	+	**79**	.	.	.	.	.	.	+	+	.	.	**18**	.	.	.	.	**.**	.	+	**1**
Stipa pulcherrima	3	.	a	.	.	**2**	.	.	.	a	3	b	b	b	+	r	+	b	a	+	1	4	3	1	3	3	a	.	.	**75**	.	.	.	.	.	.	.	.	.	.	.	**.**	+	.	4	.	**2**	.	3	**1**
*Helianthemum *obscurum*	.	.	.	+	.	**1**	+	+	+	+	+	.	+	+	+	.	+	+	1	+	+	+	1	+	+	.	.	.	.	.	**71**	.	.	1	.	.	r	.	1	.	.	**27**	.	.	.	+	**1**	.	.	**.**
Verbascum lychnitis	.	.	.	.	.	**.**	.	+	.	+	+	+	+	r	.	+	.	+	.	+	.	.	r	r	+	+	+	+	+	+	**67**	+	.	.	.	.	.	+	.	.	.	**18**	.	.	.	.	**.**	.	.	**.**
Taraxacum sect. *Erythrosperma*	.	.	+	.	.	**1**	+	+	r	+	+	+	+	.	.	+	+	+	+	+	+	.	.	.	.	+	.	+	.	+	**67**	.	.	.	.	+	r	+	.	+	.	.	**36**	.	.	.	.	**.**	.	.	**.**
Thlaspi perfoliatum	.	.	.	.	.	**.**	.	r	+	+	r	.	+	+	+	.	r	+	+	+	+	.	.	+	+	+	.	.	.	.	**63**	+	.	+	.	.	.	+	.	+	.	.	**36**	.	1	+	1	**3**	.	.	**.**
Asplenium ruta-muraria	+	.	.	+	.	**2**	+	r	.	+	r	r	r	.	.	.	r	+	.	.	+	.	+	.	.	+	+	r	r	.	**58**	.	.	.	.	.	.	.	.	.	.	.	**.**	.	.	.	.	**.**	.	.	**.**
Pleurochaete squarrosa E_0	.	.	.	.	.	**.**	.	.	+	+	.	.	.	1	1	1	.	.	.	+	.	.	+	+	+	1	+	1	1	**54**	1	.	.	.	.	.	+	.	.	.	.	**18**	.	.	.	.	**.**	.	.	**.**
Polygonatum odoratum	.	.	.	.	.	**.**	+	r	.	.	1	.	+	.	+	.	r	+	+	+	+	.	.	+	.	.	+	.	.	.	**50**	.	.	.	.	.	.	.	.	.	.	.	**.**	.	.	.	.	**.**	.	.	**.**
*Thymus *praecox*	+	.	.	.	.	**1**	.	+	.	1	+	1	1	1	.	.	m	+	.	.	.	.	.	.	.	a	.	+	1	.	**46**	+	.	.	.	.	.	.	.	.	.	.	**9**	.	.	.	.	**.**	.	.	**.**
Schistidium apocarpum E_0	.	+	.	.	.	**1**	.	+	+	+	.	.	+	.	1	.	.	1	.	.	.	.	1	.	.	.	+	.	+	+	**42**	.	.	.	.	.	.	.	+	.	.	.	**9**	.	.	.	.	**.**	.	.	**.**
Pulsatilla grandis	.	.	.	.	.	**.**	+	+	r	.	.	.	+	.	.	+	r	+	1	+	.	.	.	.	.	.	.	.	.	.	**38**	.	.	.	.	.	.	.	.	.	.	.	**.**	.	.	.	.	**.**	.	.	**.**
Geranium sanguineum	.	.	.	.	.	**.**	r	.	+	.	r	.	.	+	+	.	.	+	.	.	.	.	+	+	+	.	.	.	.	.	**38**	.	.	+	.	.	.	.	+	.	.	.	**18**	.	.	.	.	**.**	.	.	**.**
Weissia condensa E_0	.	.	.	.	.	**.**	.	.	+	.	.	.	.	+	.	1	.	+	.	.	1	.	.	.	+	.	+	.	.	+	**33**	.	.	.	.	.	.	.	+	.	.	.	**9**	.	.	.	.	**.**	.	.	**.**
Festuca valesiaca s.lat.	.	.	.	1	1	**2**	3	b	+	a	r	3	a	1	.	+	.	.	.	+	.	.	b	1	1	b	+	+	1	**71**	4	b	3	3	5	b	3	4	a	+	.	**91**	.	+	.	.	**1**	.	.	**.**
Festuca valesiaca s.str.	.	.	.	1	1		3	.	+	a	r	3	.	.	.	+	.	.	.	+	.	.	b	.	1	.	+	+	1		.	.	3	3	.	b	3	4	.	+	.		.	+	.	.		.	.	
Festuca pseudodalmatica	.	.	.	.	.		.	b	.	.	.	.	a	1	.	.	.	.	.	.	.	.	.	1	.	b	.	.	.		4	b	.	.	5	.	.	.	a	.	.		.	.	.	.		.	.	
Poa angustifolia	.	.	.	.	.	**.**	+	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	+	.	.	.	**21**	+	+	a	.	+	.	+	r	.	+	1	**73**	1	1	.	.	**2**	.	.	**.**
Securigera varia	.	.	.	.	.	**.**	+	.	.	+	.	r	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	**17**	a	+	+	.	+	+	.	.	+	+	+	**73**	1	+	.	+	**3**	+	.	**1**
Achillea nobilis	.	.	.	.	.	**.**	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	+	**17**	+	+	.	.	1	+	+	+	.	.	+	**64**	.	.	.	.	**.**	.	.	**.**
Lepidium campestre	.	.	.	.	.	**.**	.	.	+	.	.	.	r	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	**13**	.	+	.	+	+	.	.	+	+	+	+	**64**	.	.	.	.	**.**	.	.	**.**
Convolvulus arvensis	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	.	.	.	**13**	+	+	+	+	+	.	.	+	.	.	.	**55**	1	+	.	.	**2**	.	.	**.**
Agrimonia eupatoria	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	**8**	.	a	.	+	+	.	.	.	+	+	+	**55**	a	.	+	.	**2**	.	.	**.**
Medicago lupulina	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	**4**	+	.	+	+	+	.	.	.	.	+	1	**55**	.	.	.	.	**.**	.	.	**.**
Hypnum cupressiforme E_0	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**.**	.	1	.	1	1	.	.	.	a	+	a	**55**	.	.	.	.	**.**	.	.	**.**
Arrhenatherum elatius	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**.**	.	4	+	.	+	.	+	.	.	.	a	**45**	3	.	.	.	**1**	.	.	**.**
Pilosella officinarum	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**.**	.	+	.	+	+	.	.	.	.	+	+	**45**	+	.	.	.	**1**	.	.	**.**
Plantago lanceolata	.	.	+	.	.	**1**	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	**8**	+	.	.	+	+	.	.	.	.	.	+	**36**	+	.	+	.	**2**	.	.	**.**
Cladonia symphycarpa E_0	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	**8**	.	.	.	+	.	.	.	.	+	+	+	**36**	.	.	.	.	**.**	.	.	**.**
Cladonia furcata E_0	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	**4**	.	.	+	.	.	.	.	.	+	+	+	**36**	.	.	.	.	**.**	.	.	**.**
*Alyssum *heterophyllum*	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**.**	.	.	.	.	.	1	.	.	.	.	.	**9**	.	.	.	.	**.**	.	.	**.**
Achillea pannonica	.	.	+	.	.	**1**	.	+	.	.	.	+	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	**21**	.	1	1	1	+	+	+	.	+	r	.	**73**	+	+	+	+	**4**	1	1	**2**
Seseli hippomarathrum	.	.	.	.	+	**1**	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	**8**	.	.	.	.	.	.	.	.	.	.	.	**.**	.	+	+	+	**3**	.	.	**.**
Genista pilosa	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	**8**	.	.	.	.	.	.	.	.	.	.	.	**.**	.	+	+	+	**3**	.	.	**.**
Valerianella rimosa	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	**8**	.	.	.	.	.	.	.	.	.	.	.	**.**	.	+	+	+	**3**	.	.	**.**
Filipendula vulgaris	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	**4**	.	.	.	.	.	.	.	.	.	+	.	**9**	.	+	.	+	**2**	.	+	**1**

Festuca rupicola	. . 3 . .	**1**	. . a . . . . b 3 3	**17**	. . . . + b 3	**27**	4 5 b 5	**4**	1 b	**2**
Chamaecytisus albus	. . . . .	**.**	. . . .	**.**	. . . .	**.**	. . . .	**.**	1 b	**2**
Dianthus pontederae	. . . . .	**.**	. 1 . + ... + ...	**13**	. . . . 1 .	**9**	. + . .	**1**	1 +	**2**
Peucedanum cervaria	. . . . .	**.**	. . . . + ...	**4**	. . . .	**.**	. . . .	**.**	+ +	**2**
Vicia cracca agg.	. . . . .	**.**	. . . .	**.**	. . . .	**.**	. . . .	**.**	+ +	**2**
Onobrychis viciifolia	. . . . .	**.**	. . . .	**.**	. . . .	**.**	. . . .	**.**	+ +	**2**
Colymbada scabiosa	. . . . +	**1**	. . . r . . . . +	**8**	. . . .	**.**	. . . .	**.**	+ +	**2**
Bromo pannonici-Festucion pallentis										
Teucrium montanum	+ . + + +	**4**	. . 1 + + + + + . 1 . + 1 + . + + + + + + + + +	**79**	. . + + . 1 . + + . +	**55**	. . . 1	**1**	+ .	**1**
Campanula sibirica	+ a 1 + .	**4**	. . . . . + . . . + . + . + . 1 + + + . . + + +	**46**	. + r . + + . + + . .	**55**	. . + .	**1**	+ +	**2**
Alyssum montanum	a a + + +	**5**	. . + ... + ... 1 + . + . . 1 + +	**33**	. . + . . . + . . + .	**27**	+ . + .	**2**	. .	**.**
Poa badensis	. + + + .	**3**	+ . . r . . . . m 1 1 + . + 1 1 a . . . . + . .	**46**	. . . . . r	**9**	1 . . .	**1**	. .	**.**
*Jovibarba *hirta*	. . . . .	**.**	. . . + . + . . . + . + . . . + 1 . . + . + + .	**38**	. . + + + . 1 + + . .	**55**	+ . 1 .	**2**	. .	**.**
Silene otites	. . . . .	**.**	. . . . + ... + 1 . . . . + + +	**25**	. . . + . . . + r . .	**27**	b . + .	**2**	. .	**.**
Inula ensifolia	a . . 1 .	**2**	. . + + r + . + . . . + . 1 . + . 1 r	**42**	. . . .	**.**	. . . .	**.**	+ a	**2**
Onosma visianii	+ . + . .	**2**	. . . r . . . + ... 1	**13**	. . . .	**.**	. . 1 .	**1**	. .	**.**
Festucion valesiacae										
Koeleria macrantha	. . . a 1	**2**	. . a 1 + + a a + 1 + a b m + a + + + 1 1 + + a	**92**	a a 1 a b + b 3 . a 1	**91**	. b a a	**3**	+ +	**2**
Eryngium campestre	. . . . +	**1**	+ . . + + + + + + . . r + . . + + + + + + + r .	**71**	+ + . 1 + + + + . + +	**82**	1 1 1 +	**4**	. +	**1**
Thymus pannonicus	1 a a r +	**5**	1 . . . . + . + 1 + . . . + . . a . . +	**33**	. a + 1 1 + b . 1 + a	**82**	. a 1 a	**3**	+ +	**2**
Arenaria serpyllifolia agg.	+ . + r .	**3**	. . + . . r . + + + . + + + + . + + . + . + + +	**63**	. . r . . . + + + . +	**45**	. . . +	**1**	. .	**.**
Sedum sexangulare	. . . . .	**.**	. . . + . . . + ... + + . . + + + + +	**38**	+ + . + + + . + + . 1	**73**	. + + .	**2**	. .	**.**
Echium vulgare	+ b 1 . .	**3**	. . r . . . . + ... r . + + ... +	**25**	+ + r . + . . + r . .	**55**	. . + +	**2**	. .	**.**
Acosta rhenana agg.	+ 1 + + .	**4**	. . . . r . . . . + . + . r . . . + ... +	**25**	. . + ... + . . +	**27**	. + + .	**2**	. .	**.**
Stipa capillata	. . . a .	**1**	. . + ... a . . 1 . . . + + . . . + + b	**33**	. . . . 1 . . + . . 1	**27**	. . 1 .	**1**	. .	**.**
Acinos arvensis	. 1 + . .	**2**	. . + . . r . + . + . . . r . . . . + + + . . .	**33**	. . . . +	**9**	. . + .	**1**	. .	**.**
Adonis vernalis	. . + . .	**1**	. 1 . . . . 1 . . . . . + ... + ...	**17**	. . 1 . . . . . + + .	**27**	. . . .	**.**	. .	**.**
Medicago minima	. . . . .	**.**	. . . . + + r + +	**21**	+ . . . . . 1 . . . +	**27**	. . . .	**.**	. .	**.**
Tragopogon dubius	+	**1**	. . . . r + . + ... +	**17**	. . . . . . + ...	**9**	. . + .	**1**	. .	**.**
Saxifraga tridactylites	. . . . .	**.**	. . . . + + . . . r	**13**	. . . . + . . .	**9**	. . . .	**.**	. .	**.**
Cirsio-Brachypodion pinnati										
Pilosella bauhinii	1 . . + .	**2**	. . + . m . . + . + r . . . + + + + + . . + + a	**54**	+ + + + 1 . . + + . r	**73**	+ . 1 .	**2**	1 .	**1**
Scabiosa ochroleuca	. . . . .	**.**	. . + r r . . . . . . + . + . . . + . . + . . +	**33**	. + . + . + . r + r +	**64**	. + . .	**1**	. r	**1**
Viola hirta	. . . . .	**.**	+ + . + . r + r . . . . r + . . + . . . +	**42**	. + + . + . . . + . .	**36**	+ . . +	**2**	. .	**.**
Aster amellus	. . . . .	**.**	. . . . + ... 1 . . . + ...	**13**	. . . . + . .	**9**	. . . .	**.**	. +	**1**
Carex michelii	. . . . .	**.**	r	**4**	. . + ... + . .	**18**	. . . +	**1**	. +	**1**
Plantago media	. . . . .	**.**	. . . .	**.**	. + . . . r	**18**	. . . .	**.**	+ .	**1**
Festuco-Brometea										
Teucrium chamaedrys	+ + + + +	**5**	a a a a a a 1 m + 1 r 1 a m + a a 1 b m 3 + . +	**96**	a 1 1 b 1 1 a a a m m	**100**	a b a a	**4**	m .	**1**
Potentilla arenaria s.lat.	3 1 a b 1	**5**	3 . b a + m 3 a 3 3 b a a + 3 3 4 b a b + 3 4 a	**96**	3 1 + 3 b 1 . b b 3 4	**91**	1 b 3 b	**4**	. .	**.**

Relevé No.	1	2	3	4	5	P	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	C (%)	30	31	32	33	34	35	36	37	38	39	40	C (%)	41	42	43	44	P	45	46	P
Tithymalus cyparissias	a	a	+	+	+	**5**	1	.	a	+	m	1	+	+	1	+	1	1	1	m	1	+	+	+	1	1	+	1	+	.	**92**	1	+	+	+	1	+	1	+	+	+	+	**100**	.	1	+	+	**3**	+	+	**2**
Bothriochloa ischaemum	.	.	1	1	+	**3**	.	.	1	+	.	+	1	+	+	1	+	.	1	.	+	1	+	1	+	+	+	+	m	1	**79**	+	+	.	1	1	a	1	a	.	1	a	**82**	.	.	.	1	**1**	+	.	**1**
Allium flavum	+	.	.	+	.	**2**	+	+	+	+	.	.	+	r	+	+	.	+	+	.	r	+	+	+	+	.	+	r	.	r	**75**	.	.	+	+	+	r	.	+	+	.	.	**55**	.	+	+	+	**3**	.	.	**.**
Dorycnium pentaphyllum agg.	a	.	.	1	+	**3**	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.	r	+	+	**29**	1	b	+	+	b	.	.	.	+	1	.	**64**	.	1	.	+	**2**	+	1	**2**
Salvia pratensis	.	+	.	1	a	**3**	.	+	.	+	r	+	+	+	.	.	.	.	+	r	+	+	1	1	.	.	.	.	.	.	**50**	.	.	1	+	.	+	+	.	1	1	.	**55**	.	1	1	a	**3**	.	.	**.**
Fragaria viridis	.	.	.	.	.	**.**	1	+	+	.	.	.	.	.	.	.	r	.	a	.	.	.	+	.	m	+	.	.	.	.	**33**	m	b	.	.	1	+	.	.	1	+	m	**64**	.	1	a	a	**3**	a	+	**2**
Asperula cynanchica	.	.	.	.	.	**.**	.	.	+	+	+	+	+	+	+	+	r	+	.	.	.	.	+	+	+	.	r	+	+	**67**	+	.	.	r	.	+	.	+	+	+	.	**55**	.	+	.	+	**2**	.	.	**.**
Hypericum perforatum	.	.	+	.	+	**2**	+	r	+	.	.	+	.	r	.	+	.	.	.	r	.	.	.	+	r	.	+	r	+	+	**54**	r	+	.	.	.	.	.	+	.	.	+	**36**	.	.	.	+	**1**	.	.	**.**
Melica ciliata	1	.	.	.	+	**2**	.	.	+	.	.	.	.	1	.	+	.	.	.	.	.	.	.	+	a	+	+	+	+	1	**42**	.	.	1	+	1	.	.	+	+	.	.	**45**	.	.	.	1	**1**	.	.	**.**
Thesium linophyllon	.	+	+	.	.	**2**	.	.	+	r	.	5	.	+	.	+	.	.	.	.	+	.	.	.	+	+	+	+	+	.	**46**	.	.	+	.	.	.	.	+	.	+	.	**27**	.	.	.	.	**.**	1	+	**2**
Seseli osseum	.	.	.	+	.	**1**	.	.	.	.	+	.	.	.	+	+	1	.	r	+	.	.	+	.	+	.	+	+	+	.	**50**	.	.	+	.	.	.	+	1	+	.	.	**36**	.	.	.	.	**.**	.	+	**1**
Sanguisorba minor	.	.	.	.	.	**.**	.	.	r	.	.	.	.	.	.	.	.	+	.	.	.	+	+	.	.	.	.	r	+	.	**25**	.	+	.	+	+	+	.	+	+	+	+	**73**	+	.	.	.	**1**	1	+	**2**
Hippocrepis comosa	.	.	.	.	.	**.**	1	.	.	+	+	.	m	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	**33**	.	+	+	.	1	.	.	.	+	1	.	**45**	.	+	.	+	**2**	+	+	**2**
Arabis hirsuta agg.	.	.	.	.	+	**1**	+	r	.	.	+	+	.	.	.	.	+	.	+	.	.	r	.	.	.	.	r	.	+	**38**	+	+	+	.	+	.	.	+	.	+	.	**55**	.	.	.	.	**.**	.	.	**.**
Medicago falcata	.	.	+	.	.	**1**	.	.	+	+	1	+	+	.	+	.	.	+	.	.	.	.	.	+	.	.	r	.	.	**38**	.	.	+	.	.	.	.	.	+	+	**27**	.	.	+	.	**1**	.	.	**.**
Primula veris	.	.	.	.	.	**.**	+	+	.	+	.	.	.	.	.	.	+	.	1	.	.	.	.	.	r	.	.	.	**25**	.	.	.	.	.	.	.	.	.	.	.	.	**.**	.	.	.	.	**.**	.	.	**.**
Trifolium montanum	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	**13**	.	.	.	.	.	.	.	.	.	+	.	**9**	.	.	.	.	**.**	+	.	**1**
Bromus erectus	.	.	.	.	4	**1**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**.**	.	1	.	.	.	+	.	.	.	.	.	**18**	.	.	.	.	**.**	b	.	**1**
Galium verum	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**.**	+	.	.	.	.	.	+	.	+	.	.	**27**	.	.	.	+	**1**	.	.	**.**
Carex caryophyllea	.	.	.	.	.	**.**	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	**8**	.	.	.	.	.	.	.	.	.	m	.	**9**	.	.	.	.	**.**	.	.	**.**
Polygala major	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	**8**	.	.	.	.	.	.	.	.	.	+	.	**9**	.	.	.	.	**.**	.	.	**.**
Other taxa																																																			
Erysimum odoratum	.	+	1	+	+	**4**	+	.	+	.	.	.	.	.	+	.	+	+	.	.	+	+	+	.	+	+	+	+	+	+	**54**	+	.	+	.	.	.	+	+	.	.	**36**	+	.	+	.	**2**	.	.	**.**
Sedum acre	.	.	.	.	+	**1**	.	r	.	.	.	r	r	+	+	+	.	.	1	+	+	.	.	+	r	+	.	.	.	1	**54**	.	.	.	+	.	.	1	.	+	.	.	**27**	+	1	+	.	**3**	.	+	**1**
Vincetoxicum hirundinaria	.	.	.	+	+	**2**	r	+	.	r	r	.	+	.	.	r	.	.	.	r	.	.	.	.	+	.	.	.	.	+	**38**	r	.	.	.	.	.	.	.	.	.	.	**9**	.	.	.	+	**1**	.	.	**.**
Artemisia campestris agg.	.	.	.	.	+	**1**	.	.	.	+	.	r	+	.	.	.	.	.	.	.	r	+	+	.	r	.	.	.	.	1	**33**	.	.	+	.	.	.	.	.	+	.	.	**18**	.	.	1	+	**2**	.	+	**1**
Vicia angustifolia	.	.	.	.	.	**.**	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	**17**	+	.	.	.	.	.	.	+	.	+	.	**27**	r	+	.	.	**2**	.	.	**.**
Origanum vulgare	.	.	.	.	.	**.**	+	r	.	.	.	+	+	.	.	.	.	+	.	.	+	+	+	.	.	.	.	.	.	.	**33**	.	.	1	.	.	.	+	.	+	.	.	**27**	+	.	+	.	**2**	.	.	**.**
Ranunculus bulbosus	.	.	.	.	.	**.**	1	+	+	.	.	+	+	.	.	.	+	r	.	.	r	.	.	.	.	.	.	.	.	.	**33**	.	1	.	.	.	.	.	.	.	.	.	**9**	1	+	.	+	**3**	.	.	**.**
Elytrigia intermedia	.	.	.	.	.	**.**	.	.	.	.	.	.	.	.	.	.	.	.	.	+	m	.	.	+	+	.	.	.	.	.	**17**	.	.	+	+	.	.	.	+	.	.	+	**36**	.	a	+	b	**3**	3	.	**1**
Genista tinctoria	.	.	.	.	+	**1**	.	r	+	.	.	+	.	.	.	.	.	.	a	+	+	.	.	.	.	.	.	.	.	.	**25**	.	+	.	.	.	1	.	.	.	1	.	**27**	+	.	a	.	**2**	.	+	**1**
Veronica austriaca	.	.	.	.	.	**.**	.	.	.	.	.	r	+	+	.	.	.	+	.	r	.	.	.	.	.	+	+	.	.	.	**29**	+	.	+	.	.	.	+	.	+	.	.	**36**	.	.	.	.	**.**	.	.	**.**
Linaria palidiflora	.	.	.	.	.	**.**	.	.	+	+	+	.	.	+	.	.	+	.	.	+	.	.	.	.	+	.	.	.	.	.	**29**	r	.	.	.	.	.	.	.	.	.	.	**9**	.	+	1	.	**2**	.	.	**.**
Aster linosyris	.	.	.	+	+	**2**	.	.	.	.	.	.	.	+	.	r	.	+	.	1	.	.	.	1	+	.	.	.	.	+	**29**	.	.	.	.	.	.	.	.	.	.	.	**.**	.	.	.	.	**.**	.	.	**.**
Sedum album	.	.	.	.	.	**.**	.	.	.	.	r	.	.	1	r	+	.	.	+	+	+	.	.	.	.	.	.	.	.	.	**29**	.	.	r	.	.	.	.	.	.	.	.	**9**	.	.	.	.	**.**	.	.	**.**
Pseudolysimachion spicatum	.	.	.	.	.	**.**	+	1	.	1	.	.	+	.	.	r	.	.	.	+	+	.	.	.	.	.	.	.	.	.	**29**	.	.	.	.	.	.	.	.	.	.	.	**.**	.	+	.	.	**1**	.	.	**.**
Galium glaucum	.	.	.	+	+	**2**	.	.	.	.	1	.	.	.	.	.	+	+	1	.	.	.	+	.	.	.	.	.	.	.	**21**	.	.	.	.	.	.	.	.	.	+	.	**9**	.	.	.	.	**.**	.	.	**.**
Ajuga genevensis	.	.	.	.	.	**.**	+	+	.	.	.	r	+	.	.	.	+	.	a	.	.	.	.	.	.	.	.	.	+	**29**	.	.	.	.	.	.	.	.	.	.	.	**.**	.	.	.	.	**.**	.	.	**.**

Digitalis grandiflora	.	.	.	.	.	.	+	+	.	r	.	r	+	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	.	**29**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Jurinea mollis	.	.	.	1	+	**2**	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	.	.	.	.	.	.	**17**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	**1**
Sempervivum marmoreum	.	.	.	.	.	.	r	+	.	.	.	.	+	.	+	+	.	.	.	.	+	.	.	.	.	.	+	.	.	.	**29**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Iris pumila	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	+	.	.	.	.	.	.	+	.	.	.	.	.	.	**17**	.	.	.	.	.	.	.	+	.	.	.	**9**	.	1	.	+	**2**	.	.	.
Myosotis arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	r	.	.	+	.	.	+	**17**	+	.	.	.	.	.	.	.	.	.	.	**9**	.	.	+	.	**1**	.	.	.
Lappula squarrosa	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.	r	+	+	**25**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	**1**	.	.	.
Carduus collinus	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	r	+	+	+	.	.	.	**25**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	**1**	.	.	.
Melampyrum arvense	.	.	.	+	.	**1**	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	**8**	+	.	.	.	.	.	+	+	.	.	.	**27**	.	.	.	.	.	.	+	**1**
Thymus glabrescens	.	.	.	.	.	.	.	+	.	r	.	.	.	.	1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	**17**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa compressa	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**8**	.	.	.	.	+	+	.	.	+	.	.	**27**	.	.	.	+	**1**	.	.	.
Lactuca viminea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	**13**	.	.	.	.	1	.	1	.	.	.	.	**18**	.	.	1	.	**1**	.	.	.
Asperula tinctoria	+	.	.	.	.	**1**	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	**13**	.	.	+	.	.	.	.	.	.	.	.	**9**	.	.	.	.	.	.	.	.
Trifolium alpestre	.	.	.	.	.	.	+	1	.	+	.	.	1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	**21**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Picris hieracioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	**4**	.	.	.	.	r	.	.	r	.	r	.	**27**	.	.	.	.	.	.	.	.
Thalictrum minus	.	.	.	+	.	**1**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	**4**	.	.	.	.	.	.	.	r	.	.	.	**9**	.	1	.	+	**2**	.	.	.
Vicia tetrasperma	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	**8**	.	.	.	.	.	.	+	.	.	.	.	**9**	.	+	.	+	**2**	.	.	.
Veronica chamaedrys agg.	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	**17**	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	**1**	.	.	.
Cleistogenes serotina	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	**17**	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	**1**	.	.	.
Cyanus triumfettii agg.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	r	.	.	.	.	.	.	.	.	.	.	**13**	.	.	.	.	.	.	.	+	.	.	.	**9**	.	.	.	.	.	1	.	**1**
*Verbascum *austriacum*	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**4**	.	.	.	.	.	r	.	.	.	.	.	**9**	.	+	+	.	**2**	.	r	**1**
Cytisus nigricans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	**13**	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	**1**	.	.	.
Stipa joannis	.	.	.	.	+	**1**	1	3	.	.	.	.	.	.	.	.	.	.	b	.	.	.	.	.	.	.	.	.	.	.	**13**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygala comosa	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	**17**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pilosella cymosa	.	.	.	.	.	.	.	1	.	.	.	.	+	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	**17**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bupleurum longifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	+	.	.	.	.	.	.	.	**8**	.	.	.	.	.	.	.	+	+	.	.	**18**	.	.	.	.	.	.	.	.
Arabis auriculata	.	.	.	+	.	**1**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	**4**	.	.	.	.	.	.	+	.	.	.	.	**9**	.	.	+	.	**1**	.	.	.
Chondrilla juncea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	r	.	.	**8**	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	**2**	.	.	.
Daucus carota	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	**4**	.	.	.	.	+	.	.	.	.	.	.	**9**	.	.	.	+	**1**	.	.	.
Vicia hirsuta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	**18**	.	+	.	.	**1**	.	.	.
Campanula bononiensis	.	.	.	.	r	**1**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	**9**	.	.	+	+	**2**	.	.	.
*Chamaecytisus *leucotrichus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	**8**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	**1**	.	.	.
*Chamaecytisus *ciliatus*	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	**8**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium mollugo agg.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	**8**	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	**1**	+	.	**1**
Trifolium campestre	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	**18**	.	.	1	.	**1**	.	+	**1**
Viola arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r	.	.	.	**8**	.	.	.	.	.	.	+	.	.	.	.	**9**	.	.	.	.	.	.	.	.
Cerastium brachypetalum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	**8**	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	**1**	.	.	.
Cuscuta epithymum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	**8**	.	.	+	.	.	.	.	.	.	.	.	**9**	.	.	.	.	.	.	.	.
Senecio jacobaea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	r	r	**13**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tithymalus epithymoides	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	.	**13**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthemis tinctoria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.	**13**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Relevé No.	1	2	3	4	5	P	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	C (%)	30	31	32	33	34	35	36	37	38	39	40	C (%)	41	42	43	44	P	45	46	P
Thalictrum aquilegiifolium	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valeriana officinalis agg.	.	.	.	.	.	.	.	1	.	r	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campanula rotundifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Valerianella dentata	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carduus crispus	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex muricata agg.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	4	.	+	.	.	.	.	.	.	.	.	.	.	9	+	.	.	.	1	.	.	.
Veronica arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	4	+	.	.	.	.	.	1	.	.	.	.	.	18	.	.	.	.	.	.	.	.
Clinopodium vulgare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	4	.	.	.	.	+	.	.	+	.	.	.	18	.	.	.	.	.	.	.	.
Geranium columbinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	4	.	.	.	.	.	.	.	.	+	.	+	18	.	.	.	.	.	.	.	.
Phleum phleoides	.	.	b	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	+	.	1
Scorzonera purpurea	.	.	.	.	.	.	.	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1
Bupleurum falcatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	1	.	.	.	.	.	.	.	.	9	.	.	.	.	.	+	.	1
Pimpinella major	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	+	.	1
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Thuidium abietinum	.	1	.	.	.	1	1	1	+	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	m	1	1	.	33	b	.	b	.	.	a	1	+	a	3	a	73	.	.	1	+	2	.	.	.
Grimmia pulvinata	1	.	+	1	+	4	+	+	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	+	+	.	+	+	1	38	+	+	.	+	+	.	.	.	.	.	36	.	.	.	.	.	.	.	.
Orthotrichum cupulatum	.	.	.	.	.	.	+	.	.	+	.	.	+	.	.	.	+	.	.	1	+	.	+	.	+	+	.	.	+	42	+	+	.	+	+	1	.	.	+	.	.	55	.	+	.	.	1	.	.	.
Rhytidium rugosum	.	.	.	.	.	.	.	+	+	+	.	.	+	+	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	29	.	1	b	.	1	.	1	.	1	.	.	45	.	+	.	.	1	.	.	.
Cladonia pocillum	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	+	21	+	.	.	+	.	.	.	.	.	.	.	18	.	.	.	.	.	.	.	.
Homalothecium lutescens	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	17	.	.	.	.	.	.	.	.	.	+	.	9	.	.	.	.	.	.	.	.
Tortula ruralis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	1	.	13	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.	.	.
Cladonia subulata	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	13	.	.	.	.	.	.	.	.	.	.	+	9	.	.	.	.	.	.	.	.
Verrucaria nigrescens	+	.	.	.	.	1	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Grimmia anodon	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	+	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladonia fimbriata	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	8	.	.	.	.	.	.	+	.	.	.	+	18	.	.	.	.	.	.	.	.
Cladonia pyxidata	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.
Cladonia coniocraea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	8	.	.	.	.	.	.	.	+	.	.	.	9	.	.	.	.	.	.	.	.
Ditrichum flexicaule	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	8	.	.	.	.	.	1	.	.	+	.	.	18	.	.	.	.	.	.	.	.
Homalothecium sericeum	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.
Bryum caespiticium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	+	.	.	9	.	.	.	.	.	+	.	1
Tortula intermedia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	1	.	.	.	.	9	.	.	1	.	1	.	.	.

Species present in one or two relevés:

E_2: *Acer campestre* 41: 1; *Carpinus betulus* 38: r, 41: +; *Cornus mas* 5: +, 34: +; *Rhamnus cathartica* 7: +, 38: +; *Rosa gallica* 23: r; *Spiraea media* 9: r; *Viburnum lantana* 5: +, 38: +;

E_1: *Aconitum anthora* 7: +; *Allium senescens* subsp. *montanum* 3: 1; *Alyssum alyssoides* 15: +, 30: +; *A. montanum* subsp. *brymii* 9: +, *Arabidopsis thaliana* 15: +; *Asplenium trichomanes* 6: r; *Avenula praeusta* 46: +; *Brachypodium pinnatum* 6: r, 12: r; *Bupleurum affine* 24: r; *Camelina microcarpa* 18: r; *Campanula trachelium* 45: +; *Cerastium holosteoides* 31: +; *C. semidecandrum* 15: +; *Cerinthe minor* 41: +; *Clematis vitalba* 46: r; *Crupina vulgaris* 24: +, 29: +; *Cytisus procumbens* 17: +, 19: +; *Eremogone micradenia* 9: +, 17: +; *Erysimum diffusum* agg. 24: r, 35: +; *Falcaria vulgaris* 23: 1, 39: +; *Fallopia convolvulus* 7: r, 23: +; *Festuca csikhegyensis* Simonk. 9: **+,** *F. pratensis* agg. 31: 1, 34: +; *F. pseudodalmatica* x *F. pallens* 21: +; *F. rubra* agg. 34: +, 41: 1; *Fumaria schleicheri* 10: r; *Galium boreale* 45: +; *G. pumilum* 29: +; *Geranium dissectum* 44: +; *Geum urbanum* 34: +; *Globularia punctata* 8: +, 45: 2a; *Hieracium bauhinii* 35: +; *Holosteum umbellatum* 25: +, 36: +; *Hylotelephium maximum* 15: +; *Inula conyza* 11: r; *I. hirta* 9: +; *Isatis praecox* 6: r, 9: +; *Knautia arvensis* 45: +; *Lamium amplexicaule* 25: +; *Lathyrus heterophyllus* 18: +, 45: +; *L. pannonicus* 44: +; *Leopoldia tenuiflora* 13: 1, 39: +; *Libanotis pyrenaica* 46: 1; *Linaria vulgaris* 25: +; *Linum catharticum* 31: 1, 41: +; *Lithospermum arvense* 36: r, 41: +; *L. officinale* 11: +; *Lotus corniculatus* agg. 39: +; *Melilotus officinalis* 25: 1; *Mentha arvensis* 31: +; *Nonea pulla* 42: +, 45: +; *Odontites vulgaris* 27: +, 30: +; *Orchis tridentata* 10: +, 14: r; *Petrorhagia prolifera* 25: +, 29: +; *Pimpinella saxifraga* agg. 1: +, 30: +; *Piptatherum virescens* 22: r; *Potentilla argentea* agg. 41: +; *P. heptaphylla* 7: 1; *P. recta* 36: +; *Prunella grandiflora* 21: r; *Ranunculus illyricus* 3: +; *Reseda lutea* 2: +; *Salvia verticillata* 39: r, 46: +; *Saxifraga paniculata* 4: +; *Scorzonera austriaca* 8: +; *Sesleria heufleriana* 12: +; *Silene bupleuroides* 32: +; *S. donetzica* subsp. *sillingeri* 36: r; *S. latifolia* subsp. *alba* 41: +; *S. nutans* 31: 1; *Stachys germanica* 31: +; *Stellaria graminea* 41: +; *Tanacetum corymbosum* 38: +; *Taraxacum* sect. *Ruderalia* 26: r, 41: r; *Tragopogon orientalis* 41: r; *Trifolium arvense* 40: +; *T. pratense* 41: +; *T. repens* 31: 1; *T. sarosiense* 12: +; *Trinia glauca* 17: +, 19: +; *Thalictrum foetidum* 15: r; *Tephroseris integrifolia* 37: r; *Thymus* x *subhirsutus* 8: +, 24: 1; *Valerianella locusta* 36: +; *Verbascum nigrum* 45: +; *V. phoeniceum* 7: +; *Veronica prostrata* 35: r; *Vinca herbacea* 8: +, 13: +; *Waldsteinia geoides* 41: 1;

E_0: *Aspicilia contorta* 14: +, 17: +; *Barbula unguiculata* 8: +, 37: +; *Brachythecium glareosum* 37: +; *Bryum argenteum* 20: 1, 21: +; *B. capillare* 28: +; *Cetraria islandica* 35: 1; *Cladonia chlorophaea* 41: +; *C. polycarpoides* 32: +, 42: +; *C. ramulosa* 35: +; *C. subfurcata* 30: +; *Collema fuscovirens* 27: +; *C. cristatum* 6: +, 25: +; *Didymodon acutus* 23: +; *D. cordatus* 13: +; *Diploschistes muscorum* 38: +; *Ditrichum heteromallum* 3: +; *Encalypta vulgaris* 1: 1; *Fissidens dubius* 17: 1; *Lecanora dispersa* 7: +; *L. muralis* 25: +, 27: +; *Lobothallia radiosa* 33: +; *Porella platyphylla* 17: +; *Rinodina bischoffii* 12: +; *Toninia athallina* 9: +; *T. tumidula* 6: +; *T. sedifolia* 13: +; *Tortella inclinata* 43: 1; *Squamarina* sp. 1: +, 21: +; *Staurothele rufa* 13: +; *Verrucaria muralis* 12: +, 27: +; *Weissia longifolia* 40: 1.

Locations of relevés

Relevé number, country code (HU – Hungary, SK – Slovakia), detailed description of the locality, latitude, longitude, relevé area, altitude, aspect in letters and degrees (E 90°, S 180°, W 270°, N 360°), slope, cover total (E_t), cover of shrub layer (E_2), cover of herb layer (E_1), cover of mosses and lichens (E_0), cover of bare rock (E_r), relevé author(s), field number, date (day/month/year).

1. SK, Slovenský kras Mts, Hrhov, Okrúhle Mt., 48°36'36"N, 20°46'57"E, 25 m^2, 376 m, S (180°), 50°, E_t 80%, E_2 10%, E_1 70%, E_0 15%, E_r 30%, D. Dúbravková & M. Zaliberová, 27/05, 3. 6. 2005.
2. SK, Slovenský kras Mts, Dvorníky, Zemné hradisko Nature Reserve, the stand is located in a patch with dominance of *Anthylis vulneraria*, 48°36'16"N, 20°48'51"E, 25 m^2, 290 m, E (90°), 10°, E_t 90%, –, E_1 90%, E_0 10%, E_r 10%, D. Dúbravková & M. Zaliberová, 25/05, 3. 6. 2005.
3. SK, Slovenský kras Mts, Dvorníky, Zemné hradisko Nature Reserve, the stand is located in a small patch with dominance of *Anthylis vulneraria*, 48°36'18"N, 20°48'56"E, 25 m^2, 280 m, E (90°), 10°, E_t 85%, E_2 2%, E_1 80%, E_0 15%, –, D. Dúbravková & M. Zaliberová, 26/05, 3. 6. 2005.
4. SK, Slovenský kras Mts, Turňa nad Bodvou, Turniansky hradný vrch National Nature Reserve, karst rocky field above blue tourist path, a large homogenous stand, 48°36'36"N, 20°52'22"E, 25 m^2, 340 m, SSW (203°), 40°, E_t 60%, –, E_1 60%, E_0 10%, E_r 50%, D. Dúbravková & M. Zaliberová, 12/05, 31. 5. 2005.
5. SK, Slovenský kras Mts, Turňa nad Bodvou, Turniansky hradný vrch National Nature Reserve, a slope over a farm, *Bromus erectus* takes over the stands with deeper soil (basis of a plateau), 48°36'37"N, 20°52'32"E, 25 m^2, 330 m, SSW (203°), 10°, E_t 85%, –, E_1 80%, E_0 5%, –, D. Dúbravková & M. Zaliberová, 14/05, 31. 5. 2005.
6. SK, Slovenský kras Mts, Vidová, Plešivská planina Plateau, Plešivská stráň, Nad Vidovou, 48°34'14"N, 20°26'19"E, 32 m^2, 555 m, E (90°), 15°, E_t 90%, E_2 1%, E_1 90%, E_0 15%, E_r 7%, D. Dúbravková, J. Kolbek & R. Šuvada, 4/06, 17. 5. 2006.
7. SK, Slovenský kras Mts, Plešivec, Plešivská planina Plateau, Plešivská stráň, Nad novým hámrom (Site of the European Importance), 48°33'59"N, 20°24'19"E, 25 m^2, 476 m, SWW (250°), 25°, E_t 80%, E_2 3%, E_1 75%, E_0 20%, E_r 10%, D. Dúbravková, J. Kolbek & R. Šuvada, 2/06, 17. 5. 2006.
8. HU, Aggteleki-karszt Mts, Jósvafö, Nagy-oldál, Bok, western part of the locality, behind a small valley Nagy-szod-völgy, 48°30'22"N, 20°33'43"E, 25 m^2, 492 m, SSW (200°), 25°, E_t 95%, E_2 1%, E_1 95 , E_0 5%, –, D. Dúbravková, 51/06, 1. 6. 2006.
9. SK, Slovenský kras Mts, Slavec, Plešivská planina Plateau, Slavecká stráň, an abandoned orchard, litter layer about 5 cm thick, 48°36'36"N, 20°27'51"E, 24 m^2, 557 m, SSE (150°), 45°, E_t 85%, –, E_1 80%, E_0 10%, E_r 15%, D. Dúbravková & R. Šuvada, 6/06, 18. 5. 2006.
10. SK, Slovensky kras, Hrušov, 48°35'54"N, 20°37'54"E, 32 m^2, 508 m, S (180°), 30°, E_t 60%, E_2 4%, E_1 60%, E_0 3%, E_r 12%, M. Janišová & J. Kolbek, 4/06 MJ, 19. 5. 2006.
11. SK, Slovensky kras, Slavec, Plešivská planina Plateau, Slavecká stráň, the stand burnet few years ago, 48°35'32"N, 20°27'54"E, 25 m^2, 484 m, EES (113°), 33°, E_t 80%, –, E_1 75%, E_0 3%, E_r 15%, M. Janišová & J. Kolbek, 1/06 MJ, 18. 5. 2006.
12. SK, Slovenský kras Mts, Plešivec, Plešivská planina Plateau, Plešivská stráň, Nad novým hámrom, slope above a small factory in Plešivec, 48°33'53"N, 20°24'21"E, 25 m^2, 468 m, W (265°), 25°, –, E_2 3%, E_1 70%, E_0 15%, E_r 15%, D. Dúbravková, J. Kolbek & R. Šuvada, 3/06, 17. 5. 2006.
13. HU, Aggteleki-karszt Mts, Jósvafö, Nagy-oldál, 48°30'11"N, 20°33'58"E, 25 m^2, 430 m, SSW (195°), 30°, E_t 75%, –, E_1 70%, E_0 10%, E_r 30%, D. Dúbravková, 50/06, 1. 6. 2006.
14. SK, Slovenský kras Mts, Hrušovo, Silická planina Plateau, Hrušovská lesostep National Nature Reserve, thin soil layer, 48°35'55"N, 20°37'48"E, 8 m^2, 500 m, SSW (210°), 30°, E_t 55%, –, E_1 50%, E_0 30%, –, D. Dúbravková & R. Šuvada, 8/06, 19. 5. 2006.
15. HU, Aggteleki-karszt Mts, Bódvarákó, Szalonnai-hegység, Esztramos-hegy Mt., near the hilltop, 48°31'01"N, 20°44'51"E, 25 m^2, 336 m, SSW (203°), 25°, E_t 75%, –, E_1 60%, E_0 18%, E_r 30%, D. Dúbravková, E. Illyés & V. Virók, 34/06, 29. 5. 2006.
16. SK, Slovensky kras, Hrušov, 48°35'54"N, 20°37'53"E, 6 m^2, 519

m, SSW (200°), 30°, E_t 45%, –, E_1 30%, E_0 10%, E_r 40%, M. Janišová & J. Kolbek, 3/06 MJ, 19. 5. 2006.

17. SK, Slovenský kras Mts, Silica, Silická planina Plateau, 48°34'03"N, 20°28'28"E, 25 m², 530 m, SW (235°), 20°, E_t 80%, –, E_1 75%, E_0 20%, E_r 20%, D. Dúbravková, M. Janišová, J. Kolbek & R. Šuvada, 5/06, 18. 5. 2006.
18. SK, Slovenský kras Mts, Plešivec, Plešivská planina Plateau, above blue tourist path, 48°33'55"N, 20°24'09"E, 21 m², 344 m, W (270°), 35°, E_t 75%, E_2 5%, E_1 75%, E_0 10%, E_r 15%, D. Dúbravková & M. Zaliberová, 20/05, 2. 6. 2005.
19. SK, Slovensky kras, Silica, 48°34'03"N, 20°28'28"E, 25 m², 540 m, SWW (237°), 25°, E_t 75%, –, E_1 70%, E_0 5%, E_r 10%, M. Janišová & J. Kolbek, 2/06 MJ, 18. 5. 2006.
20. SK, Slovenský kras Mts, Hrušovo, Silická planina Plateau, Hrušovská lesostep National Nature Reserve, a small rocky ridge, 48°35'54"N, 20°37'55"E, 4.5 m², 525 m, SSW (210°), 45°, E_t 50%, –, E_1 45%, E_0 25%, E_r 40%, D. Dúbravková & R. Šuvada, 7/06, 19. 5. 2006.
21. SK, Slovenský kras Mts, Vidová, Plešivská planina Plateau, above a forest road connecting village and plateau, 48°34'14"N, 20°26'36"E, 25 m², 418 m, SE (135°), 5°, E_t 70%, –, E_1 60%, E_0 10%, E_r 40%, D. Dúbravková & M. Zaliberová, 21/05, 2. 6. 2005.
22. SK, Slovenský kras Mts, Vidová, Plešivská planina Plateau, near a forest road connecting village and plateau, under an edge of plateau, 48°34'19"N, 20°26'29"E, 25 m², 470 m, SW (225°), 10°, E_t 70%, –, E_1 55%, E_0 20%, –, D. Dúbravková & M. Zaliberová, 23/05, 2. 6. 2005.
23. HU, Aggteleki-karszt Mts, obec Jósvafö, Jósva-völgy, a grassland above the road curve, 1 km eastwards from the village, 48°28'44"N, 20°34'29"E, 25 m², 238 m, S (178°), 25°, E_t 80%, –, E_1 75%, E_0 10%, E_r 10%, D. Dúbravková, E. Illyés & V. Virók, 37/06, 29. 5. 2006.
24. HU, Aggteleki-karszt Mts, Jósvafö, Nagy-oldál, 48°30'10"N, 20°34'07"E, 25 m², 409 m, S (170°), 40°, E_t 65%, –, E_1 60%, E_0 5%, –, D. Dúbravková, 49/06, 1. 6. 2006.
25. HU, Aggteleki-karszt Mts, Alsó-hegy Mt., Komjáti, a karst rocky field above the villge, 48°33'21"N, 20°44'57"E, 25 m², 281 m, SSE (158°), 25°, E_t 90%, E_2 10%, E_1 80%, E_0 15%, –, D. Dúbravková, 46/06, 31. 5. 2006.
26. HU, Aggteleki-karszt Mts, Alsó-hegy Mt., Szögliget, Szád-vár, an oppening on S slope of the castle hill, 48°32'31"N, 20°39'49"E, 24 m², 347 m, SSE (165°), 35°, E_t 65%, –, E_1 60%, E_0 20%, E_r 40%, D. Dúbravková, E. Illyés & V. Virók, 43/06, 30. 5. 2006.
27. HU, Aggteleki-karszt Mts, Alsó-hegy Mt., Komjáti, NW from the village, a karst rocky field above a farm, 48°33'19"N, 20°44'53"E, 9 m², 260 m, SSE (160°), 15°, E_t 50%, –, E_1 40%, E_0 10%, E_r 50%, D. Dúbravková, 45/06, 31. 5. 2006.
28. HU, Aggteleki-karszt Mts, Alsó-hegy Mt., Komjáti, a karst rocky field above the centre of the village, 48°33'20"N, 20°45'06"E, 12 m², 244 m, SSE (150°), 12°, E_t 70%, –, E_1 60%, E_0 20%, –, D. Dúbravková, 47/06, 31. 5. 2006.
29. HU, Aggteleki-karszt Mts, Alsó-hegy, Komjáti, a karst rocky field above the village, 48°33'20"N, 20°45'10"E, 25 m², 231 m, SSE (160°), 25°, E_t 65%, –, E_1 60%, E_0 20%, E_r 40%, D. Dúbravková, 48/06, 31. 5. 2006.
30. HU, Aggteleki-karszt Mts, Alsó-hegy, Komjáti, about 100 m above the vineyards NW from the village, 48°33'15"N, 20°44'48"E, 25 m², 248 m, S (170°), 15°, E_t 90%, –, E_1 85%, E_0 30%, E_r 10%, D. Dúbravková, 44/06, 31. 5. 2006.
31. SK, Slovenský kras Mts, Kečov, Kečovské škrapy National Nature Reserve, *Arhenatherum elatius* takes over the stand, 48°29'40"N, 20°29'16"E, 25 m², 420 m, SW (225°), 10°, E_t 90%, –, E_1 85%, E_0 10%, –, D. Dúbravková & M. Zaliberová, 18/05, 1. 6. 2005.
32. HU, Aggteleki-karszt Mts, Jósvafö, Kossuth-barlang Mt., W slope, 48°29'05"N, 20°33'08"E, 25 m², 258 m, NWW (290°), 45°, E_t 100%, E_2 1%, E_1 100%, E_0 60%, –, D. Dúbravková, E. Illyés & V. Virók, 41/06, 30. 5. 2006.
33. HU, Aggteleki-karszt Mts, Aggtelek, Galya-tetö, a karst rocky field above the village, 48°28'13"N, 20°30'49"E, 25 m², 399 m, W (260°), 20°, E_t 90%, –, E_1 85%, E_0 15%, –, D. Dúbravková, E. Illyés & V. Virók, 38/06, 29. 5. 2006.
34. SK, Slovenský kras Mts, Kečov, Kečovské škrapy National Nature Reserve, 48°29'39"N, 20°29'17"E, 25 m², 425 m, SW (225°), 15°, E_t 80%, –, E_1 75%, E_0 10%, –, D. Dúbravková & M. Zaliberová, 17/05, 1. 6. 2005.
35. SK, Slovenský kras Mts, Jablonov nad Turňou, Horný vrch Plateau, Hodovník Mt.(eastwards from Kukudičova skala Mt.), 48°36'16"N, 20°40'05"E, 24 m², 560 m, SSW (210°),15°, E_t 85%, E_2 5%, E_1 65%, E_0 40%, E_r 15%, D. Dúbravková & M. Dúbravka, 1/07, 30. 4. 2007.
36. SK, Slovenský kras Mts, Turňa nad Bodvou, Turniansky hradný vrch National Nature Reserve, near the castle, 48°36'37"N, 20°52'26"E, 15 m², 345 m, S (180°), 25°, E_t 80%, –, E_1 70%, E_0 15%, –, D. Dúbravková & M. Zaliberová, 13/05, 31. 5. 2005.
37. HU, Aggteleki-karszt Mts, Bódvarákó, Szalonnai-hegység, Esztramos-hegy Mt., edge of a quarry, 48°30'59"N, 20°44'50"E, 25 m², 320 m, SSW (195°), 20°, E_t 85%, E_2 1%, E_1 80%, E_0 10%, –, D. Dúbravková, E. Illyés & V. Virók, 35/06, 19. 5. 2006.
38. HU, Aggteleki-karszt Mts, Jósvafö, Kosuth-barlang, above the N part of village, a rocky field on right side of red tourist path, 48°29'08"N, 20°33'09"E, 24 m², 261 m, SWW (245°), 45°, E_t 60%, E_2 5%, E_1 55%, E_0 40%, –, D. Dúbravková, E. Illyés & V. Virók, 42/06, 30. 5. 2006.
39. HU, Aggteleki-karszt Mts, Jósvafö, N from the village, a pasture located between blue and red tourist path, 48°29'31"N, 20°33'19"E, 25 m², 281 m, –, –, E_t 98%, –, E_1 85%, E_0 40%, –, D. Dúbravková, 52/06, 1. 6. 2006.
40. HU, Aggteleki-karszt Mts, Aggtelek, Szölö-hegy (elevation point 440 m), E of the village, near the quarry Aggtelek Köbánya, an 10–15 years abandoned pasture for catle, 48°28'05"N, 20°31'13"E, 25 m², 420 m, SSW (205°), 5°, E_t 98%, –, E_1 98%, E_0 40%, –, D. Dúbravková, E. Illyés & V. Virók, 40/06, 30. 5. 2006.
41. SK, Slovenský kras Mts, Vidová, Plešivská planina Plateau, above a forest road leading to top of the plateau, under the edge of the plateau, 48°34'20"N, 20°26'30"E, 25 m², 490 m, SW (225°), 2°, E_t 90%, E_2 5%, E_1 85%, E_0 10%, E_r 20%, D. Dúbravková & M. Zaliberová, 22/05, 2. 6. 2005.
42. SK, Slovenský kras Mts, Domica, Domické škrapy National Nature Reserve, above a tourist path leading to Starňa, W of the Domica cave entrance, 48°28'43"N, 20°28'04"E, 21 m², 380 m, S (180°), 25°, E_t 90%, –, E_1 90%, E_0 5%, –, D. Dúbravková & M. Zaliberová, 16/05, 1. 6. 2005.
43. SK, Slovenský kras Mts, Slavec, Plešivská planina Plateau, slope over the E part of village, 48°35'26"N, 20°28'00"E, 25 m², 335 m, W (270°), 50°, E_t 80%, –, E_1 75%, E_0 15%, –, D. Dúbravková & M. Zaliberová, 24/05, 2. 6. 2005.
44. SK, Slovenský kras Mts, Domica, Domické škrapy National Nature Reserve, above red tourist path, E of the Domica cave entrance, 48°28'42"N, 20°28'20"E, 17 m², 380 m, S (180°), 5°, E_t 90%, –, E_1 90%, E_0 3%, E_r 7%, D. Dúbravková & M. Zaliberová, 15/05, 1. 6. 2005.
45. SK, Slovenský kras Mts, Silica, Silická planina Plateau, Fabiánka Hill, an orchard that burnet about 2–3 years ago, 48°33'52"N, 20°32'38"E, 25 m², 600 m, S (180°), 10°, E_t 70%, –, E_1 70%, –, –, D. Dúbravková & M. Zaliberová, 19/05, 1. 6. 2005.
46. HU, Aggteleki-karszt Mts, Szölösardö, Galyaság, Zabaryik-hegy Mt., *Brachypodium pinnatum* dominates the neighbouring stands, 48°27'28"N, 20°37'40"E, 25 m², 405 m, S (175°), 10°, E_t 100%, E_2 1%, E_1 100%, E_0 5%, –, D. Dúbravková, E. Illyés & V. Virók, 36/06, 29. 5. 2006.